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THE INTERNATIONAL COMPETITION ON SUSTAINABLE EDUCATION



20TH AUGUST 2025

TRANSFORMING EDUCATION, DRIVING INNOVATION AND
ADVANCING LIFELONG LEARNING FOR EMPOWERED WORLD

THE FOURTH INTERNATIONAL COMPETITION ON SUSTAINABLE EDUCATION 2025

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E-PROCEEDING

SUSED2025



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Preface

Sustainable Development, defined as an evolution that meets the current needs without endangering the future generations' abilities.

it is a way in sustaining the sustainability of education through e-learning in meeting the demand of contemporary education, whilst enabling appropriate changes without threatening basic resources from losing its effectiveness.

Building upon the practice of Education for Sustainable Development (ESD) as a a lifelong learning process and fostering cross-sectoral collaboration, it is with a hope that the continuation of this program would spearhead the collective action to a sustainable development.

This competition highlights on the importance of sustainability in education by promoting successful practices through academic development, leadership, and innovation. In short, SUSED2025 aims to inspire and showcase education system by empowering educators and students to become of agents of change, hence *'Transforming Education, Driving Innovation and Advancing Lifelong Learning for Empowered World'*.



Foreword by the Head of Centre

It is my distinct honour to present the e-proceedings of the Fourth Innovation Competition on Sustainable Education (SUSED 2025), a scholarly platform dedicated to fostering innovation, creativity, and sustainability in education. More than a competition, SUSED represents a collective commitment to re-envisioning education in ways that address current challenges while safeguarding the prospects of future generations. Guided by the theme and tagline, "Transforming Education, Driving Innovation, and Advancing Lifelong Learning for an Empowered World," SUSED 2025 aligns closely with the international agenda of the Sustainable Development Goals (SDGs), particularly SDG 4: Quality Education. By convening educators, researchers, students, and institutional partners, this event serves as a catalyst for intellectual exchange, innovative practices, and the advancement of sustainable educational approaches.

The contributions in this volume reflect both academic rigour and practical significance, presenting strategies to address the evolving demands of contemporary education. They emphasise the crucial role of collaboration, critical reflection, and knowledge dissemination in fostering educational ecosystems that are resilient, equitable, and sustainable.

As the advisor of SUSED2025, I extend my sincere appreciation to all participants, organisers, adjudicators, and collaborators whose dedication has been instrumental to the success of this event. Special acknowledgment is given to Universiti Teknologi MARA (UiTM) Cawangan Negeri Sembilan, Malaysia, the host institution represented by Miss Anis Shahira Bazlan and Madam Nur'Ain Zuraimi, Program Directors; the International Islamic University Malaysia (IIUM), represented by Dr. Siti Fatimah Abdul Rahman; Pangasinan State University (PSU), Philippines, represented by Dr. Gloria Capanang, Coordinator for International Partnerships and Dr. Liezel M. Del Castillo; Universitas Islam Sumatra Utara (UISU), Indonesia, represented by Prof. Dr. Safrida, Rector; Universitas Hasyim Asy'ari (UNHASA), Indonesia, represented by Dr. Sayid Ma-rifatulloh; and Universitas Islam Darul Ulum (UNISDA) Lamongan, Indonesia, represented by Dr. Ida Sukowati. Their active engagement has strengthened both the national and international dimensions of SUSED, underscoring the value of academic partnership and shared vision in advancing the discourse on sustainable education.

I hope that the works presented herein will continue to inspire scholarly inquiry, guide educational policy, and encourage meaningful innovations, thereby advancing our shared vision of an empowered and sustainable future.

DR. RAFIDAH BINTI KAMARUDIN

*Head of Academy of Language Studies (UiTM CNS) & Advisor
International Competition on Sustainable Education 2025 (SUSED2025)*

Foreword by the Advisor (IIUM)

It is my great pleasure to extend my warmest greetings and congratulations to all participants, organizers, and supporters of the Fourth International Competition on Sustainable Education (SUSED 2025). This remarkable event is a testament to our shared commitment to advancing knowledge, promoting sustainability, and nurturing innovation in education. SUSED has consistently provided a global platform where ideas, creativity, and collaboration converge to shape the future of learning and teaching.

I wish to express my deepest gratitude to Akademi Pengajian Bahasa, Universiti Teknologi MARA, Cawangan Negeri Sembilan, Kampus Kuala Pilah, for their dedication and generosity in hosting SUSED2025. Equally, I am delighted to highlight the fruitful collaboration between the Kulliyah of Education, International Islamic University Malaysia (IIUM), and APB UiTM Negeri Sembilan. This partnership demonstrates how institutions can work hand in hand to foster excellence, innovation, and sustainability in education. May this collaboration continue to flourish, creating more opportunities for meaningful engagement in the years ahead.

SUSED2025 is not just a competition; it is an opportunity for students, educators, and researchers to broaden perspectives and exchange transformative ideas.

Through this platform, participants are encouraged to think critically, act responsibly, and design solutions that address the pressing challenges of sustainability in education and society at large. These experiences undoubtedly contribute to developing a generation that is not only knowledgeable but also globally responsible.

Moreover, this event fosters intercultural understanding and collaborative spirit across borders. By bringing together diverse talents and viewpoints, SUSED2025 strengthens the bonds between institutions, nations, and communities. It nurtures creativity, resilience, and leadership, qualities essential for facing the complex demands of the 21st century. Such an initiative ensures that the outcomes go beyond competition and extend into impactful, real-world contributions.

In closing, I commend all participants for their enthusiasm and hard work, and I encourage you to carry forward the lessons, networks, and inspirations gained here. Let us continue to support SUSED as a platform that elevates sustainable education worldwide. May SUSED2025 be remembered as a milestone in our collective journey towards a brighter, more sustainable future. See you at SUSED2026!

DR. SITI FATIMAH BINTI ABD. RAHMAN

Advisor (IIUM)

International Competition on Sustainable Education 2025 (SUSED2025)

Foreword by the Chairperson I

With His blessing, Alhamdulillah, we are pleased to introduce to you the e-proceedings of the Fourth International Competition on Sustainable Education (SUSED2025). This competition, held from February to August 2025, brings together educators, researchers, and students from Malaysia and abroad to share their ideas, innovations, and practices in advancing Sustainable Development Goal 4 (Quality Education).

SUSED2025 provides a dynamic platform for participants to showcase extended abstracts highlighting innovations in teaching and learning, educational research, technology integration, and sustainability initiatives. We have accepted more than 130 extended abstracts from various universities and institutions across Malaysia, Indonesia, and the Philippines, demonstrating a testament to the growing interest and commitment towards embedding sustainability in education.

The extended abstracts featured in this e-proceeding are grouped into two main categories: Innovation in Teaching & Learning and Innovation in Educational Research. Collectively, they cover a wide range of themes, from gamified learning, digital platforms, curriculum innovation, and language education, to sustainability integration, cost analysis, and research methodologies in higher education. This diversity demonstrates the creativity and dedication of contributors in reshaping education for the future.

The success of SUSED2025 is the result of collective effort. I would like to extend my deepest appreciation to our jury members, reviewers, authors, and participants, as well as our dedicated organising committee whose hard work and commitment made this competition possible. Special gratitude is also due to our strategic partners and supporting institutions for their continuous collaboration and encouragement.

We hope this e-proceeding will serve not only as an academic reference but also as an inspiration for future innovations and collaborations in sustainable education. May SUSED continue to flourish as a prestigious platform that strengthens global educational networks and nurtures excellence in teaching, learning, and research.

ANIS SHAHIRA BINTI BAZLAN

Chairperson I

International Competition on Sustainable Education 2025 (SUSED2025)

Foreword by the Chairperson II

Alhamdulillah, with the blessings of Allah SWT, it is with great pleasure that I present this foreword for the e-proceedings of the Fourth International Competition on Sustainable Education (SUSED2025). This year's competition continues to serve as a vibrant platform for the exchange of ideas and innovations that enrich teaching and learning while advancing the principles of sustainability in education.

The papers compiled in this volume represent two significant categories: Innovation in Teaching and Learning, where educators explore novel classroom practices, technologies, and learner-centred strategies, and Innovation in Educational Research, which offers valuable insights into methodologies, policies, and research-based approaches that inform future practices. Together, these contributions reflect the vibrancy of educational innovation across institutions and disciplines.

Equally important, SUSED2025 fosters professional growth and institutional advancement by offering opportunities for recognition, collaboration, and integrating sustainable practices into both research and education. In doing so, the competition empowers a new generation of leaders equipped with the skills, knowledge, and perspectives necessary to embed sustainability within global education systems.

Anchored in its vision, SUSED2025 embodies the mission of transforming education, driving innovation, and advancing lifelong learning for an empowered world.

I wish to express my sincere appreciation to the authors, participants, and reviewers, as well as to the organizing committee for their perseverance and teamwork. May this e-proceeding serve as both an academic reference and an inspiration for further collaboration, ensuring that SUSED remains a catalyst for positive change in education worldwide.

NUR'AIN BINTI ZURAIMI

Chairperson II

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1PAGE NOTES - STORY WRITING: A COMPREHENSIVE LEARNING RESOURCE 01 FOR NARRATIVE WRITING

Nor Haniza Hasan, Tuan Sarifah Aini Syed Ahmad*, Wan Zumusni Wan Mustapha, Angeline Ranjethamoney A/P Vijayarajoo, & Ida Sukowati

A SCRABBLE-INSPIRED PHYSICS LEARNING TOOL TO ENHANCE 09 UNDERSTANDING AND RETENTION OF NEWTON'S LAWS OF MOTION

Noorezal Atfyinna Mohd Napiah*, Siti Azlina Rosli & Haslinda Abdul Hamid

A TRANSFORMATIVE APPROACH TO ENVIRONMENTAL IMPACT 15 ASSESSMENT: LINKING SDGS WITH INNOVATION IN TEACHING

Norhafezah Kasmuri*

ACT IT TO GRASP IT: ROLE PLAY AS A CATALYST FOR DEEPER 20 UNDERSTANDING IN ACTIVE CLASSROOMS

Raja M. Aslam Raja Arif*, Abdul Hadi Abdol Rahim, Suhadiyana Hanapi, Miqdad Khairulmaini & Radzi Abdul Rasih

ADMINISTRATIVE LAW: TERMINOLOGIES SERIES ONE 26

Izyan Farhana Binti Zulkarnain*, W Fatimah Hanun Binti Wan Mohamad Saferdin, Siti Mahanisayu Binti Marhaban, Nurul Aqmal Bin Roslan & Ikhwan Naguib Bin Jusoh

AN INTERACTIVE EDUCATIONAL APPROACH TO PLASTIC POLLUTION: 29 INTEGRATING EBOOKS AND QR CODE TECHNOLOGY

Muhammad Adamhakime Bin Roslan*, Cempaka Alyaa Binti Mohd Ali, Nurhanis Binti Nordin, Ts. Mastura Binti Omar & Nursuzieana Binti Hassan Nazri

AQDILAB: INTERACTIVE SIMULATION OF MUAMALAT CONTRACTS 35

Khairul Azhar Meerangani*, Mohammad Fahmi Abdul Hamid, Norhana Ahad & Muhammad Ikhlas Rosele

BEYOND DRAWINGS: INNOVATING AND EVALUATING CAD SKILLS WITH A 40 CAP-DRIVEN PEDAGOGICAL MODEL

Kausalyah Venkatasoon* & Shasthri Sivaguru

BILLBUDDY: AI-POWERED RECEIPT CAPTURE AND SMART BILL SHARING 48 FOR EASY EXPENSE MANAGEMENT

Nur Athirah Suhaimi, Nur Aqilah Mohd Ariff, Aime Aqilah Ahmad Zahar, Nur Mas Syahierah Sukri & Rohaiza Kamis*

BIM CONNECT: A MOBILE LEARNING APPLICATION FOR MALAYSIAN SIGN 52 LANGUAGE

Aini Faridah Azizul Hassan*, Humaira Mohamad, Nur Izyani Zulkifle, Nur Sabrina Zainudin & Putri Kharisma Ibnu Robi

BRAIN BOX 58

Alisha Dafinah Adi Iskandar, Nurul Farahani Khairol Nizam, Nurul Ajiebah Mardhiyyah Rohaizad, Nurul Huda Abdullah, Ku Syafiqah Arina Ku Shahril & Nur Atiqah Akhyani*

BRIDGING CALCULUS AND ENGINEERING PRACTICE: AN INSTRUCTIONAL VIDEO SERIES BY UITM CAWANGAN PULAU PINANG EDUCATORS 63

Zuraira Libasin*, Ahmad Rashidi Azudin, Noor Azizah Mazeni, Nur Azimah Idris & Norshuhada Samsudin

CalcSteps: A CALCULATOR ASSISTANT APP FOR CULTIVATING MATHEMATICS EDUCATION 68

Noor Syazana Ngarisan*, Nur Azlina Mat Noor, Hazrel Idlan Hafizal & Nurjulita Najwa Jumri

CHATTING WITH NATURE: EXPLORING LOCAL PLANTS USING AI & LENS 74

Wan Nurhayati Wan Hanafi*, Wan Rozianoor Mohd Hassan & Izzati Adilah Azmir

CLOCK-2BeZ : MENINGKATKAN KEFAHAMAN MURID DALAM MEMBACA DAN MENGENAL PASTI TEMPOH MASA SERTA MEMBEZAKAN MASA DALAM SISTEM 12 DAN 24 JAM 80

Siti Seri Kartini Mohd Yatim*, Phd, Muhammad Danial Haikal Mohd Azmi, Nurul Fadhilah Ahmad, & Tuan Nor Azian T. Aziz

COLLOVOC: TECHNOLOGY-ENHANCED LISTENING PROCESSING APPROACH 86

Madeline Liew Szu Hwa*, Izyani Binti Mistar, Rohaizad Bin Abd Aziz & Siti Musalmah Binti A. Hamid

CORROSIGHT: WEB-BASED PLATFORM FOR REAL-TIME CORROSION RATE CALCULATION AND FATIGUE ASSESSMENT IN GAS PIPELINES 93

Russell Spielberg Richard Liasngon*, Shahrom Ismail, Jamaluddin Mahmud, Muhammad Taufik Amir Hassan, Mohamad Faiz Mohamad Assaat

DATA-BUDDY: A GAMIFIED MOBILE LEARNING APP FOR INTERACTIVE STUDENT ENGAGEMENT IN DATA MINING EDUCATION 96

Tuan Norhafizah Tuan Zakaria*, Nasrul Hazim Mohamad

DESIGN THEORY EXPLORER (DTEp.V1.0): VISUAL-INTERACTIVE INNOVATION FOR BASIC DESIGN PRINCIPLES IN INTERIOR DESIGN EDUCATION 101

Azizah Md Ajis* & Ahmad Fuzi Md Ajis

DEVELOPMENT OF AN EDUCATIONAL TOOL FOR LEARNING PERIODIC TABLE 108

Nor Akmalazura Jani*, Wan Elina Faradilla Wan Khalid & Siti Zaharah Mohd Ruslan

T A B L E O F C O N T E N T S

I N N O V A T I O N I N T E A C H I N G & L E A R N I N G

DEVELOPMENT OF THE DIGITAL HUMAN RESOURCE TRAINING PLATFORM FOR WOMEN EMPLOYEES	114
Prof. Dr. Safrida, S.E., M.Si*, Prof. Dewi Budhiartini, Dr. Supriadi, S.E., M.M., M.Si, Dr. Zenni Riana, S.E., M.M. & Dr. Yusrita, S.E., M.M.	

DIFNOVA	119
Abdul Rashid Jusoh, Nurul Husna Mat Zaki, Yusrafizal Yusof, Siti Fatin Shaari & Thavarajah Selvarajah*	

DIGI-FC-SML: ENHANCING SOIL MECHANICS LABORATORY LEARNING WITH INTERACTIVE FLASHCARDS	123
Asmidar Alias*, Kamisah Ariffin & Nur Asmaliza Mohd Noor	

e-FinLex (e-FINANCIAL LEXICON)	128
Joycelyne Anak Nyandang*, Azlan Yusof Punding, Umi Insyirah Pakasa & Norazimah Mejri	

SISTEM E-REKOD TASMIK RAUDZATI (E-RTR): MEMPERCEPATKAN PENGURUSAN DATA BACAAN AL-QURAN DAN MENJANA PELAKSANAAN PROGRAM INTERVENSI	132
Mohamad Fadzil Yahaya*, Badrud-Din Hamid, Nor Afza Abdullah, Mohd Hanif Halim & Fatimah Sulaiman	

EDUVERSE: A CROSS-DISCIPLINARY GAMIFIED LEARNING PLATFORM FOR 21ST- CENTURY EDUCATION	140
Cerinna Khairul Nizan, Nurul Izzatie Hamezan, Bibi Elyana Sarkawi, Ummi Zahidah Zulkiflee & Akmal Shafiq Badarul Azam*	

EMPOWERING LIFELONG LEARNING THROUGH MICRO-CREDENTIALS IN SOCIAL SECURITY EDUCATION	146
Mohd Zaki Awang Chek* & Isma Liana Ismail	

ENGINEERING DYNAMICS REIMAGINED: A GAMIFIED ONLINE LEARNING PLATFORM	149
Yazmin Sahol Hamid, Mohd Raizamzamani Md Zain*, Nurbaiah Mohammad Noh, Mazlina Mohamad & Nurul Adhlin Ilyana Rosli	

ENHANCING ACTUARIAL EDUCATION DIGITAL INNOVATION via MINDAPPZ EBOOK	155
Mohd Zaki Awang Chek* & Isma Liana Ismail	

ENHANCING ENGLISH VOCABULARY ACQUISITION AMONG DIPLOMA STUDENTS THROUGH MAGNETIC COMPOUND WORD BOARD GAMES (WORMSMITHERY GAME)	159
Imelia Laura Anak Daneil*, Tang Howe Eng & Jacqueline Susan Anak Rijeng	

T A B L E O F C O N T E N T S

I N N O V A T I O N I N T E A C H I N G & L E A R N I N G

ENHANCING TAX EDUCATION THROUGH MULTI-FORMAT GAMIFIED LEARNING TOOLS 163

Norhayati Sulaiman*, Irda Syahira Khair Anwar, Norul Akma Mansor & Roslan Abdul Wahab

ESCAPE ROOM: ISLAMIC BANKING CHALLENGE 169

Mohd Shafiz Saharan*, Mohd Fazil Jamaludin, Khairul Azfar Adzahar, Mohd Firdaus Ruslan & Roseamilda Mansor

EXPLORING THE PEDAGOGICAL IMPACT OF “DUMMIES IN COMMUNICATION” ON 21st CENTURY LEARNERS 175

Kee Li Li*, 'Adnin Hanan Mohd Nasir, Nur Aina Rodhiah Rosli, Dayang Farahany Abang Taufik & Ain Sofia Abu Shahni

EVALUATING THE EFFECTIVENESS OF TELEGRAM CHATBOTS IN ENHANCING VOCABULARY ACQUISITION AMONG ESL AND EFL LEARNERS 180

Mohamed Izzat Mohamed Khalil*, Dianna Suzieanna Mohamad Shah, Mohamad Safwat Ashahri Mohd Salim, Mohd Nur Fitri Mohd Salim & Siti Nurshafezan Ahmad

EVERYONE CAN DRINK 187

Law Siew Kiat, Hii Chong Jie, Kelly Tiong Zhi Qin, Theresa Yew Shi Yun & Wong Shi Mei

EXPERIENCES OF STUDENT NURSES UTILIZING QR CODES IN MEDICAL-SURGICAL NURSING CLASS RECITATION TO ENHANCE ENGAGEMENT 191

Jumar B. Baratang, MAN, RN

EXPLOREARABIC 199

Abdul Ariff bin Abdul Karim*, Muhammad Asyraaf bin Mohd Ismail Farhari, Elhussein Ibrahim Hussein Mohamed & Muhammad Sabri bin Sahrir

EZCukai 202

Saifulrizan Norizan*, Nadiyah Abd Hamid, Ida Suriya Ismail, Zalilah @Azalilah Kassim & Azlin Abdillah

FINLOGIC.@STATEMENTS 205

Saifulrizan Norizan, Josephine Avelind Noyem*, Mariam Rahmat, Dayangku Ruhayah Awang Bolhan & Gibson Gary Leman Keska

FONARAB: FORMULA PENGAJARAN NOMBOR DAN AYAT BAHASA ARAB 210

Syahirah Almuddin & Azhani Almuddin*

FUNETIX: AN INTERACTIVE PHONETICS LEARNING GUIDE 217

Aisha Nafeesa Binti Zahriman & Farah Fatinah Enche Shaari*

FROM TEACHERS TO GLOBAL EDUCATORS: THE MALAYSIAN GCED MANUAL 221

Amirah Athirah Amir Yazid*, Syed Mohamad Syed Abdullah, Anis Shaari & Anis Shahira Bazlan

GAMIFIED LEARNING TOOL WITH INTEGRATED FORMATIVE ACTIVITIES FOR BASIC ELECTRICITY AT DIPLOMA LEVEL 226

Mohamad Adha Mohamad Idin*, Noorezal Atfyinna Mohd Napiah & Zul Atfyi Fauzan Mohd Napiah

GAMIFIKASI DALAM PSIKOLOGI KAUNSELING: KEMBARA KERJAYA 231

Mohammad Hazim Bin Amir Nordin*, Hamimi Binti Mohd Nozlan, Ts. Dr. Nurhafizah Binti Amir Nordin, Nurul Iffah Binti Mohd Zahid & Mohammad Hanis Bin Mohammad Fazin

GAMIFIKASI E-SUKAN 3S-TVM: MENINGKATKAN PENGUASAAN NILAI MASA WANG PELAJAR LEMAH 236

Dr. Lingaswaran Arjunan*, Noor Azman Bin Abdullah, Khazirah Hanim Binti Abdul Wahab & Rasikumari A/P Muniandy

i-AQADQUEST 244

Azlan Yusof Punding*, Hilda Henry, Flora Anak Ayum, Elizabeth Anak Richardson & Jeslyna Jeliah Anak Henry

i-BanCross 2.0 (ISLAMIC BANKING CROSSWORD 2.0) 250

Azlan Yusof Punding*, Mohd. Zuhaili Kamal Basir, Sitti Hawa Sheikh Mohammad, Geogrey Clarry Anak Garry & Resa Claudia Clara Anak Robert

i-Cons 2.0 (ISLAMIC CONTRACTS 2.0) 256

Azlan Yusof Punding*, Norazimah Mejri, Charolyna Binti Suharto, Mohamad Khairulamirin Bin Yusop & Nur Syafiqah Binti Hussein

iDOOR3D: IMMERSIVE SKETCHUP LEARNING OF DOOR CONSTRUCTION IN QUANTITY SURVEYING EDUCATION 262

Farhan Md Dahlan*, Abdul Muhaimin Ab. Wahid, Suhaila Ali, Norsyazwana Jenuwa & Norbaizura Abu Bakar

IMPROVING FAULT ANALYSIS WORKFLOW: A TABLE- BASED APPROACH FOR PER UNIT EQUIVALENT CIRCUITS IN BASIC POWER ENGINEERING COURSE 267

Nur Atiqah Abdul Rahman*, Muhd Firdaus Muhd Yusoff & Fatimatul Anis Bakri

T A B L E O F C O N T E N T S

I N N O V A T I O N I N T E A C H I N G & L E A R N I N G

INFECTICODE: THE MOLECULAR LOCKDOWN - UNLOCKING MOLECULAR MYSTERIES THROUGH AN EDUCATIONAL ESCAPE ROOM **273**

Suwaibah Mohamed, Ammar Akram Kamarudin, Nadia Aqilla Shamsusah, Norul Fadhilah Ismail & Nurhamimah Zainal-Abidin*

INNOVATING TRoW AS WORKFORCE GAME-BASED LEARNING FOR SUSTAINABLE EDUCATION **280**

Nurul Hayani Abd Rahman*, Nani Ilyana Shafie, Shaira Ismail & Nurul Fazila Abd Rahman

INONAT TIME TRAVEL ADVENTURE **286**

Ong Elly, Muhammad Khairul Ahmad*, Muhd Syahir Abdul Rani, Nazirul Mubin Mohd Noor & Mohamad Safwat Ashahri Mohd Salim

InRES: A DIGITAL SOLUTION FOR ENHANCING RESEARCH ORIGINALITY AND SUPERVISION IN HIGHER EDUCATION **291**

Mohd Amli Abdullah @Baharum*, Azmi Salim, Naliza Solat, Zuria Akmal Said & Nurul Zahidah Md Juperi

INSPECT TO INVEST: ESG-DRIVEN REAL ESTATE LEARNING **297**

Adibah Mohd Arif*, Nurul Afiah Ahmad & Wan Norhishamuddin Wan Rodi

I-SYARIAH CHECK: A DIGITAL LEARNING TOOL TO ENHANCE ETHICAL UNDERSTANDING IN ISLAMIC FINANCE EDUCATION **302**

Muhammad Amirul Fahmi Zaid, Muhammad Asyraf Nazri, Nurul Asmiera Kardi, Nuraliya Natasha Misdi & Rohaiza Kamis*

KYSS: KNOW YOUR STORY STRUCTURE **306**

Maisarah Noorezam*, Siti Mariam Mohammad Iliyas, Siti Hajar Aisyah Azhari, Hawa Syamsina Md. Supie & Muhamad Safwan Bin Abu Bakar

LAB SAFETY REIMAGINED: BRIDGING THEORY AND PRACTICE THROUGH TASK- BASED ASSESSMENT **312**

Al'aina Yuhainis Firus Khan*, Nurshamshida Md Shamsudin & Sharipah Ruzaina Syed Aris

LEARN & LEAD STUDY LOG: INNOVATIVE PEDAGOGIES IN MANAGEMENT ACCOUNTING **318**

Emmarelda Maswesi Ahmad*, Marshita Hashim, Najihah Abu Bakar, Muhamad Ridzuan Hashim & Mohd Afiq Azero

LINGOLAND: THE ACADEMIC QUEST **324**

Nurul Munirah Azamri*, Halimatun Saadiah Ab. Mutalib & Nooraileen Ibrahim

LINGUABRIDGE – ACADEMIC DIGITAL SCAFFOLD	329
Puvana Gnanasagaran* & Syaliana Jamaludin	

MAGICAL WORDLAND AND EXPLODING GRAMMAR	335
Qairunnissa Safia Mohd Hassan & Anis Athira Syahirah Saifuddin*	

MATHVENTURE: NUMBERS BECOME AN ADVENTURE!	341
Thavarajah Selvarajah*	

MineLab 360: Safe Science, Infinite Discovery	348
Nurshamshida Md Shamsudin*, Norezan Ibrahim & Al' Aina Yuhainis Firus Khan	

MIX & MATCH: COST ME IF U CAN	352
Norhayati Zamri*, Puteri Damia Qistina Abdul Rani, Nur Syafiqah Afifah Ahmad Muhibbuddin, Nik Fathiah Izzati Nik Azmi & Nur Syafiqah Afrina Ahmad Muhibbuddin	

MODALS IN ACTION: EXPLORING GRAMMAR THROUGH PADLET & CHATGPT	357
Mirrah Diyana Maznun*, Nurshahirah Azman, Nur Hazirah Mohd Fuat, Noor Fazzriene Jz Nun Ramlan & Sheema Liza Idris	

MOOC RC DESIGN	365
Nurizaty Zuhan, Nadiah Saari*, Oh Chai Lian, Norliyati Mohd Amin & Rozaina Ismail	

PENGUASAAN BIOLOGI SPM MELALUI VIDEO PEMBELAJARAN KOMPREHENSIF	372
Tun Mohd Firdaus Azis* & Tun Norasida Aziz	

PICTO-PAIR DUEL: CHINESE CHARACTER BATTLE	377
Ting Hie Ling*	

RED HERRINGS: AN INTERACTIVE MURDER MYSTERY GAME	383
Nur Arissa Safiyya Binti Mohd Tarmizi, Fazillah Binti Sulaiman*	

T A B L E O F C O N T E N T S

I N N O V A T I O N I N T E A C H I N G & L E A R N I N G

REINFORCING SEXUAL BOUNDARIES THROUGH INTERACTIVE SOCIAL NARRATIVES: AN INNOVATIVE APPROACH FOR ASD 388

Mohd Yusof Zulkefli*, Muhamad Hafiz Hassan, Ireena Nasiha Ibnu, Ahmad Farid Abdul Fuad & Hamizah Sahharon

REVOLUTIONIZING OBE WITH CO-AIMS 392

Ezril Hisham Mat Saat*, Norhalida Othman, Nur Amalina Muhamad, Noor Hasliza Abdul Rahman & Wan Muhammad Alif Daniel bin Wan Zazrajmir Halim

RHYTHM & RECALL: EDUBEATZ FOR COGNITIVE-FRIENDLY ECONOMICS EDUCATION 398

Hazalinda Harun*, Nornajihah Nadia Hasbullah, Rohaiza Kamis, Mohd Isham Abidin, & Amizatul Hawariah Awang

S.T.O.R.I.A. STORYTELLING AND TECHNOLOGY OUTREACH FOR REVIVING INDIGENOUS ARABIC 404

Sharina Saad*, Shafilla Subri, Anis Aisyah Binti Abdul Aziz, Tengku Aina Munirah Binti Tengku Mahazir, Muhammad Uzair Bin Zuhaidy, Muhammad Zaid Bin Kamarul Zaman

SHAREPAD: A COLLABORATIVE AND CUSTOMISABLE DIGITAL PLATFORM FOR TEACHING AND LEARNING 412

Rafidah Kamarudin*, Amalia Qistina Castaneda Abdullah, Mazliyan Zainal Arifin & Nur'Ain Zuraimi

SHIFTING THE TRADITIONAL: STUDENT FEEDBACK ON FLIPPED CLASSROOM APPROACH IN LEARNING A STATISTICS COURSE 418

Faridah Zulkipli*, Nor Aslily Sarkam, Nor Hazlina Mohammad & Siti Salihah Shaffie

SKETCHSCAPE: TRANSFORMING 2D LANDSCAPE SKETCHES INTO IMMERSIVE 3D PAPER ART 425

Nadiyanti Mat Nayan*, Azrul Bahaluddin & Helmi Hamzah

SMARTCALC GUIDE: ADVANCING MATHEMATICAL FLUENCY THROUGH DIGITAL CALCULATOR INTEGRATION 429

Yusrina Andu*, Nurul Aityqah Yaacob, Siti Noor Dina Ahmad, Siti Zaharah Mohd Ruslan & Zuraida Jaafar

SPEAKSPRINT: ENHANCING ENGLISH SPEAKING SKILLS THROUGH SPEED INTERVIEW PRACTICE 436

Aimi Shaheera Salleh & Emily Abd Rahman*

STA BOOST: AN INNOVATIVE DIGITAL SOLUTION TO ENHANCE STUDENT ENGAGEMENT IN INTRODUCTION TO STATISTICS 442

Mohamad Nurshahnazim Muhammad Nur Ismail, Muhammad Lutfil Hadi Abdul Halil, Geoffery Marvin Wong, Mohamad Iqmall Hakimi Mohamad Ashree & Akmal Shafiq Badarul Azam*

TABTECH 447

Hanani Bahiyah Binti Yazeed, Nurqaisara Khalishah Hana Binti Adi Barkhiar, Alieya Syahierah Binti Abu Sapien, Nur Adriana Fasiha Binti Md Shaiful Azman, Nik Nurul Atiyah Binti Nik Zuraidi & Nur Atiqah Binti Akhyani*

TEACHING FOR TOMORROW: TRANSFORMING ASSESSMENT FOR SUSTAINABILITY 452

Nooraslinda Abdul Aris*, Normahiran Yatim & Siti Syaquilah Hambali, Norli Ali

THE PEEL PATHWAY: A LEARNING INNOVATION FOR SMARTER LEARNING AND BETTER GRADES 458

Jennifah Nordin*, Nur Afisha Yusuf, Chai Shin Yi, Ivy Jugah & Sarehan Sadikin

THE POTENTIAL FLOW INTERACTIVE TEACHING TOOL (PFITT) 462

Azli Abd Razak*, Schufee Amani Suhaime and Fauziah Jerai@Junaidi

THE USE OF CLASSPOINT FOR STUDENT ENGAGEMENT IN LEARNING COMPUTER AND INFORMATION PROCESSING 468

Nur Idawati Md Enzai*, Siti Aishah Che Kar, Norhayati Ahmad & Siti Sara Rais

THREADING MEMORYSCAPES: MENTAL MAPPING AND CULTURAL STORYTELLING THROUGH STRING, SPACE & PLACE 472

Nadiyanti Mat Nayan*, Suriati Ahmad, Norasikin Hassan, Noralya Balqis Syed Guntur & Arsyad Jazli Suhazeli

TIKTOK'S ROLE IN BOOSTING MOTIVATION TO LEARN ARABIC AMONG MALAYSIAN UNIVERSITY STUDENTS 476

Professor Ts Dr. Muhammad Sabri bin Sahrir, Nurul Ain Binti Usman, Huda Binti Muhammad Sharifuddin, Fatin Nasuha Binti Mohd Shamsul & Nurfitriah Shahira Binti Nor Azman

TRADEU: BRIDGING THEORY AND THE MARKET WITH REAL-TIME FINANCIAL LEARNING 479

Mas Azra Zakirah Mohd Azahari, Najwa Nadhirah Mohd Nor Azman, Nuramera Amir, Nur Madihah Azuan & Rohaiza Kamis*

VARKonstruct: INNOVATING SUSTAINABLE EDUCATION IN CONSTRUCTION TECHNOLOGY THROUGH ADAPTIVE E-LEARNING 483

Siti Nur Aishah Mohd Noor*& Mohd Khairul Amri Ramly

STA BOOST: AN INNOVATIVE DIGITAL SOLUTION TO ENHANCE STUDENT ENGAGEMENT IN INTRODUCTION TO STATISTICS 442

Mohamad Nurshahnazim Muhammad Nur Ismail, Muhammad Lutfil Hadi Abdul Halil, Geoffery Marvin Wong, Mohamad Iqmall Hakimi Mohamad Ashree & Akmal Shafiq Badarul Azam*

**INTEGRATION OF VISUAL, AUDITORY, AND INTERACTIVE ELEMENTS IN
TEACHING COMPOUND WORDS: AN INNOVATIVE BEESMART APPROACH 488**

Normadiyana Abdullah*, Nazrul Azli Mohd Kamal, Nur Faatihah Aina Shahril, Nur
Fatini Syauqina Nafrizam, Mohammad Hazim Amir Nordin, Nurhafizah Amir
Nordin & Mohd Fahridzakki Abd Rahman

T A B L E O F C O N T E N T S

I N N O V A T I O N I N E D U C A T I O N A L R E S E A R C H

A METHODOLOGY FOR INTEGRATING VIRTUAL WATER DATA INTO LIFE CYCLE COST IN THE MALAYSIA'S WATER INFRASTRUCTURE SECTOR	494
Wan Nur Intan Iwani W Muhamad* & Mohd Fairullazi Ayob	

A METHODOLOGY STUDY ON THE ROLE OF QUANTITY SURVEYING INSAFETY COST PLANNING AND RISK MITIGATION IN THE CONSTRUCTION PROJECTS	500
Siti Nur Qasdina Zulkifli* & Mohd Fairullazi Ayob	

A METHODOLOGY TO INVESTIGATE COST COMPARISON BETWEEN SOIL NAILING AND SHEET PILING METHODS	504
Nur Faqihah Zainol*, Mohd Fairullazi Ayob	

A METHODOLOGY TO INVESTIGATE COST COMPARISON BETWEEN THE EXCLUSIVITY OF END-OF-LIFE (EOL) BATTERIES FOR ELECTRIC VEHICLES (EVS) IN MALAYSIA	508
Nurul Lyana Binti Mohd Jais* & Mohd Fairullazi Ayob	

A METHODOLOGY TO INVESTIGATE FINANCIAL CHALLENGES AND STRATEGIC RESPONSES OF NET ZERO BUILDING IN MALAYSIA	511
Nur Ameerah Batrisyia Mohd Taharill* & Mohd Fairullazi Ayob	

A METHODOLOGY TO INVESTIGATE THE CHALLENGES AND STRATEGIES FOR IMPROVING LIFE CYCLE COST (LCC) PRACTICE IN THE MALAYSIAN URBAN RENEWAL	514
Nur Adlina Shahimi* & Mohd Fairullazi Ayob	

ADOLESCENT SOCIAL MEDIA USE: UNDERSTANDING ITS IMPACT ON SELF-ESTEEM	518
Harith Irfan Bin Husrin*	

ANALISIS KOS-MANFAAT RePlasPro : TRANSFORMASI PLASTIK TERBUANG MENJADI PRODUK INOVATIF	523
Nur YasminMahazir*, Ismail Samsuddin, Sunita Devi Arafat Paramanandam, Hasmawi Mat Yusoff & Nurul Saqinah Abd Razak	

BEYOND AI: THE HUMAN LIBRARY IN HIGHER EDUCATION – A SYSTEMATIC LITERATURE REVIEW	528
Sharmila A/P Narayanasamy, *Anuratha A/P Anamala, & Nur Baiti binti Ismail Shauki	

BIBLIOVERSE TOK BAYU EDU: BRIDGING SOCIAL AND EMOTIONAL LEARNING THROUGH DIGITAL BIBLIOTHERAPY FOR SUSTAINABLE EDUCATION	532
Nur Dayana Balqis Binti Norul Azizi*, Profesor Madya Dr. Masitah Binti Ahmad, Profesor Madya Dr. Norhayati Binti Hussin & Rafidah Binti Abdul Aziz	

CHALLENGES FACED BY NON-NATIVE SPEAKERS IN LEARNING ARABICSYNTAX IN DIPLOMA COURSE 538

Husna Burhanuddin*, Muhammad Hazim Ali bin Mohd Hoiri, Saputra Angga

COMPOSITE MICROMECHANICAL ANALYSIS LEARNING TOOL (CMALT) 543

Schufee Amani Suhaime*, Fatin Rohaina Rosli, Mohd Shahrom Ismail, Mohd Nor Azmi Ab Patar & Jamaluddin Mahmud

DELIVERA (DELIVERY AND ASSESSMENT MODEL): THE IMPACTS OF COLLABORATIVE TEACHING ON STUDENTS 550

Wan Noor Hazlina Wan Jusoh*, Norlaila Ibrahim, Nor Faezah Ghazi Ahmad, Nik Fakrulhazri Nik Hassan

DESIGN AND DEVELOPMENT OF MOBILE APPLICATION FOR ASSESSING CRIME RISK FOR INVESTIGATION OFFICER (IO) 557

Mohd Razif Bin Maidin*, Mohamad Fahmi Hussin & Khairilmizal Samsudin

DEVELOPMENT OF A COMPACT AND SUSTAINABLE CNC MILLING MACHINE FOR PCB PROTOTYPING 563

Hana Syahirah Binti Rosli* & Mohammad Afif Bin Ayob

DysDetectV1: DYSLEXIA-DYSGRAPHIA SEVERITY CLASSIFICATION USING HANDWRITING IMAGE AND MACHINE LEARNING MODEL 569

Siti Azura Ramlan*, Iza Sazanita Isa, Nur Athiqah Harron & Abdul Aziz Abdul Muttalib

e-MANUAL INTERAKTIF BAHASA ARAB: BANGUN PASUKAN, BINA BAHASA 573

Syahirah Almuddin*, Norshida Hashim, Mashitah Nordin, Nurulnabilah Abdul Aziz & Kamaruzaman Zali

ENHANCING UNIVERSITY BUILDING PERFORMANCE: A METHODOLOGY TO INVESTIGATE MAINTENANCE AND OPERATIONAL CONDITIONS 580

Mohd Fairullazi Ayob*, Mohd. Yusri Mohamed Yunus, Khairusy Syakirin Has-Yun Bin Hashim, Abdul Razak Sopian, Ahmad Tarmizi Haron

FRAME BY FRAME: EMPOWERING ESL LEARNERS THROUGH VISUAL WRITING 585

Haziqah Zulaikha Aris*, Annur Najiah Hussaini Hussain & Aizat Shamsuddin

GAMIFYING SUSTAINABILITY: CREATING AN APP TO PROMOTE SDG PRACTICES AMONG STUDENTS 590

Noorlailahusna Mohd Yusof*, Hafizah Hammad Ahmad Khan & Azlyn Ahmad Zawawi

T A B L E O F C O N T E N T S

I N N O V A T I O N I N E D U C A T I O N A L R E S E A R C H

GLOWSAFE LUNCHBOX: AN EARLY-WARNING INNOVATION FOR FOOD SAFETY IN SCHOOLCHILDREN 596

Puan Demaisuria Kanasan*, Tishha A/P Ravi Kumar, Tulirmathii A/P Prabu, Sharane A/P Krisnan Murti, Nithyasri A/P Kumar & Divyamathi A/P Thanabalan

IMPLEMENTATION OF MEDIATION IN THE ESTATE DISTRIBUTION DIVISION (EDD) TO RESOLVE ESTATE DISPUTES 600

Muhammad Amrullah Drs Nasrul, Akmal Hidayah Halim, Anis A'fifah Zairin Zain*

INNOVATIVE USE OF SAGO PITH WASTE IN CEMENT BRICKS: A SUSTAINABLE APPROACH TO SAND REPLACEMENT 605

Mohd Dzuliqyan bin Jasni, Hazman bin Seli, Shahana Adin binti Hasbullah, Nur Syakirah binti Mohd Yunus, Nathanael Subil

INTEGRATING DEEPSEEK INTO RURAL ELDERLY SERVICES: OPPORTUNITIES, CHALLENGES, AND ADAPTATION STRATEGIES IN JILIN PROVINCE, CHINA 612

Wang Hanjue , Thenmolli Vadeveloo* & Suhaimi Abd. Samad

INTEGRATING ECONOMICS LESSONS INTO SNAKE AND LADDER GAME: AN INNOVATION APPROACH TO SUSTAINABLE EDUCATION 617

Nor Zuriati Amani Ab Rani, Nik Suriati Nik Hassan* & Hamnah Che Hamzah

INTEGRATING GREEN NANOTECHNOLOGY RESEARCH INTO ENGINEERING EDUCATION USING PALM-OIL-BASED TRANSFORMER NANOFLUIDS 623

Muhammad Zaki Bin Amiruddin & Ir. Ts. Dr. Nik Hakimi Nik Ali

KEBERKESANAN KEMPEN KESEDARAN TERHADAP PENJAGAAN BUKU TEKS SPBT DALAM KALANGAN MURID TAHUN 3 SEKOLAH KEBANGSAAN RANTAU PANJANG, KLANG 629

Fatin Afiqah Binti Khamsuliskandar*, Alfiah Binti Baidawi , Khairuh Azlina Binti Ngah , Norlida Binti Abdul Rahman & Zati Haslinda Binti Mohd Rokhani

LEAFSENSE 633

Muhammad Aliff Hafiy Bin Mohammad Syahril, Muhammad Harith Bin Muhammad Hilmi, Muhammad Shahmi Ukail BinSamingin, Syed Hassan Al Husaini Bin Syed Mohd Akhirudin, Ahmad Hazim Luqman Bin Ahmad Azli & Nur Atiqah binti Akhyani*

LEXITOONS: AN EDUCATIONAL INNOVATION TO ENHANCE CONTEXTUAL LEGALESE USING COMIC STRIPS 638

Nurshafawati Ahmad Sani, Nur Salina Ismail & Mairas Ab Rahman

MINDREST: INTERVENSI AUDIO-VISUAL TERAPEUTIK BAGI MENINGKATKAN KUALITI TIDUR DAN KESIHATAN 644

Fizzy Sherani Mohd Izhar, Mohd Fahridzakki Abd Rahman, Mohammad Akmal Abd Razak, Mohammad Hazim Amir Nordin & Nurul Shafiqah Jalal

ME-BIPLP - THE DEVELOPMENT OF A MALAY-ENGLISH BILINGUAL LANGUAGE PRACTICES QUESTIONNAIRE FOR MALAYSIAN PARENTS AND CAREGIVERS

648

Fatin Nadiah Mahmud*, Khazriyati Salehuddin & Nur Ainil Sulaiman

MENINGKATKAN KECEKAPAN MURID TAHUN 6 MENGHADAPI DUNIA VUCA MELALUI PENDEKATAN PEMBELAJARAN INOVATIF

655

Ismail Bin Samsuddin*, Zuraidawati Binti Zolkaflee, Tan Keh Chin & Mohd Hanapi Bin Mohd Daud

MORI NORI (MORINGA OLEIFERA INNOVATION INTO HEALTHY NORI SNACKS)

660

Dimas Fahrezi, Gita Tresno Asih Raharjo, Olga Octaviani Eka Sari*, Paujia Hanum & Syarif Hidayatullah

OPTIMIZATION OF TURBIDITY REMOVAL FROM WASTEWATER USING CARICA PAPAYA SEED EXTRACT VIA RESPONSE SURFACE METHODOLOGY

664

Nurul Najwa Hussin & Azianabiha A Halip Khalid*

PREDICTING FACTORS IN FINANCIAL LOSS AMONG MALAYSIAN SCAM VICTIMS USING MACHINE LEARNING

671

Nur Alisa Binti Azian* & Che Norhalila Binti Che Mohamed

PRESERVING MALAYSIA'S CULINARY HERITAGE: A BILINGUAL E-BOOK OF FESTIVE DISHES

678

Amirah Damia Rosnizam & Farah Zahidah Binti Mohd Noor*

RATTAN WEAVING ART AS A CONCEPTUAL APPROACH TO STRESS REDUCTION

684

Nurhafizah Amir Nordin*, Mohammad Hazim Amir Nordin, Mohd Fahridzakki Abd Rahman, Normadiyana Abdullah & Ameer Aiman Mison

REDUCTION OF POLLUTANTS IN BRINE EFFLUENT USING ELECTROCOAGULATION

688

Nurul Aina Yaziz*, Norhafezah Kasmuri, Nur Dhiya Aqilah Mazlan & Muhammad Najmi Sahrudin

RePlasPro CARBON TRACKER

692

Sunita Devi Binti ArafatParamanandam*, Nurul Saqinah Binti Abd Razak, Nur Yasmin Binti Mahazir, Ismail Bin Samsudin & Hasmawi Bin Mat Yusoff

RePlasPro SEBAGAI MODEL PEDAGOGI INOVATIF: MENGHUBUNGKAN PEMBELAJARAN MAKLUM STEM DENGAN PENGHASILAN PRODUK KITAR SEMULA

698

Zuraidawati Binti Zolkaflee*, Kaushalya A/P Dhayalan, Ismail Bin Samsuddin, Tan Keh Chin & Hasmawi Bin Mat Yusoff

SAHSIAH TRACKER: APLIKASI PEMANTAUAN SAHSIAH DAN PENGURUSAN DISIPLIN MURID TAHUN 6 SECARA BERSTRUKTUR 701

Hasmawi Bin Mat Yusoff, Ismail Bin Samsuddin, Zuraidawati Binti Zolkaflee, Shamsuri Bin Sainan & Mohamad Muzafar Bin Maasom

SIGNOVA: A SIGN LANGUAGE LEARNING REVOLUTION FOR STUDENTS WITH DISABILITIES 706

Mat Redhuan Samsudin*, Rushana Sulaiman & Noorlida Daud

SMART MICRO-CREDENTIALS IN HIGHER EDUCATION: ENHANCING STUDENT ENGAGEMENT IN PROBABILITY LEARNING 713

Mohd Zaki Awang Chek*, Isma Liana Ismail & N. F. A. Razak

STRATEGIC CURRICULUM REVIEW FRAMEWORK USING HOUSE OF QUALITY (HOQ) 718

Norliana Mohd Abbas*, Azli Abd Razak, Nor Fazli Adull Manan, Mohd Afzan Mohd Anuar & Idris Saad

TECHNOLOGY AS SUICIDE RISK AND PROTECTIVE FACTORS: FROM COUNSELLING POINT OF VIEW 724

Nur Syuhada Mohd Munir*, Haniza Rais & Ainol Madziah Zubair

THE KHUTUB KHANAH 729

Atiqah Al-Insyirah Binti Hamdan Yusi*, Prof Madya Dr Masitah Binti Ahmad, Prof Madya Dr Saidatul Akmar Binti Ismail, Dr Nurul Izzah Binti Jamil & Nur Rawaidah Binti Rahmat

THE MEDIA'S DOSE OF DUTY: GUIDELINES FOR ETHICAL REPORTING 734

Wan Norshira Binti Wan Mohd Ghazali*, Wan Muhammad Wan Abdul Aziz, Norhidayu Hasan, Nor Hafizah Abdullah

TRANSFORMING PROGRAMMING EDUCATION THROUGH A QUIZ-BASED MOBILE APP: AN INNOVATION IN FORMATIVE LEARNING FOR C++ 739

Nur Syafikah Ibrahim*, Azrina Suhaimi, Azyan Yusra Kapi @ Kahbi, Harshida Hasmy & Mohamad Faizal Ab Jabal

TEKNIK "SIMBOL" SATU KAEDAH MENGUASAI TAJUK TEORI PENGELUARAN 745

Dr. Muruga a/I Krishnan*

TRANSFORMING ODL PRACTICES: AN ASSESSMENT TOOL FOR CONTINUANCE INTENTION IN HIGHER EDUCATION 751

Shafinaz Lyana Abu Talib* & Rusliza Yahaya

T A B L E O F C O N T E N T S

I N N O V A T I O N I N E D U C A T I O N A L R E S E A R C H

USING GEMINI AI TO IMPROVE MATRICULATION STUDENTS' WRITING PERFORMANCE	755
Efa Natrah Binti Nordin* & Revathy Ananthan	

VIRTUAL ESCAPES: EXPLORING THE EFFECTS OF NATURE-BASED VR ENVIRONMENTS DURING ACADEMIC BREAKS	762
Nor Izana Mohammed Shobri* & Farhan Md Dahlan	



THE EXTENDED

ABSTRACT

C A T E G O R Y A & B

INNOVATION IN TEACHING & LEARNING

1PAGE NOTES - STORY WRITING: A COMPREHENSIVE LEARNING RESOURCE FOR NARRATIVE WRITING

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ABSTRACT

The accessibility of comprehensive learning resources is essential to foster effective educational outcomes. Learning resources can facilitate comprehension of lessons to enhance students' knowledge and skills. This project focuses on the narrative writing genre. Therefore, an innovative product namely "1PAGE NOTES – STORY WRITING" was developed to provide comprehensive and engaging notes on narrative writing on just one page. It was specially designed for a university social responsibility initiative involving undergraduate students as participants from Universitas Islam Darul Ulum, Lamongan, Indonesia. Therefore, "1PAGE NOTES – STORY WRITING" is available in two languages namely English and Indonesian. This innovative bilingual learning tool is designed to facilitate the acquisition of story writing skills among the participants. The core features of the innovation of this product lie in its unique design that all essential notes are presented on one page by using two languages, bite-sized content and essential multimedia elements. It is designed bilingually to recognize the increasing importance of multilingualism in education and the potential benefits of cross-linguistic transfer in learning complex concepts. This facilitates students to draw upon their existing linguistic knowledge to better understand new concepts and develop a deeper appreciation for language in storytelling. The other unique features are using bite-sized content and essential multimedia elements to reduce cognitive load. Moreover, the integration of essential multimedia elements can enhance engagement in learning and comprehension as the elements serve to illustrate key concepts and provide a memorable framework for students to organize their understanding of story writing techniques.

Keywords: writing, narrative, learning resources, bilingualism, multimedia elements

INTRODUCTION

Learning resources are essential for effective teaching and learning. In the case of narrative writing, it often presents significant challenges for educators and students alike (Fauzi et al., 2021). Teachers face challenges such as building knowledge, thinking critically, being creative, and using language well to write engaging stories. (Fauzi & Pratama, 2021), defining and explaining multi-level connections of narrative elements (Ye et al., 2024), and time constraints to teach narrative writing due to demands to teach other language skills and curriculum requirements (Ramasamy et al., 2023). Whereas students have problems in expressing their thoughts and ideas effectively (Jansen & Ngema, 2024) and language aspects such as tenses, vocabulary, and correct grammar (Anggreyni & Baluqiah, 2022; Taye & Mengesha, 2024). They also struggle with discourse markers (Eryılmaz & Yeşilyurt, 2020). Thus, providing educators and students with a structured yet flexible framework for mastering narrative writing can substantially improve educational outcomes.

To address the challenges, a comprehensive educational resource requires specific features. The required features are as follows.

First, it is available in English and the students' first language. It is important for students learning English where English is not their first language (Hartono et al., 2020) for bridging linguistic gaps, facilitating comprehension, promoting inclusivity, which can further enhance learning experiences and outcomes; and engage students with the material more confidently, leading to improved narrative writing skills and a greater appreciation for linguistic diversity (Song, 2024).

Second, it contains bite-sized learning contents to fit easily into small and manageable chunks, making it easier for students to read, understand, retain and apply (Singh, 2024). It can improve their narrative writing skills (Maharani & Fadilah, 2021) by segmenting the writing process into distinct, actionable steps (Re & Carretti, 2016) which include specific narrative elements such as character, setting, plot, conflict and theme.

Finally, it incorporates essential multimedia elements which include text and static graphics to enhance engagement (Mubarak & Asri, 2020, Mathew, 2022), cater to diverse learning styles (Mathew, 2022), offer varied ways to understand narrative writing concepts (Mathew, 2022) and enrich the educational experience by making complex ideas more accessible and memorable (Breakstone et al., 2021).

The selection of essential multimedia elements only and content in bite-sized is necessary to reduce cognitive load. The Multimedia Learning Theory by Mayer (2009) explains that effective learning occurs when instruction is aligned with the capacity of the human mind information processing: through dual channels namely visual and auditory which have limited capacity. Mayer (2009) states that cognitive load can be managed when extraneous processing is reduced to avoid overwhelming working memory so that meaningful learning occurs.

Undoubtedly, mastering the writing of short stories which is in the narrative writing genre requires a significant investment of time and effort from both teachers and students, highlighting the need for efficient and effective pedagogical tools. Therefore, "1Page Notes - Story Writing" was designed and

developed as a comprehensive learning resource aimed at streamlining the acquisition of narrative writing skills. The objectives of creating this resource are as follows:

To furnish educators with a structured framework for teaching narrative writing.

To provide students with engaging guidance for narrative writing.

To reduce students' cognitive load in learning narrative writing.

To facilitate understanding in more languages than English as the resource is provided in bilingual form by using the English language and the Indonesian language

METHODS

The creation of the "1-Page Notes – Story Writing" followed a rigorous methodology by applying the ADDIE Model which consists of five phases:

Analysis: The challenges were identified

Design: The product was designed based on the improved Note-in-Poster (NIP) framework by selecting languages, bite-sized content and multimedia elements

Development: Applications to develop the products were selected.

Implementation: The sample was chosen through purposive sampling consisting of undergraduate students from Universitas Islam Darul Ulum, Lamongan, Indonesia. The product was implemented in a writing workshop for writing short stories on 12 June 2025. The data was analysed using the Statistical Package for Social Sciences (SPSS).

Evaluation: The product was evaluated by using a questionnaire which was developed using Google Form distributed via a QR code before and after the workshop.

RESULTS AND DISCUSSION

Phase 1: Analysis

The review of literature indicated there are challenges in the teaching and learning of narrative writing among teachers (Fauzi & Pratama, 2021) and students (Jansen & Ngema, 2024; Taye & Mengesha, 2024; Anggreyni & Baluqiah, 2022; Sukhera, 2022; Eryilmaz & Yeşilyurt, 2020).

Phase 2: Design

Bite-sized contents were selected covering three aspects namely (1) What is a story? (2) Five Elements in a Story and (3) Language. The Improved Note-in-Poster Framework (Nor Haniza et al., 2022) was applied to facilitate the selection of content and multimedia elements. Only two types of multimedia

elements were applied in the design of the product, which were text of different colours and sizes and static graphics. The product was made available in two languages: Indonesian and English.

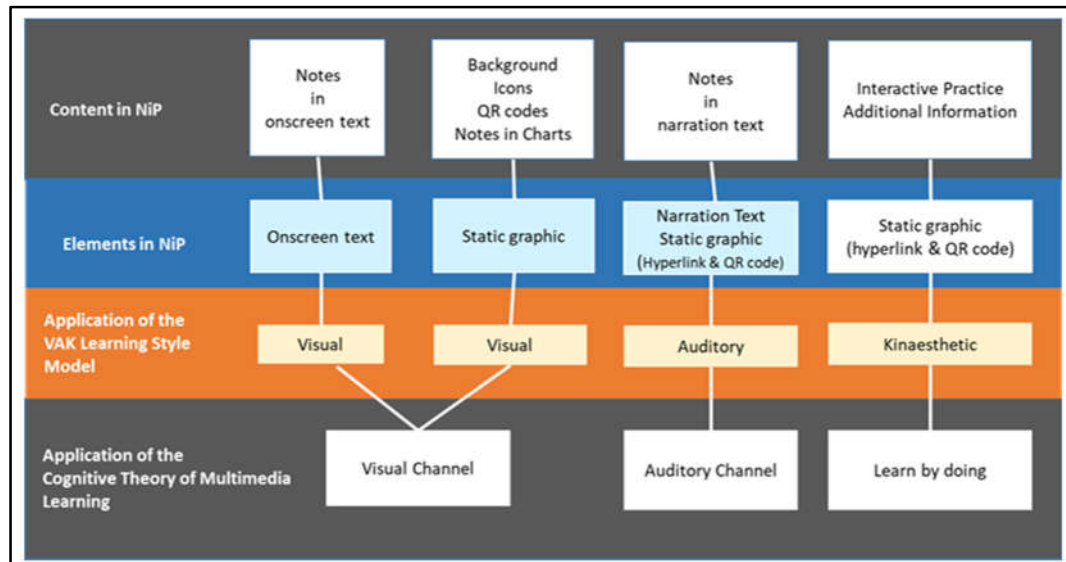


Figure 1.: The Improved NIP Framework

Phase 3: Development

In the development phase, the content and features were implemented into a one-page learning material. The one-page learning material PowerPoint and Word were used to design the product. The final product was in the digital format: Portable Document File (PDF) and hardcopy format. Figure 2 shows the developed product.

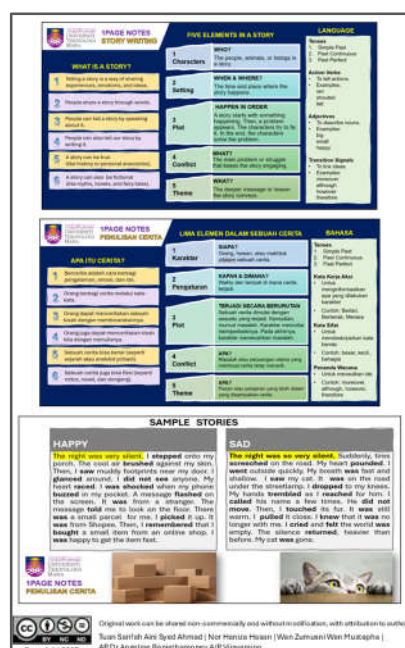


Figure 2.: 1Page Notes - Story Writing

Phase 4: Implementation

The implementation of the product was in a workshop at Universitas Islam Darul Ulum (UNISDA), Lamongan, Indonesia on 12 June 2025. The workshop was conducted face-to-face in about 90 minutes. The sample was selected through purposive sampling that consisted of 106 undergraduate students of Indonesian as the product was specially for the university social responsibility at UNISDA conducted in conjunction with the signing of Memorandum of Understanding between UiTM and UNISDA.

In the workshop, the lecturers explained to students how to write a short story in English using the product in digital form displayed on the screen. At the same time, students were also provided with the product in hardcopy form. After that, a worksheet containing a prompt was distributed to students, and they were given about 40 minutes to compose a short story individually. They could refer to the hardcopy notes while writing the short story. At the end of the workshop, the worksheet containing students' short stories were collected.

Phase 4: Evaluation

There were 22 items using five Likert scales (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree), The reliability test was conducted and the Cronbach's Alpha obtained was 0.958 (N=22) which was high and acceptable.

The workshop was attended by 106 students, but only 89 students filled in the questionnaire. The results indicate that 71.91% of the students were female while 28.09% were male. Most of them (65.17%) were 20 to 21 years of age followed by 23.60% who were 18 to 19 years of age, leaving 11.24% at 22 to 23 years of age.

Table 2 indicates the mean scores, standard deviations and the interpretation of mean scores of five questionnaire items before and after the programme. The interpretation of mean scores is based on Alston and Miller (2002): Strongly Disagree (1.0 - 1.49), Disagree (1.5 - 2.49), Neutral (2.5 - 3.49), Agree (3.5 - 4.49) and Strongly Agree (4.5 - 5.0).

The results demonstrate an increase from Neutral to Agree in the students' belief in their ability to write short stories (Item 1: M=3.46 to 3.64), their ability organize my ideas to write short stories (Item 2: M=3.47 to 3.62) and their knowledge on the five elements that need to be present in a story (Item 3: M=3.35 to 3.70). However, the results did not indicate any changes in terms of their beliefs on whether they liked writing short stories in English (Item 4: M=2.78 to 3.21) and their confidence in their ability to write short stories in English (Item 5: M=3.03 to 3.31). Although the responses indicated they were neutral for both statements before and after the programme, the values increased considerably.

Table 1.: Questionnaire items before and after the programme

Item	Before the programme			After the programme		
	Mean	Standard Deviation	Interpretati on of Mean	Mean	Standard Deviation	Interpretati on of Mean
1. I can write short stories.	3.46	.641	Neutral	3.64	.678	Agree
2. I can organize my ideas to write short stories.	3.47	.641	Neutral	3.62	.649	Agree
3. I know the five elements that need to be present in a story.	3.35	.740	Neutral	3.70	.681	Agree
4. I like writing short stories in English.	2.78	.836	Neutral	3.21	.818	Neutral
5. I am confident that I can write short stories in English.	3.03	1.016	Neutral	3.31	.806	Neutral

In conclusion, the results suggest that the workshop was able to enhance students' knowledge and skills in writing short stories in English. Besides, it also increased students' confidence in writing short stories in English and promoted positive attitudes towards writing short stories in English and learning English as well.

CONCLUSION

The development and implementation of the innovation of 1Page Notes - Story Writing have demonstrated positive outcomes in enhancing students' understanding and ability to write narrative short stories. The workshop, conducted in collaboration with Universitas Darul Ulum Lamongan, Indonesia, not only improved participants' knowledge of key narrative elements but also positively influenced their confidence and attitudes towards writing in English. The strategic use of bilingual content, bite-sized learning components, and essential multimedia elements proved effective in reducing cognitive load and engaging learners. Moreover, the innovation's non-digital format offered a refreshing alternative to screen-based learning, aligning with current concerns about digital overexposure. As a comprehensive and accessible pedagogical tool, this initiative reflects a promising step forward in narrative writing instruction and holds great potential for adaptation in other linguistic and educational contexts.

ACKNOWLEDGEMENTS

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A SCRABBLE-INSPIRED PHYSICS LEARNING TOOL TO ENHANCE UNDERSTANDING AND RETENTION OF NEWTON'S LAWS OF MOTION

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ABSTRACT

Despite the increasing use of digital tools and multimedia in classrooms, many students continue to struggle with understanding and remembering fundamental physics concepts, particularly Newton's Laws of Motion. These topics involve abstract ideas and scientific terms that are often difficult to grasp through traditional teaching methods. Recognizing these challenges, this innovation introduces a Scrabble-inspired physics learning tool designed to improve memory retention and conceptual understanding of Newton's Laws of Motion in an engaging and meaningful way. This interactive, word-based game promotes active recall and deeper learning through repeated exposure to physics terms and definitions. The tool is specifically developed for diploma-level physics students but is adaptable across various educational settings, including secondary school, matriculation, and pre-university programmes. In addition to improving conceptual retention, the tool also supports the development of 21st-century skills such as critical thinking and communication. It offers educators a creative and effective way to enhance physics instruction in the classroom. Ultimately, this tool helps students learn more effectively, understand concepts more clearly, and maintain lasting interest in physics.

Keywords: Gamified Learning, Physics Education, Newton's Laws of Motion, Conceptual Understanding, Memory Retention.

INTRODUCTION

In physics education, Newton's Laws of Motion are foundational concepts that students must grasp to understand motion and force. However, many diploma-level students struggle to retain definitions and apply these laws due to their abstract nature and technical terminology. Traditional lecture-based teaching often results in rote memorisation with limited conceptual understanding. Studies have shown that the complexity of science vocabulary significantly affects students' ability to comprehend and retain scientific concepts (Cervetti et al., 2015; Snow, 2010). Students become more engaged and better understand scientific terms when vocabulary is taught through interactive, meaningful, and game-based activities (Qian & Clark, 2016; Zainuddin et al., 2020). In addition, game-based learning has gained attention for its effectiveness in enhancing motivation and engagement, particularly in abstract science topics like physics (Zainuddin et al., 2020). To address these needs, we developed a Scrabble-inspired tool that combines active recall, collaborative play, and repeated exposure to key physics terms. This approach supports both conceptual mastery and the development of 21st-century skills such as communication and teamwork, offering an effective alternative to traditional instruction.

METHODS

This study used a quasi-experimental design to assess the effectiveness of integrating a word-based board game in physics instruction. The focus was on improving students' understanding and retention of Newton's Laws of Motion.

Game Design

This Scrabble-inspired board game was designed to be interactive, collaborative, and enjoyable while reinforcing Newtonian concepts. It includes questions, vocabulary application, and a scoring system to create a meaningful learning experience. The game targets three learning domains: cognitive (conceptual understanding), affective (interest and motivation), and behavioural (active terminology use and communication). The design aligns with Plass et al. (2015), who emphasized cognitive engagement in game-based learning.

Game Components

The game includes a board with scoring zones (Double Points, Bonus Zones), 100 letter tiles with point values, and a deck of Q&A cards. These cards test students on both definitions and applications of Newton's Laws. A scoring system allows manual recording or digital entry via QR code-linked Excel sheets. Table 1 illustrates the set of question prompts integrated into the Q&A cards, crafted to assess students' conceptual understanding.

Table 1.: Sample Questions from the Q&A Card Deck

No.	Question Prompt	Targeted Concept
1	A push or pull	Force
2	SI unit of force	Newton (N)
3	Law of action-reaction	Newton's Third Law
4	Law of inertia	Newton's First Law
5	The tendency of objects to resist a change in their state of motions	Inertia
6	An object will remain at ____ or in uniform motion in a straight line unless acted upon by a net external force	Newton's First Law
7	Force that opposes motion between two surfaces	Friction
8	The force of gravity acting on an object	Weight
9	Pointed perpendicular to the surface	Normal Force
10	The amount of matter in an object	Mass
11	The pull of one object on another object	Gravitational Force
12	Force equals mass times	Newton's Second Law

Game Setup and Rules

The game is played in pairs or small groups (two to four players or teams). Each team receives identical sets of tiles, and players take turns in a clockwise direction. Before starting, the board, tiles, cards, and score sheets are arranged to ensure a smooth session focused on learning. Words must be formed in straight lines (horizontally or vertically), and all plays must connect to existing tiles after the first turn. Incorrect spelling or isolated tiles result in no score. These rules ensure consistency and fairness.

Gameplay Procedure

Gameplay begins with a player drawing a Q&A card and reading the question aloud. The player must then answer the question verbally. If the answer is correct, the player is allowed to form the word or phrase corresponding to the answer using their letter tiles on the game board. The placement of tiles on

the board should be strategic to take advantage of scoring multipliers such as Double Points zones. After placing the tiles, the player calculates their score based on the values of each letter used, along with any applicable bonus points. The score is then recorded either manually or through the linked digital system. The game continues with the next player drawing a new card and following the same steps. The game ends after a predetermined number of rounds or when all Q&A cards have been used. The player or team with the highest cumulative score is declared as the winner. A step-by-step infographic, as shown in Figure 1, visually demonstrates the game procedure from drawing question cards to placing letter tiles on the board.



Figure 1.:Step-by-step infographic demonstrating gameplay procedures

Educational Integration

This board game is deliberately designed to merge play with learning in a meaningful, student-centred context. As students participate in the game, they are exposed repeatedly to essential physics terms and concepts related to Newton’s Laws. The process of answering questions, forming accurate scientific words, and discussing ideas with peers reinforces understanding through active recall and repetition. The collaborative and competitive elements of the game foster higher engagement, increase motivation, and support the development of soft skills such as teamwork and scientific communication. By shifting from passive to active learning, this innovation encourages deeper conceptual mastery while making the physics classroom more dynamic and enjoyable. These outcomes align with gamification research highlighting its effectiveness in promoting collaboration and meaningful student interaction (de Sousa Borges et al., 2021).

RESULTS AND DISCUSSION

Initial classroom trials showed that the game improved students' understanding and retention of Newton's Laws. Students were more active, confident, and articulate in using physics terminology post-activity. Informal comparisons of student participation and verbal responses before and after the game indicated clearer use of terminology and better explanation of Newtonian concepts. Observations also revealed high levels of engagement and collaborative interaction among learners during gameplay.

Hamari et al. (2014) confirmed that gamification enhances motivation and learning behaviours, whereas Rutten et al. (2012) demonstrated the effectiveness of interactive tools in promoting conceptual understanding in science education. Wieman et al. (2010) also concluded that active learning strategies outperform traditional methods in improving student outcomes. While this study employed a quasi-experimental design without a control group, classroom-based evidence still supports the practical value of the tool in promoting active learning and concept retention.

CONCLUSION

This Scrabble-inspired learning tool has successfully enhanced student engagement and conceptual retention of Newton's Laws of Motion. By shifting instruction from passive memorisation to active, vocabulary-rich gameplay, students developed a stronger grasp of core physics concepts. Its flexible design makes it suitable for use at secondary, pre-university, and diploma levels. Future development could incorporate higher-order thinking tasks and real-world problem-solving to extend its educational impact. Given its proven effectiveness, the tool holds potential for commercialization as a ready-to-use classroom kit or digital resource.

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A TRANSFORMATIVE APPROACH TO ENVIRONMENTAL IMPACT ASSESSMENT: LINKING SDGS WITH INNOVATION IN TEACHING

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ABSTRACT

The subject for Environmental Assessment reviews the environmental resources available and identifies the causes of environmental degradation. This subject focuses on Environmental Impact Assessment (EIA) in Malaysia, examining the environmental, social, and educational implications of environmental assessment with a strategic emphasis on advancing the United Nations' Sustainable Development Goals (SDGs). The assessment evaluates potential impacts on ecosystems, natural resources, public health, and community well-being, integrating both traditional environmental metrics and innovative educational approaches. In alignment with SDGs such as Quality Education (SDG 4), Sustainable Cities and Communities (SDG 11), and Climate Action (SDG 13), this study incorporates innovation in teaching as a tool for environmental awareness and capacity building. Educational interventions—including collaborative teaching between stakeholders and international universities, participatory open-based project assignments, and site visits on advanced technological approaches—are embedded in the mitigation framework to foster sustainability literacy. The students, who are future managers, engineers, and policymakers, play a crucial and active role in this process. By integrating EIA with education for sustainable development (ESD), this project not only assesses environmental risks but also empowers these future leaders through transformative, inquiry-driven learning. The findings demonstrate that when innovative teaching practices are aligned with sustainability objectives, environmental management becomes more inclusive, adaptive, and impactful.

Keywords: Environmental Impact Assessment, Sustainable Development Goals, Innovation in teaching, Education for sustainable development.

INTRODUCTION

Environmental Assessment (EA) is a systematic process used to evaluate the potential environmental impacts of proposed projects, policies, or developments before decisions are made, and actions are taken. It plays a crucial role in integrating environmental considerations into decision-making to promote long-term sustainability. By identifying, predicting, and evaluating the environmental effects of human activities, EA ensures that development is ecologically responsible, socially acceptable, and economically viable.

With the adoption of the United Nations Sustainable Development Goals (SDGs) in 2015, environmental assessment has gained renewed importance as a tool to support sustainable development. EA directly aligns with several SDGs, particularly for the SDG 6 (Clean Water and Sanitation) by ensuring water resources are protected from pollution and overuse; SDG 11 (Sustainable Cities and Communities) by promoting environmentally sound urban planning; SDG 13 (Climate Action) by assessing climate risks and encouraging low-carbon development strategies; SDG 15 (Life on Land) by safeguarding ecosystems and biodiversity. Furthermore, EA supports SDG 17 (Partnerships for the Goals) by fostering collaboration between governments, developers, scientists, and communities in decision-making processes.

In this context, environmental assessment serves not only as a regulatory tool but also as a strategic mechanism to guide sustainable development. It ensures that economic growth does not come at the expense of environmental integrity, thereby contributing to a balanced approach that meets present needs without compromising the needs of future generations. The subject for Environmental Assessment reviews the environmental resources available and identifies the causes of environmental degradation. This subject focuses on Environmental Impact Assessment (EIA) in Malaysia, examining the environmental, social, and educational implications of environmental assessment with a strategic emphasis on advancing the United Nations' Sustainable Development Goals (SDGs).

METHODOLOGY

A field trip to the Jeram Sanitary Landfill in Selangor offers students and professionals a practical and insightful experience in understanding waste management systems, their environmental impacts, and how they align with sustainable development. The students of this subject have been allowed to go on a field trip and check on the effluent of leachate samples. The entrance and exit surveys have been distributed to the students to see the outcomes of the field trip. The Jeram Sanitary Landfills are properly designed and managed, representing one of the best management practices for disposing of municipal solid waste. Thus, linking this experience to Environmental Assessment (EA) and the Sustainable Development Goals (SDGs) is essential for fostering a holistic understanding of sustainability in waste management. This hands-on experience not only enhances their understanding but also makes them feel more connected to the subject matter.

RESULTS

Entrance Survey

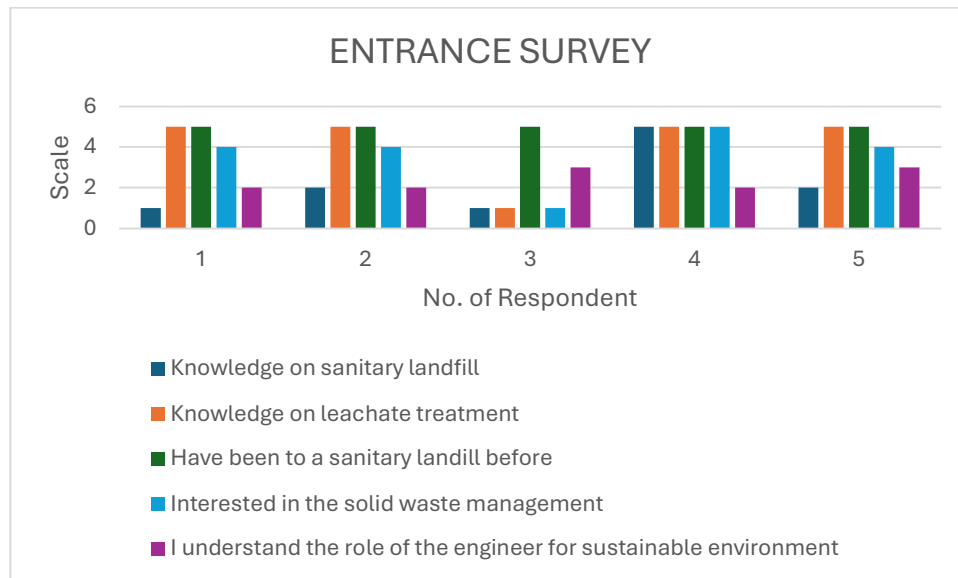


Figure 1.: Entrance Survey from the field trip

The students have completed the entrance survey, and the overall results indicate that they possess some knowledge of environmental assessment related to solid waste management.

Exit Survey

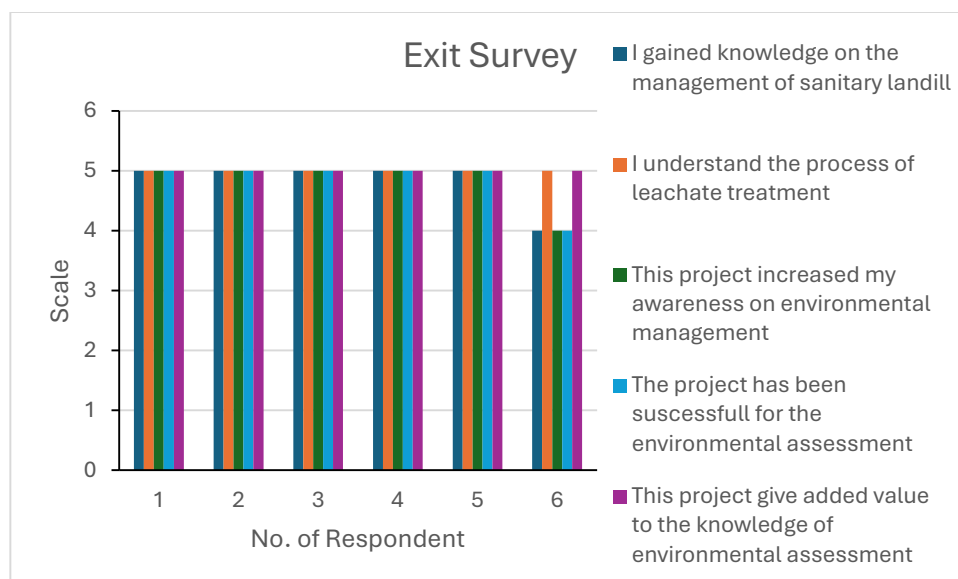


Figure 2.: Exit Survey from the field trip

Most students have given positive responses, stating that they gained very insightful knowledge on environmental assessment through field trips. They also have the opportunity to observe the landfill operations. Learning how leachate collection systems, gas capture technologies, and impermeable liners reduce environmental risks. The students understand how landfill operators monitor environmental parameters (e.g., groundwater quality, methane emissions) to ensure compliance with environmental regulations. The application of EA principles in real-world waste management highlights the importance of continuous environmental monitoring, offering reassurance about the effectiveness of waste management practices.

The operation and management of sanitary landfills are deeply interconnected with several SDGs, including:

SDG 3: Good Health and Well-being, as improper waste disposal can lead to the spread of diseases and exposure to hazardous pollutants. Sanitary landfills help minimize these risks through controlled waste handling and environmental protection measures, contributing to improved public health outcomes. SDG 6: Clean Water and Sanitation, as the major concern with landfills is leachate, a liquid that can contaminate groundwater if not properly managed. Sanitary landfills include proper leachate management systems, thus supporting the protection of freshwater resources. SDG 11: Sustainable Cities and Communities. An effective landfill design supports sustainable urban development by providing a safe and clean method of waste disposal, thereby preventing illegal dumping and reducing urban pollution. SDG 12: Responsible Consumption and Production, as these field visits highlight the need to minimize waste generation and improve recycling and composting efforts. This goal promotes awareness of sustainable production and consumption patterns, which in turn reduce reliance on landfills. SDG 13: Climate Action, as sanitary landfills equipped with methane gas recovery systems contribute to climate change mitigation by capturing greenhouse gases and potentially using them for energy production. SDG 15: Life on Land. Improperly managed waste can threaten terrestrial ecosystems through pollution and habitat destruction. Proper landfill operations safeguard the surrounding flora and fauna, aligning with the conservation of terrestrial biodiversity.

The field trip to the Jeram Sanitary Landfill in Selangor is not just an academic experience, but also a capacity-building exercise that bridges the gap between theory and practice in environmental assessment. It enhances awareness of sustainable engineering solutions in waste management and promotes interdisciplinary thinking among students and young professionals across environmental, civil, and chemical engineering fields. The field trip highlights the practical application of sustainable innovations such as waste-to-energy systems, circular economy models, and biodegradable packaging in their future careers.

CONCLUSION

A field trip to a sanitary landfill, when guided through the lens of environmental assessment and the SDGs, becomes a transformative learning opportunity. It emphasizes the importance of integrated planning, environmental protection, and sustainable infrastructure development. Such experiential learning not only enhances understanding of technical waste management systems but also inspires commitment to sustainable development goals, aligning engineering practice with environmental stewardship.

ACKNOWLEDGEMENTS

This work was supported by the Faculty of Civil Engineering, University Teknologi MARA, Shah Alam.

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ACT IT TO GRASP IT: ROLE PLAY AS A CATALYST FOR DEEPER UNDERSTANDING IN ACTIVE CLASSROOMS

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ABSTRACT

*In many technical courses, conventional lectures often lead to passive learning, where students struggle to stay engaged and find it difficult to grasp complex concepts. This was a challenge observed in the MEC241 Fluid Mechanics course, where despite clear explanations, students still found it hard to connect theory with real-world application, and frankly, they found the lectures boring. To tackle this, a teaching innovation titled "**Act It to Grasp It: Role Play as a Catalyst for Deeper Understanding in Active Classrooms**" was introduced. Instead of just listening, students were assigned roles and asked to act out real engineering scenarios. By stepping into the shoes of engineers, technicians, or team leaders, they experienced the content in a more relatable and meaningful way. The classroom was transformed into an active, collaborative space where students engaged with one another, applied concepts through dialogue and decision-making, and developed soft skills like communication and teamwork. Most importantly, they had fun while learning. Feedback collected through a student survey showed strong support for this method. Students reported improved understanding, higher engagement, and greater confidence in expressing their ideas. Many also appreciated the break from traditional lectures and recommended more sessions like this in other topics. This innovation demonstrates that role play is not just a playful activity; it's a powerful tool to enhance understanding, increase participation, and bring learning to life.*

Keywords: Active classroom, Role play, Teaching and learning innovation, Engineering

INTRODUCTION

Traditional lecture methods in technical courses often fail to engage students implicitly, especially when it comes to applying theoretical knowledge in real-world circumstances (Munjy et al., 2025; Klein et al., 2023). In the MEC241 Fluid Mechanics course, students displayed signs of disengagement, struggled with poor communication during group tasks, and had difficulty connecting abstract concepts to practical situations. These challenges highlighted a critical gap in conventional teaching, which tends to favour content delivery instead of active participation (Freeman et al., as cited in Klein et al., 2023).

To address this, role play was introduced as an innovative instructional strategy. Role play involves students assuming real-world job roles—such as materials engineer, site technician, or project lead—and performing structured tasks in an active, cooperative setting (Sano & Lemckert, 2014; Barrera et al., 2021). This approach is rooted in the belief that learning is deeper when students are immersed in realistic situations that mimic industry dynamics. It also promotes critical soft skills such as teamwork, communication, and leadership (Kedrowicz & Nelson, 2007; Torres de Macedo et al., 2024).

This teaching innovation aims to transform the classroom into an active, student-centred environment where theoretical understanding is enhanced through experiential engagement (Kozanitis & Nenciovici, 2023). In addition to addressing disengagement, role-play activities align well with the evolving educational focus on graduate employability. Engineering graduates are not only expected to demonstrate technical competence but also to possess well-rounded interpersonal and problem-solving skills. The role-play method nurtures these aspects by exposing students to simulated real-life dilemmas, stakeholder negotiations, and data-driven decision-making within a safe, structured classroom setting. Such immersive learning methods are increasingly supported by educational research and are being adopted in many global institutions to prepare students for multifaceted roles in the workforce.

Moreover, role-play supports a deeper pedagogical shift towards experiential learning. According to Kolb's Learning Theory, knowledge is created through the transformation of experience. By engaging in role-play, students progress through the experiential learning cycle, concrete experience, reflective observation, abstract conceptualization, and active experimentation and thus promoting not only retention but also the ability to apply concepts in novel situations.

METHODOLOGY

The implementation of this innovation took place entirely within the classroom setting, specifically for one group of class (16 students) during the scheduled tutorial sessions for the MEC241 Fluid Mechanics course as shown in Figure 1. Instead of the conventional approach of solving tutorial questions individually or in groups, the sessions were restructured into immersive role play activities. Students were divided into teams and assigned specific character roles based on a realistic engineering scenario. These roles included members of a consultant engineering firm, an internal engineering department, and residents lodging formal complaints about a technical issue affecting their neighborhood.



Figure 1.: Role-play activity in class.

Each group was tasked with investigating the problem, applying relevant fluid mechanics principles, and formulating a viable solution from their assigned perspective. The activity culminated in a simulated press conference where each group presented their findings and justified their recommendations to the class, acting as the public audience and stakeholders. This format encouraged cross-group interaction, critical thinking, and real-time communication. The entire process was designed to mirror real-world engineering consultations, making the classroom not just a place for learning theory but a platform for active, applied problem-solving.

The design of the role-play scenario was developed to reflect a realistic yet manageable engineering challenge involving water flow and system failures affecting a residential area, an issue that could plausibly occur and require input from various stakeholders. Care was taken to ensure that each role came with specific objectives and limitations, such as technical constraints, public interest concerns, or budgetary restrictions. This encouraged students not only to apply their technical knowledge but also to engage in negotiation, justification, and compromise when facing the collaborative challenges of the engineering profession.

To ensure all students were equally engaged, facilitators played an active role by moderating discussions, prompting deeper inquiry, and ensuring that quieter students were also drawn into the discourse. This helped maintain balanced participation across the groups and allowed students to reflect critically on their roles and responsibilities. Students were also encouraged to keep reflective notes throughout the session, which were later used in a debriefing session to consolidate learning outcomes and share perspectives on the overall experience.

RESULTS AND DISCUSSION

A feedback survey was conducted among the 16 students who participated in the role-play activity during the MEC241 tutorial session. The results offer insightful reflections on the effectiveness and reception of this active learning strategy.

A vast majority (87.5%) of the students reported that they had never participated in a role-play activity before in any class as shown in Figure 2. This suggests that the experience was novel and likely broke the monotony of typical engineering tutorials.

Have you participated in a role-play activity before in class (exclude my class)?

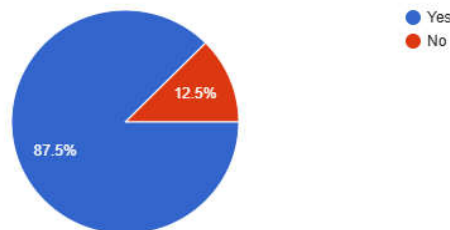
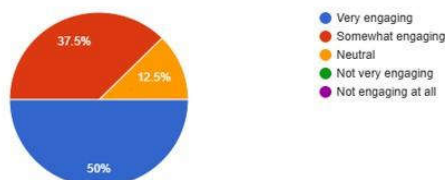


Figure 2.: Previous experience in role-play activity.

Regarding engagement, 50% of the students found the activity “Neutral,” while 37.5% found it “Somewhat engaging,” and 12.5% found it “Very engaging.” While this shows mixed levels of engagement, it is notable that none of the students found the activity “Not engaging.” More importantly, 62.5% rated the role-play as “Very effective” in helping them understand the topic, and the remaining 37.5% found it “Somewhat effective.” This indicates that the method significantly contributed to conceptual clarity as shown in Figure 3.

How engaging did you find the role-play activity?



How effective was the role-play in helping you understand the topic?

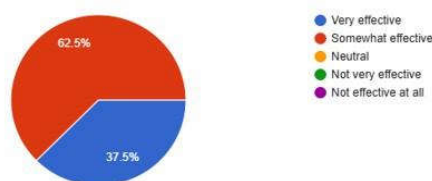
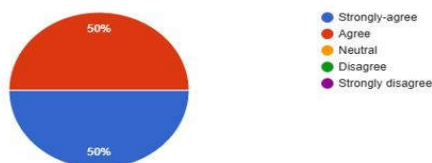


Figure 3.: Engagement and effectiveness of role-play activity

On the development of soft skills, 50% strongly agreed and 50% agreed that the activity helped improve their communication and teamwork abilities, demonstrating a unanimous perception of soft skill benefits. Finally, 75% of students rated the role-play as “Very relevant” and “Somewhat relevant” to the course content, affirming the alignment of the activity with the learning objectives as shown in Figure 4.

Did the role-play activity help improve your communication and teamwork skills?



How would you rate the relevance of the role-play to the course content?

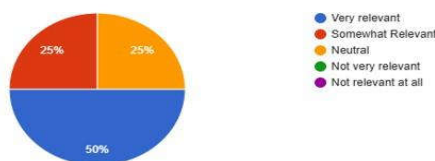


Figure 4.: Communication, teamwork and relevancy of role-play activity

These results support the idea that role-play is not only a novel engagement tool but also an effective method to enhance comprehension and professional competencies in technical courses.

CONCLUSION

The integration of role-play into the MEC241 classroom has proven to be an effective and engaging strategy for bridging the gap between theoretical learning and real-world engineering practice. By allowing students to step into professional roles and simulate collaborative problem-solving, the activity not only enhanced conceptual understanding but also nurtured essential soft skills such as communication and teamwork. Feedback from the students affirms the relevance and impact of the method, suggesting that such active learning innovations hold great potential for improving student engagement and learning outcomes in technical education.

Furthermore, it is recommended that this role-play approach be extended to other classes and subjects within the engineering curriculum or even across disciplines. Its adaptability allows educators to tailor scenarios to specific course content, making it a versatile tool for enhancing student participation, critical thinking, and real-world application in various educational contexts. Subjects such as project management, design thinking, thermodynamics, or even ethics in engineering can benefit from role-play elements that simulate industry-like situations. Encouraging cross-collaboration among departments fosters interdisciplinary learning and better prepares students for the complex, multifaceted challenges they may face in their future careers.

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ADMINISTRATIVE LAW: TERMINOLOGIES SERIES ONE

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ABSTRACT

Administrative law is a branch of public law that governs the actions and procedures of public authorities. It plays a fundamental role in ensuring that governmental power is exercised in a lawful, fair, and transparent manner. This series aims to introduce and explore key terminologies essential to the study of administrative law. A clear understanding of terms such as ultra vires, natural justice, judicial review, delegated legislation and discretionary power is crucial for students to grasp the core concepts of the subject. Students without a legal background often face difficulties in understanding and interpreting legal terminology. Therefore, familiarising themselves with these key terms is an important step towards building a solid foundation in administrative law.

Keywords: *Administrative law, Judicial review, Ultra vires, Rules of natural justice, Discretionary power*

INTRODUCTION

Administrative law in Malaysia governs the functions and powers of government agencies and public authorities. It ensures that their actions are in accordance with key legal principles particularly fairness, legality and accountability. Malaysian administrative law offers mechanisms such as judicial review which enables the courts to evaluate the validity of administrative decisions. It safeguards citizens from the arbitrary exercise of power and reinforces the rule of law. The key areas of administrative law include subsidiary legislation, the principles of natural justice and the regulation of discretionary power. This branch of law plays an important role in promoting transparent, fair and responsible public administration.

METHODS

The method used to explain legal terminologies involves defining each term clearly and concisely. This approach is designed to help non-law students understand legal concepts more easily. The definitions are then contextualized within the framework of administrative law to show how and where these terms apply. In order to make learning more accessible, this innovation replaces reliance on traditional hardcopy dictionaries with an online platform that can be accessed anytime and anywhere. This offers greater convenience and flexibility for non-law students, making it easier for them to grasp complex legal terminologies on-the-go.

RESULTS AND DISCUSSION

Studying legal subjects can be particularly challenging for non-law students, especially when it comes to understanding legal terminologies. These terms often involve complex legal concepts, such as judicial review, natural justice and ultra vires, which require a foundational understanding of legal systems and doctrines. Additionally, many legal terms such as *audi alteram partem* and *nemo judex in causa sua* are derived from Latin or old English, making them even more difficult to comprehend for those who are unfamiliar with legal language. Administrative law also encompasses abstract ideas about authority, rights, and procedures, which may not be easily relatable to everyday experiences. Furthermore, since administrative law evolves through court decisions, the meanings and applications of these terminologies can shift over time. Its overlap with constitutional, civil and criminal law adds another layer of complexity that can confuse learners without a legal background.

However, the feedback from a published video demonstrated strong interest and positive reception among non-law students toward this learning approach. Today's students prefer digital, interactive and easily accessible learning tools. This innovative platform motivates them to engage more actively with legal subjects, as they can explore and review key terminologies at their own pace using smartphones, tablets or computers. The flexibility and user-friendliness of this method make legal studies more approachable and effective for non-law learners.

CONCLUSION

The creation of this innovation aims to make legal studies more accessible and enjoyable for non-law students, who often perceive law subjects as difficult; mainly due to the complexity of legal terminologies used. As such, by offering simplified, clear explanations and an easy-to-use platform, this innovation helps them to understand and retain key legal terms more effectively. In addition, a simple tool can significantly enhance their ability to grasp and memorize legal concepts, ultimately improving their confidence and performance in law-related subjects.

ACKNOWLEDGEMENTS

This work was made possible through the collective efforts and dedication of all team members, whose contributions were essential to the successful development of simplified legal terminologies for understanding administrative law.

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AN INTERACTIVE EDUCATIONAL APPROACH TO PLASTIC POLLUTION: INTEGRATING EBOOKS AND QR CODE TECHNOLOGY

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ABSTRACT

This project introduces an innovative way to raise awareness about plastic pollution using an interactive eBook called “Ocean Plastic Pollution” and printed design tags with QR codes placed on plastic bottles. These tags are more than labels; they connect consumers directly to educational content. When someone buys a bottle with the tag, they can scan the QR code to access a free eBook, which features engaging videos, quizzes, and activities about the impact of plastic waste and practical ways to make a difference. Plastic pollution, especially from single-use bottles, is a global problem that harms wildlife and the environment. Many people are unaware of the consequences of careless plastic disposal. By placing QR-coded tags on everyday products, this project brings vital information directly to consumers, making learning accessible and interactive. The eBook is designed for all ages, encourages group activities, such as clean-up events and recycling challenges, making it useful for schools and community programs. Businesses and organizations, such as beverage companies and environmental groups, can support or sponsor the project by branding the tags, demonstrating their commitment to environmental responsibility. This approach not only promotes the initiative but also encourages positive corporate involvement. In summary, this project leverages simple technology to connect daily habits with environmental education, making it easy and enjoyable for people to learn about plastic pollution. By integrating digital learning with physical products, it empowers individuals and communities to adopt sustainable behaviours and showcases how technology, education, and corporate responsibility work together to address environmental challenges.

Keywords: *Plastic pollution, interactive eBook, QR code, tags, plastic bottles, worldwide problem, environment, community programs.*

INTRODUCTION

Plastic waste harms animals, contaminates water sources, and sabotages the aquatic ecosystem, and thus the plastic pollution is a global environmental concern bottles particularly add significantly to these issues since they are commonly used and discarded in a haphazard fashion. As beverage labels are an important aspect of bottle packaging, they can have a critical impact on the successful recycling of PET plastic bottles (Gwenner, 2023). Even though awareness is increasing, consumers remain unaware of the negative impact of plastic pollution in the long term and the requirement for sustainable consumption. Traditional methods of teaching do not come through to the public so well, particularly in everyday life.

To address this gap, this project offers a new, accessible solution in combining digital learning with physical consumer products. The ocean plastic pollution” interactive eBook is used alongside QR-coded design labels put over plastic bottles. As a gateway to the eBook, these tags enable visitors to scan and see interactive material that debunks popular myths, discusses the causes and effects of plastic waste and promotes doable environmental actions. Through the use of captivating media, this strategy seeks to build environmental awareness while incorporating learning opportunities into everyday life. It also provides the opportunity for cooperation with groups and companies to promote sustainable activities.

Another option for enforcing environmentally friendly behaviour at the individual and group level is provided by the introduction of a hybrid learning framework, combining technology, physical products and environmental education.

METHODS

Concept Development

The first step was to think of a way to combine a QR-coded tag on plastic bottles with an interactive eBook. Making a clear connection between learning and everyday objects was intended to increase accessibility to environmental education. The concept was created to be easy to use, accessible to all age groups, and straightforward. The team prepared the eBook’s functionality, topic it would cover, and how readers could quickly access it through QR codes at this phase.

The project integrates two main components:

- **QR-Coded Tags:** Specially designed tags featuring QR codes are affixed to plastic bottles. These codes, when scanned using smartphones, direct users to the interactive eBook.
- **Interactive eBook:** The eBook titled "Ocean Plastic Pollution" includes multimedia elements such as short educational videos, interactive quizzes, and group activity suggestions like clean-up drives and recycling challenges.

Content Creation

Next, the eBook titled "Ocean Plastic Pollution" was created. The content was written in simple language and focused on explaining what plastic pollution is, the different types of plastic, where pollution comes from, and how it affects our oceans. It also included a "Myth vs. Facts" section and fun, interactive activities like videos and quizzes. The design was made using Adobe InDesign to ensure that the layout, colors, and visuals were attractive and easy to follow. The eBook was tested to make sure it worked well on different devices, such as smartphones and tablets. The materials were reviewed by environmental experts, educators, and design specialists to ensure accuracy and appeal.

The eBook content was developed with the following key objectives:

- Simplify complex information about plastic pollution for general audiences.
- Engage users through interactive elements.
- Encourage actionable behaviour change.

Tag Design and Production

Creating and printing the QR-coded tags was the third stage. With straightforward visuals and instructions for scanning the QR code, each tag was made to be both visually appealing and educational. The code directs people to the digital eBook when it has been scanned. Plastic bottles and other single-use items can have these tags attached to them. High-quality printing was done on the tags to make sure they would withstand handling and could be used in conjunction with businesses like beverage companies or environmental projects. The tags were designed to be visually appealing and durable. They feature eco-friendly ink and biodegradable materials.

RESULTS AND DISCUSSION

The outcome of this project is a comprehensive and easy-to-use environmental education platform that links everyday plastic items to interactive learning. The eBook "Ocean Plastic Pollution" as shown in Figure 1 has been warmly welcomed because of its colorful layout, easy-to-understand language, and entertaining features including films, quizzes, and suggested activities. Early feedback from community members, teachers, and students indicated that users found the eBook enjoyable and easy to understand. Many users said they feel more inspired to change their regular routines including using less plastic and participating in cleanup efforts after learning new information about plastic waste.

The eBook was successfully shared with a larger audience using the QR-coded tags. The tags reach individuals in real-life settings since they are attached to objects like plastic bottles (Figure 2), which gives the learning process a more personal and relevant sense. This method encourages consumers to consider how much plastic they use when handling or utilising plastic objects.

Furthermore, the project has opened doors for collaboration. Businesses, NGOs, and educational institutions expressed interest in utilising the tags to promote their eco-friendly brands or support

environmental initiatives. This demonstrates how digital education can engage communities and businesses in real-world problem-solving outside of the classroom.

Overall, the findings demonstrate that using physical QR tags together with digital content is an effective strategy to raise awareness of environmental issues and motivate action.

Table 1.: Description of output items

Output Item	Description
Interactive eBook	Includes videos, fun facts, and educational content
QR Code Design	Links directly to the eBook
Bottle Tag Design	Visually appealing tags for sending messages in physical products

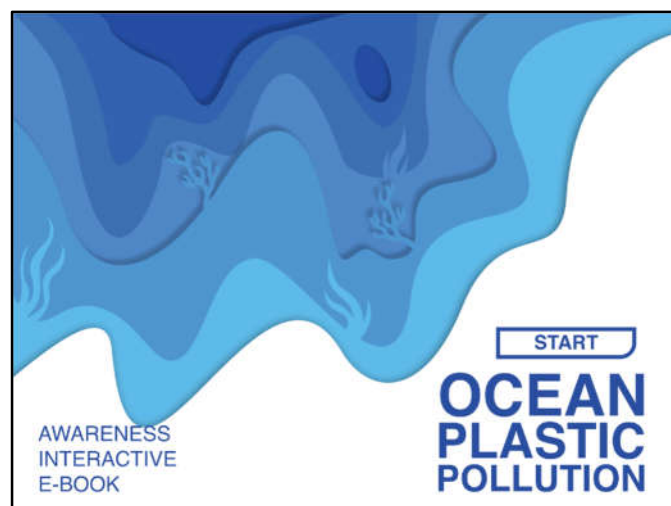


Figure 1.: eBook front cover



Figure 2.: Plastic bottle tag

CONCLUSION

The Ocean Plastic Pollution initiative effectively raises awareness about plastic waste by combining actual products with internet education. The initiative makes it simple and efficient for individuals to learn about environmental challenges in their daily lives by using an interactive eBook and QR-coded tags applied to plastic bottles. The eBook is entertaining, instructive, and age-appropriate, and the QR tags expand its audience by using everyday items. This strategy invites companies to participate in raising awareness while also promoting environmental education. All things considered, the initiative demonstrates how straightforward technology, and imaginative design can combine to encourage sustainable behaviour and safeguard the environment.

ACKNOWLEDGEMENTS

We would like to thank all the people and organizations that helped make this project a success. A special thank you to the environmental education specialists on the internet who contributed invaluable insights into content design, guaranteeing the accuracy and accessibility of the information. Additionally, thanks are given to the graphic designers who created the eBook's and the tag designs' eye-catching visual components, which appeal to a wide range of users. We appreciate the technical advisors' assistance which is our lecturer in creating and connecting the QR codes. Peers and academic mentors are also acknowledged for their insightful criticism during the ideation phases. Without the cooperation and support of all those involved, this project would not have been feasible.

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AQDILAB: INTERACTIVE SIMULATION OF MUAMALAT CONTRACTS

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ABSTRACT

AqdiLab: Interactive Simulation of Muamalat Contracts is a teaching and learning innovation developed for the course IMU102 – Introduction to Fiqh Muamalat at UiTM. This approach integrates interactive simulations with real-world case studies to help students understand the structure and application of Islamic contracts such as sales, leasing, and partnerships. Students are presented with practical scenarios and are required to solve them using principles derived from classical fiqh texts and contemporary references. The method aims to enhance students' comprehension of key concepts and contractual logic through an engaging and contextual learning experience. AqdiLab incorporates elements such as quizzes, clues, case-based experiments, and rewards to encourage active student participation. It addresses the limitations of conventional teaching methods by offering a more dynamic, flexible, and student-centered learning environment. Its effectiveness was evaluated through student feedback and lecturer reflections. Findings show that 70% of students reported an improved understanding, 85% found the approach more engaging than traditional methods, and 80% of lecturers agreed that this innovation enhanced their teaching delivery. Overall, AqdiLab not only enriches the simulation-based pedagogical approach but also demonstrates its potential as a reference model for interactive and applied learning in the field of Islamic commercial jurisprudence, aligned with 21st-century education goals.

Keywords: *Interactive Learning, Fiqh Muamalat, Contract Simulation, Islamic Finance Education, Gamified Teaching Approach*

INTRODUCTION

The subject of Introduction to Fiqh Muamalat plays a crucial role in introducing students to the foundations of Islamic financial contracts, ethical principles, and jurisprudential reasoning. However, the abstract and theoretical nature of Islamic contract law often poses challenges in traditional lecture-based teaching (Yaacob & Haron, 2017; Mohamad & Abd Ghani, 2020). Students may find it difficult to relate legal terminology and contract types to practical scenarios. Considering this, educational innovations must align with 21st-century learning demands by integrating interactive, student-centered, and experience-based methods (Kolb, 2015; Zainuddin et al., 2020). Gamification and experiential learning are increasingly recognized as powerful pedagogical tools in higher education. These approaches allow students to apply theoretical knowledge in simulated environments, increasing motivation, understanding, and real-world readiness (Kapp, 2012; Deterding et al., 2011).

AqdiLab was developed in response to this pedagogical need, focusing on contract-based case simulations in the context of Islamic finance. It aims to enhance students' engagement and mastery of muamalat concepts through interactive learning, scenario-based challenges, and collaborative reflection. It integrates physical exploration, case-based simulation, and digital interactivity to create an engaging, student-centered learning experience. Focused on various types of Islamic contracts (e.g., bai', ijarah, wakalah), this approach presents students with real-life scenarios, allowing them to apply classical fiqh principles to contemporary financial transactions. The innovation aims not only to enhance conceptual understanding and application but also to stimulate higher-order thinking, collaboration, and decision-making skills among learners.

METHODS

This innovation project adopted a design-based research (DBR) approach to develop, implement, and evaluate the effectiveness of AqdiLab within the teaching and learning of IMU102: Introduction to Fiqh Muamalat at Universiti Teknologi MARA (UiTM). The implementation involved 100 Diploma in Muamalat students over the course of one academic semester. The AqdiLab model was designed as an interactive, case-based learning activity simulating real-world Islamic financial contracts. The AqdiLab model involves multiple phases: case briefing, scenario exploration, problem-solving via contract analysis, and group presentations. Students worked in small groups and were presented with authentic scenarios involving contracts such as bai', ijarah, wakalah, and mudarabah. Each group was required to identify the type of 'aqd, assess its Shariah validity, and apply principles from classical fiqh to formulate appropriate rulings and solutions.

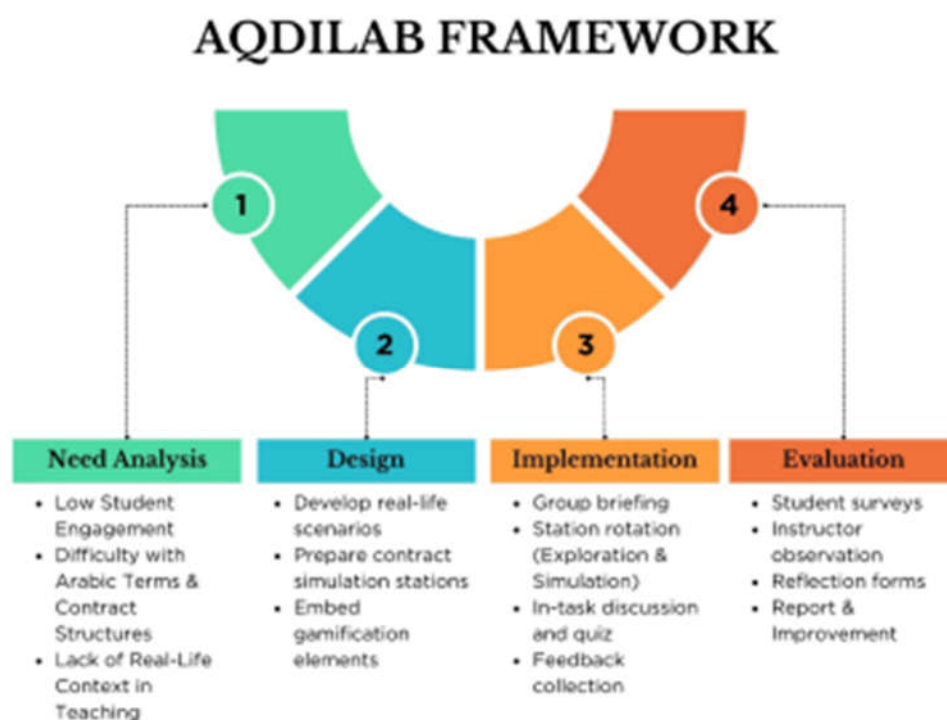


Figure 1.: AqdiLab Framework

The learning process was supported by gamification elements including clue cards, challenge stations, digital quizzes, rewards, and penalties to enhance student engagement. Each group completes the simulation with guided questions, clue-based tasks, and reflective feedback sessions. The gamification structure is based on Werbach and Hunter’s (2012) model, combining dynamics (motivation), mechanics (rules), and components (badges, points, and levels). Data was collected through student feedback surveys, classroom observations, and post-activity reflection. Quantitative data were analysed using descriptive statistics, while qualitative responses were examined thematically to assess student perceptions and learning outcomes. Feedback was collected through post-activity surveys and semi-structured interviews with both students and instructors. The aim was to measure usability, engagement, comprehension, and satisfaction with the learning experience.

RESULTS AND DISCUSSION

The implementation of AqdiLab yielded promising results in enhancing students’ understanding and engagement in the subject of Fiqh Muamalat. Quantitative data from post-activity surveys revealed that:

- 82% of students reported a clearer understanding of the different types of Islamic contracts.
- 88% found the simulation method more engaging compared to traditional lectures.
- 75% stated that the interactive challenges helped them relate theoretical concepts to real-life applications.
- 80% felt more confident in explaining contract structures based on classical sources.

Qualitative feedback from students highlighted that the physical movement, collaborative tasks, and real-world scenarios made the learning process more meaningful and memorable. Many expressed that the

active learning format fostered deeper reflection and improved their problem-solving skills.

These findings are consistent with previous research by Kapp (2012) and Kolb (2015), which emphasize the effectiveness of experiential and gamified learning in fostering critical thinking and motivation. These results also support previous studies by Hamari, Koivisto, and Sarsa (2014), who found that gamified learning environments enhance motivation, performance, and enjoyment. Students particularly appreciated the real-world scenarios and interactive problem-solving approach, which fostered higher-order thinking skills and collaborative learning. AqdiLab also demonstrated potential in bridging the gap between classical fiqh knowledge and contemporary financial realities, making the abstract subject of Islamic contracts more tangible and applicable. Moreover, instructors noted a significant increase in student participation, attendance, and performance during the implementation period. The gamified, student-centered approach contributed to a more dynamic and inclusive classroom environment, aligned with the pedagogical aspirations of 21st-century learning.

CONCLUSION

The AqdiLab innovation has proven to be an effective pedagogical strategy for enhancing student engagement, conceptual understanding, and applied learning in the subject of Introduction to Fiqh Muamalat. By integrating simulation, gamification, and real-life contract analysis, this approach successfully transformed passive theoretical learning into an interactive, student-centered experience.

The results suggest that AqdiLab not only supports cognitive learning outcomes but also fosters critical thinking, collaboration, and ethical awareness; key elements in preparing students for real-world challenges in Islamic finance. While the findings are encouraging, further refinement of the digital platform and training modules for instructors are recommended to improve scalability and sustainability.

This project contributes to the growing body of educational innovations that leverage active learning and contextual application in Islamic studies. AqdiLab may serve as a replicable model for other Shariah-based courses, particularly those requiring applied understanding of legal and ethical principles within dynamic societal contexts.

ACKNOWLEDGEMENTS

The authors would like to express their sincere appreciation to the Academy of Contemporary Islamic Studies (ACIS), Universiti Teknologi MARA (UiTM) Melaka Branch, for the opportunity, support, and collaboration extended throughout the implementation of the AqdiLab project.

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BEYOND DRAWINGS: INNOVATING AND EVALUATING CAD SKILLS WITH A CAP-DRIVEN PEDAGOGICAL MODEL

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ABSTRACT

Computer-Aided Design (CAD) education is integral to developing the technical competencies of engineering students. However, traditional assessment approaches in CAD courses often suffer from subjectivity and lack of consistency. This study introduces a structured evaluation method using the Course Attainment Parameter (CAP) framework to objectively measure student performance across cognitive, psychomotor, and affective learning domains. Conducted with 367 students enrolled in a core CAD course at a Malaysian public university, the research aligns Course Outcomes (COs) with measurable indicators, mapped to Programme Outcomes (POs) based on Outcome-Based Education (OBE) principles. Data analysis revealed a strong overall performance in the psychomotor and affective domains—particularly CO3 to CO5—where over 93% of students achieved satisfactory or higher results. Conversely, only 57.8% met the expected threshold in CO1, highlighting persistent challenges in cognitive attainment, particularly in understanding CAD-related theories. These findings emphasize the disparity between practical skill acquisition and theoretical comprehension. The CAP-based approach offers a transparent, data-driven tool for continuous course improvement and serves as a feedback mechanism for both instructors and students. This method not only enhances assessment accuracy but also supports curriculum refinement, instructional strategy optimization, and alignment with accreditation standards. Ultimately, this study demonstrates the value of CAP as a scalable model to improve learning outcomes and elevate the quality of CAD education in technical programs.

Keywords: *Computer-Aided Design (CAD), Course Attainment Parameter (CAP), Course Outcomes, Outcome-Based Education (OBE), Student Attainment*

INTRODUCTION

This project introduces a structured, data-driven approach to evaluating student performance in a Computer-Aided Design (CAD) course by integrating the Course Attainment Parameter (CAP) methodology within the framework of Outcome-Based Education (OBE). Conducted at a Malaysian public university involving 367 engineering students, the study redefines traditional assessment practices by mapping student achievements across the cognitive, psychomotor, and affective learning domains, in alignment with five Course Outcomes (COs).

The core innovation lies in the application of the CAP model to dissect performance trends and uncover domain-specific strengths and gaps. Unlike conventional grading, which often focuses narrowly on end results, the CAP framework enables granular insight into students' theoretical understanding (CO1), practical modelling skills (CO2), communication (CO3), teamwork (CO4), and ethical awareness (CO5) (Krathwohl, 2002; Means et al, 2013). The results revealed a high success rate in affective and psychomotor competencies—with over 93% of students attaining satisfactory or better levels in CO3–CO5—while also spotlighting deficiencies in cognitive comprehension, particularly in theoretical CAD concepts, where only 57.8% met the minimum expected threshold.

To support student learning, the course incorporated blended learning techniques, including face-to-face lectures, hands-on lab sessions, online resources, and project-based assessments. Despite these interventions, engagement issues were noted among low-performing students, indicating the need for improved instructional scaffolding, motivational strategies, and personalized academic support (Freeman et al., 2014; Mat Isa et al, 2024).

This innovation not only enhances the transparency and fairness of student evaluations but also offers a feedback-rich mechanism for continuous curriculum refinement. By using CAP as both an evaluative and diagnostic tool, the study provides actionable insights for educators and program developers to strengthen learning outcomes, address competency gaps, and align teaching practices with accreditation standards (Álvarez Ariza, 2024; Graham, 2018; Terenzini et al., 2001). Ultimately, this project demonstrates how thoughtful integration of structured assessment models can elevate the quality and consistency of technical education in engineering disciplines.

METHODS

This study employed a Course Attainment Parameter (CAP)-based evaluation approach within the framework of Outcome-Based Education (OBE) to assess student performance in the *Computer Aided Design (CAD)* course, offered at a public university in Malaysia during the OCT 24–FEB 25 academic semester. The objective was to determine the degree of attainment across five predefined Course Outcomes (COs), each mapped to relevant Programme Outcomes (POs) as stipulated by the Engineering Accreditation Council (EAC) Malaysia (Mohd Saim et al., 2021).

Course Structure and Participants

The CAD course included both theoretical and practical components aimed at developing cognitive, psychomotor, and affective competencies in CAD. A total of 367 students from multiple sections participated in this study, with all students undergoing the same instructional content, assessments, and evaluation rubrics. Teaching methods included face-to-face and online lectures, practical lab sessions, group discussions, and project-based learning. Assessments were conducted continuously throughout the semester and were distributed across final tests, lab tests, assignments, and mini projects.

Course Outcomes and Assessment Plans

The course learning outcomes and the respective assessment plans are as shown in Table 1 and the continuous assessment scores are shown in Table 2. The course outcomes are mapped to the general engineering degree's program outcomes (POs), learning outcomes (LOs), soft skills and CAP assessments. Upon completion of this course, students are expected to fulfil these course outcomes.

Table 1.: Course learning outcomes and the respective assessment plans

COURSE LEARNING OUTCOMES (CO)	METHOD OF DELIVERY	METHOD OF ASSESSMENT
CO1: Explain various concepts of Computer Aided Design (CAD), Engineering (CAE), and Manufacturing (CAM) in design, engineering, and manufacturing processes	Face-to-Face and Online Lecture	Final Test
CO2: Build the competency in applying the techniques available in CAD in order to construct, develop, and draft CAD models	- Face-to-Face (F2F) and Online Lecture - F2F and Online Practical Lab Sessions	- Lab Assignments - Lab Test - Mini Project Report
CO3: Explain and communicate effectively the design solutions for engineering problems and design systems, components, or processes that take into consideration public health, safety, cultural, societal, and environmental considerations	- F2F and Online Lecture - F2F Classroom Discussion	Presentations for the Mini Project
CO4: Organize and report work independently as well as in a group during the project implementation	- Group Discussion - Problem-Based Learning	Mini Project Report

COURSE LEARNING OUTCOMES (CO)	METHOD OF DELIVERY	METHOD OF ASSESSMENT
CO5: Adhere to ethical principles and commit to professional ethics and responsibilities and norms of engineering practice	- F2F and Online Lecture - Classroom Discussion	Mini Project Report

Table 2.: Continuous Assessment (100%)

Assessment Components	CO Addressed	Weightage
TESTS		50%
1. Final Test	CO1	30%
2. Lab Test	CO2	20%
Mini Project and Assignments		50%
3. Lab Assignments	CO2	10%
4. Mini Project	CO2, CO4, CO5	15%, 10%, 5%
5. Presentation	CO3	10%

RESULTS AND DISCUSSION

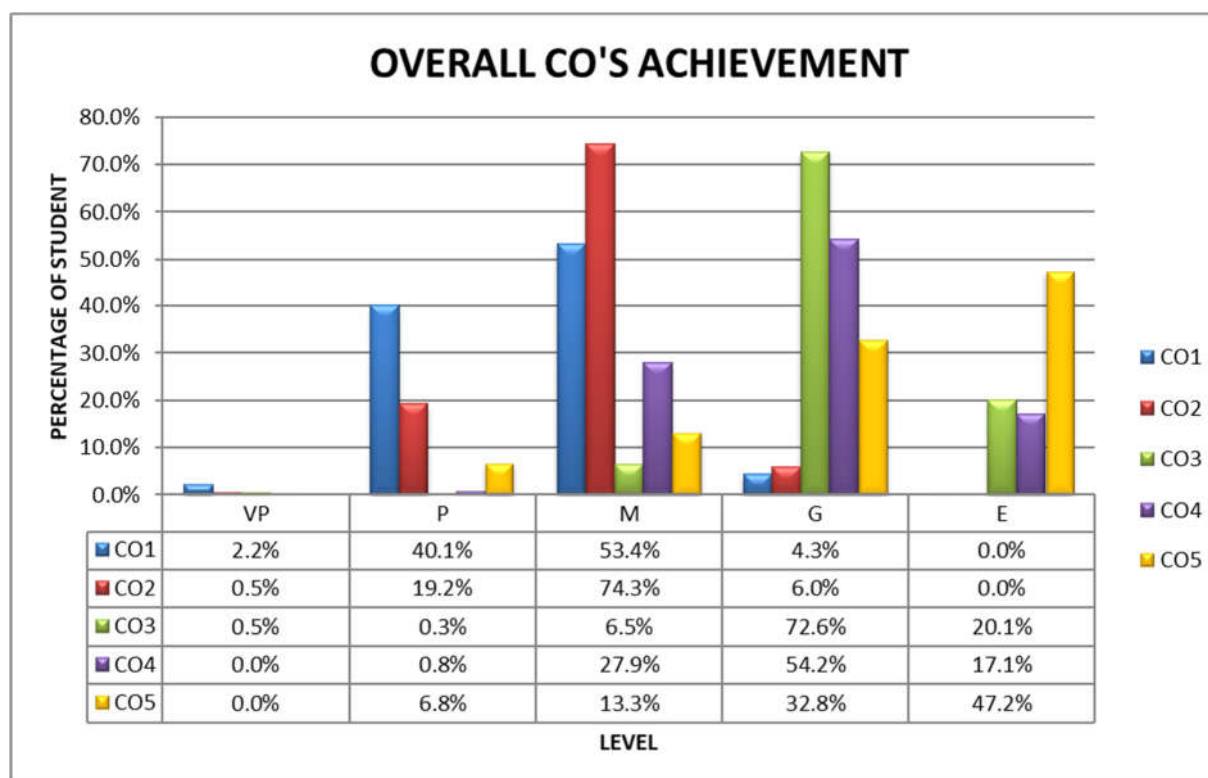


Figure 1.: Overall CO Achievement

Overall CAP Achievements

Figure 1 illustrates the comparative achievement levels across the five Course Outcomes (CO1–CO5) for students enrolled in the CAD course during the October 2024 – February 2025 semester. The results reveal a significant disparity in student performance across the cognitive, psychomotor, and affective domains. CO1, which measures students' theoretical understanding of CAD, CAE, and CAM concepts, recorded the lowest achievement. Only 57.8% of students scored 50% and above, falling short of the 75% Key Performance Indicator (KPI) target. This underperformance suggests persistent challenges in cognitive engagement, possibly due to poor preparation, low exam attempt rates, and a reliance on hands-on activities over theoretical mastery.

In contrast, CO2 showed moderate success with 80.4% achieving satisfactory and above, reflecting a reasonable level of practical competency in CAD model construction. However, gaps in engagement and consistency remain, particularly among students who did not complete lab activities or assignments. The most promising results were observed in CO3, CO4, and CO5, where over 93% of students achieved satisfactory or higher scores. These outcomes indicate strong development in communication, teamwork, and ethical awareness—core competencies in the affective and psychomotor domains. High performance in these areas suggests that the blended instructional strategies, group-based mini projects, and presentation components were effective in fostering applied skills and soft skill development.

Overall, Figure 1 highlights the need for targeted instructional interventions to improve cognitive outcomes (CO1), while reinforcing the successful strategies used in CO3–CO5 to ensure balanced performance across all learning domains.

Development of an Educational Assessment Software Tool

The structured CAP model can be translated into a digital platform or software solution that automates course outcome tracking, generates performance dashboards, and provides actionable feedback for instructors and students. This would be particularly valuable to higher education institutions seeking to:

- Ensure OBE and accreditation compliance
- Standardize assessments across multiple course sections
- Conduct real-time performance diagnostics

Such a platform could be developed as a subscription-based SaaS (Software-as-a-Service) model and marketed to engineering faculties, polytechnics, and technical training centres.

Curriculum Consultancy and Training Packages

Given the robust instructional alignment and proven assessment outcomes demonstrated in this study, the CAP-based framework could be packaged into professional development programs or consultancy services for academic institutions. These services may include:

- Customizable CO-PO mapping workshops
- CAP-based rubric development
- In-house academic staff training for OBE implementation
- Diagnostic audits for underperforming programs

This offers a revenue-generating path through institutional capacity-building engagements.

Policy and Accreditation Alignment Solutions

As countries shift toward outcome-driven education models, tools that directly support engineering accreditation bodies (e.g., EAC Malaysia, Washington Accord) are in high demand. The methodology outlined in the paper can serve as the foundation for compliance-ready templates, bridging the gap between teaching practice and audit-readiness for academic programs.

Potential for Research Commercialization and Licensing

The underlying methodology, once refined into a framework or toolkit, could be licensed to education technology providers or embedded within Learning Management Systems (LMS) (e.g., Moodle,

Blackboard). Integration with AI-driven analytics could further enhance predictive capabilities and personalized learning pathways.

CONCLUSION

The project presented in this study holds significant commercialization potential and future scalability, particularly within the fields of engineering education, educational technology solutions, and curriculum development. The innovative CAP-based assessment framework, grounded in Outcome-Based Education (OBE) principles, offers more than just academic insights—it introduces a replicable, scalable, and data-driven solution that can be commercialized for widespread use across institutions. In summary, this project has clear value beyond academia, offering commercially viable solutions that address ongoing challenges in learning assessment, quality assurance, and accreditation. With targeted development, this framework could evolve into a marketable educational innovation contributing to the digital transformation of technical and higher education globally.

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BILLBUDDY: AI-POWERED RECEIPT CAPTURE AND SMART BILL SHARING FOR EASY EXPENSE MANAGEMENT

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ABSTRACT

Managing individual and shared financial responsibilities can be challenging, particularly during group activities like dining out or traveling with friends or coworkers. This study introduces BillBuddy, a mobile application designed to simplify personal budgeting and group expense management using Artificial Intelligence (AI) and Optical Character Recognition (OCR) technologies. By allowing users to scan receipts, the app automatically extracts, categorizes, and logs expense data, eliminating manual entry, reducing errors, and improving financial accuracy. Beyond individual tracking, BillBuddy enables users to create shared events, split costs equitably or proportionally, track contributions, and receive automated payment reminders, promoting transparency and reducing social friction. Combining smart receipt scanning with a collaborative expense-sharing platform, BillBuddy addresses everyday financial challenges, enhances budgeting habits, and supports fair, informed decision-making. As demand grows for accessible, user-friendly fintech solutions that encourage both social interaction and financial responsibility, BillBuddy demonstrates strong potential for widespread adoption in consumer markets and financial education settings.

Keywords: Finance education, Trading simulation, Bursa Malaysia, Gamified learning, Digital classroom

INTRODUCTION

Expense tracking and cost-sharing remain difficult, especially for students and young professionals. This demographic frequently engages in group activities such as dining out or traveling, which naturally involve shared financial responsibilities. However, traditional tracking methods—like jotting down expenses in notes apps, manually splitting costs, or discussing payments in group chats—are inefficient and prone to errors.

These approaches often lead to missed reimbursements, calculation mistakes, strained relationships due to awkward social dynamics, and uncomfortable reminders. This aligns with research indicating that unresolved group financial interactions can cause emotional stress in shared social contexts (Grady et al., 2019). Despite the prevalence of digital tools in everyday life, a seamless and reliable solution for managing shared expenses remains lacking.

BillBuddy aims to address this gap by offering a user-friendly mobile platform that leverages Artificial Intelligence (AI) and Optical Character Recognition (OCR) technology. By automating expense capture and group cost division, the app reduces the friction typically associated with financial coordination among peers. More than just a budgeting app, BillBuddy enhances transparency, promotes mindful spending, and supports healthier financial interactions in collaborative settings.

METHODS

The progression of BillBuddy was aligned with a distinct mobile application development process that sequentially advanced with technology and user-based principles. The ability to capture receipts transformed into a digitized expense report through smartphone integration with specific AI and OCR technologies harnessed advanced technologies. This automation eliminates the tedious and often inaccurate manual data input process.

In the initial phase, a functional prototype was built and refined, followed by user testing through simulated real-world scenarios such as group meals, trip planning, and shared utility payments. These scenarios were chosen to reflect the common financial situations experienced by the app's primary user demographic: students and young adults.

To ensure accessibility for all users, regardless of their level of technological familiarity, the interface was designed with layered navigation, clean visual elements, and simplified input requirements. These features reflect key User Experience (UX) principles and demonstrate a focused application of usability and accessibility standards.

For secure user authentication, data synchronization, and information storage, **Firebase**, a real-time database management system, was integrated into the application. This platform ensures seamless interaction, easy access, and secure storage of users' financial data. Feedback from participants at **Universiti Teknologi Mara (UiTM)** during the testing phase provided critical insights into group dynamics and real-world use. Their suggestions led to the development of essential features such as

adjustable expense splitting, expense history tracking, and personalized notification systems, all designed to enhance the app's practicality and effectiveness.

RESULTS AND DISCUSSION

According to user feedback, **BillBuddy** significantly reduced the amount of manual data entry required, resulting in a 70 percent decrease in time spent compared to traditional methods of expense tracking. Users specifically praised the receipt scanning feature for its ability to effortlessly categorize expenses, streamlining the entire process.

In collaborative settings, participants appreciated the smart bill-splitting feature, which allowed them to assign proportional shares of expenses with just a few taps. This functionality effectively eliminated confusion and disputes over payment responsibilities. The group and event creation feature further enhanced coordination by organizing expenses under specific activities, making it easier to track shared spending.

Users valued the automatic receipt categorization and were especially satisfied with the automated expense assignment feature, which minimized manual effort while fairly allocating individual shares. The app's ability to send polite and neutral payment reminders also received positive feedback. By using respectful language, these reminders helped reduce social friction and encouraged timely payments, aligning with Jackson's (2019) assertion that fair and respectful communication fosters trust and cooperation within social groups.

One of the most impactful outcomes of the testing phase was the increase in users' financial awareness. The app's expense summaries and visual cash flow representations provided valuable insights into spending habits, empowering users to make better financial decisions. This directly supports the goal of improving financial literacy, particularly for individuals still developing foundational budgeting skills.

Moreover, the integration of AI and OCR technologies helped reduce the effort required for financial tracking, especially for users who find conventional budgeting tools tedious or overwhelming. By automating repetitive tasks, **BillBuddy** made the budgeting process more engaging and accessible to everyday users, not just those with a background in finance.

ACKNOWLEDGEMENTS

We would like to express our heartfelt appreciation to our academic supervisor for their invaluable guidance throughout this project. Our gratitude also goes to the test users from Universiti Teknologi MARA (UiTM) for their constructive insights and feedback. Finally, we sincerely acknowledge the dedication and teamwork of all members involved in the development and testing of the app prototype.

CONCLUSION

BillBuddy demonstrates how technology can turn complex and repetitive personal finance tasks into automated user-friendly functions. With Artificial Intelligence and Optical Character Recognition, the app automates the processes of receipt scanning, expense categorization, and group bill sharing. This alleviates the time, mental burden, and social anxiety that often accompanies the coordinated payment of shared expenses common among students and young employees.

More than a budgeting application, BillBuddy promotes fairness and responsible spending, transparency, and trust within social groups, reflecting psychological principles that emphasize the importance of reducing bias and promoting equitable interactions (Jackson, 2019). Due to its intuitive interface, real-time expense tracking, and automated reminders, financial management becomes effortless. Given that financial habits are often acquired in early life, BillBuddy equips users to forge good practices and navigate social finance confidently and effortlessly.

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BIM Connect:

A MOBILE LEARNING APPLICATION FOR MALAYSIAN SIGN LANGUAGE

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ABSTRACT

The number of hearing-impaired people has gradually increased in Malaysia, which necessitates sign language skills. Since the establishment of the Malaysian Federation of the Deaf in 1998, Malaysian Sign Language (BIM) has been used as the primary means of communication for the deaf-mute community in Malaysia. Hearing individuals should be encouraged to learn and practice sign language in an effort to bridge the communication gap and improve accessibility. The significance of this study lies in the novel opportunity it provides for hearing learners to learn BIM through effective methods which have never before seen in the Malaysian context. This is in line with the growing need for accessible BIM references which are scarcely available in Malaysia to date which necessitates unique innovations of this kind. Hence, this study aims to design a mobile application that can facilitate the learning of BIM by using the Figma designing tool. With respect to the standards in BIM, the researchers self-produce the contents related to the hand gestures that represent the signs. The application is then tested by having beginner learners use it. The results indicate that the learners are able to benefit from it through the lessons and exercises provided which suit their proficiency level as beginners. It can be deduced that this application helps BIM learners to grasp the foundational concepts of sign language which allows them to understand diversity and break social barriers.

Keywords: Malaysian Sign Language, deaf-mute community, communication gap, accessibility, mobile application

INTRODUCTION

The deaf-mute community in Malaysia represents a vibrant yet often marginalized segment of society, comprising individuals who navigate daily life with limited or no access to auditory and verbal communication. Despite Malaysia's growing awareness of inclusivity and disability rights, members of the deaf-mute community frequently encounter barriers in education, employment, healthcare, and social integration due to a lack of widespread understanding and institutional support for their communication needs. In other words, deaf individuals face challenges integrating into mainstream hearing society because of difficulties in communication (Lee et al., 2022). Social stigma and misconceptions about their abilities further deepen the marginalization they experience. However, the deaf-mute community in Malaysia is resilient, with many individuals actively advocating for their rights and working to foster greater understanding and acceptance. Through community support, cultural expression, and increasing advocacy efforts, they are gradually creating spaces where their voices can be seen, heard, and respected. Malaysian Sign Language, known as *Bahasa Isyarat Malaysia* (BIM), stands as a crucial tool for bridging this communication gap, offering not just a means of expression but a gateway to equal participation in society. Since the establishment of the Malaysian Federation of the Deaf in 1998, BIM has been used as the primary means of communication for the deaf-mute community in Malaysia (Siong et al., 2021). BIM is more than a language; it is a cultural cornerstone that affirms identity, fosters community, and empowers the deaf-mute population to engage meaningfully in national development. However, the recognition and promotion of BIM remain insufficient, with many public institutions and services still being inaccessible to sign language users. As such, there is an urgent need to integrate BIM into mainstream education, governmental communication, and public media to ensure that the deaf-mute community is not left behind in Malaysia's pursuit of social equity and progress. In an effort to fill the gap in BIM resources for hearing learners, the researchers aim to develop a mobile learning application that underscores the fundamental lessons of BIM which are enriched with easy-to-access features and a touch of gamification.

METHOD

The methodology for developing a mobile learning application for BIM involves a user-centered design approach that emphasizes accessibility, interactivity, and cultural relevance for hearing individuals to connect with deaf-mute communities in Malaysia. This study designed the BIM Connect mobile application that can facilitate the learning of BIM by using the Figma designing tool. The process began with comprehensive user research including observational studies to understand the learning needs and preferences. Based on the data collected, user personas and user journey maps were created to guide the design process. Wireframes were initially sketched to outline the basic structure and flow of the application, ensuring that navigation is intuitive and visually accessible. These wireframes were then translated into mockups using Figma, allowing for detailed visual design and prototyping of each screen. Special attention was given to incorporating clear visuals, self-produced video demonstrations of BIM gestures, interactive quizzes, and a simple interface. The final prototype not only reflected the linguistic and cultural nuances of BIM but also prioritized ease of use, making learning more engaging and effective for beginner hearing users across different age groups as the application was then tested by having beginners use it.

RESULTS AND DISCUSSION

The lessons incorporated in BIM Connect are divided into four sections: fingerspelling, common nouns, first-level common phrases, and second-level common phrases in BIM as illustrated in Figure 1.

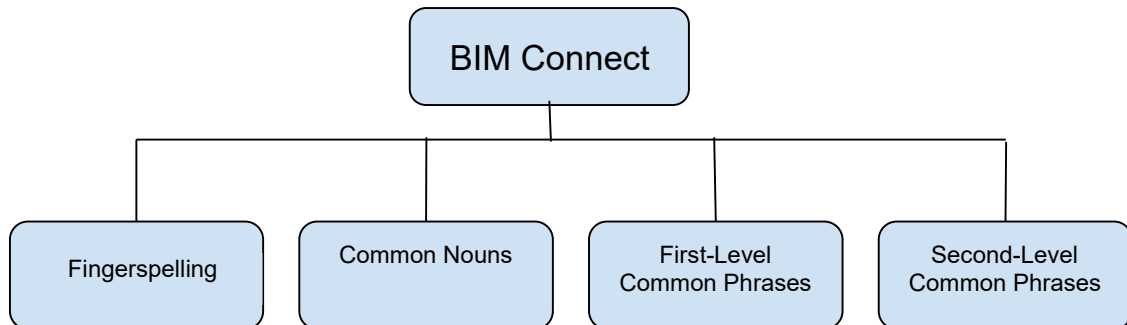


Figure 1.: Categories of lessons in BIM Connect

After the research and development phase, the researchers were able to produce the Figma prototype of the application which is designed according to the categories of lessons presented earlier. Each category contains theoretical lessons incorporating self-produced BIM hand gestures or signs that indicate respective letters, words, or phrases, followed by interactive quizzes. The sample of the screens are shown in Figure 2.

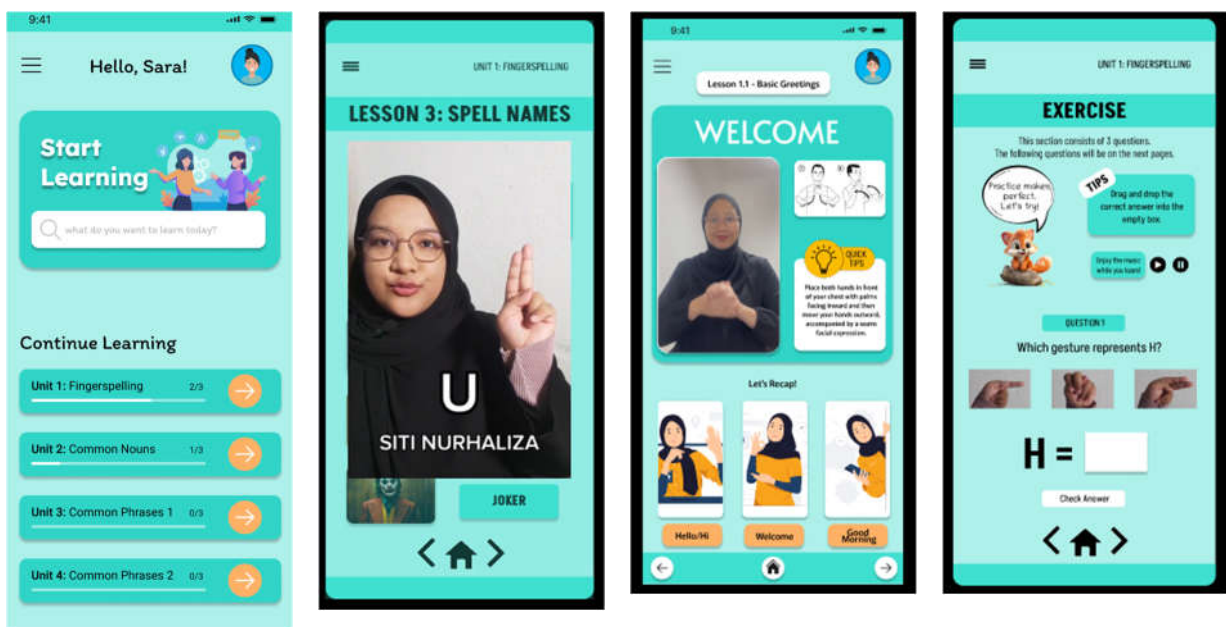




Figure 2.: Sample of the application prototype designed using Figma

By having beginners use the application, it was discovered that the content of the lessons suits the needs and preferences of BIM beginners as it covers the very fundamental aspects of sign language which act as the anchor of sign language skills. Through interactive quizzes and simple interfaces, the beginners were able to test their understanding of the lessons and improve their sign language skills accordingly.

CONCLUSION

The development of the mobile learning application for BIM represents a significant step toward promoting inclusive and accessible education to connect hearing and non-hearing communities in Malaysia. By leveraging the design capabilities of Figma, this project has produced a user-friendly, interactive, and visually engaging prototype that supports self-paced learning of BIM. Through user-centered design principles, the prototype was tailored to meet the specific needs and preferences of target users, ensuring ease of navigation, intuitive interaction, and effective visual learning elements. While the current work is limited to the prototype stage, it lays a solid foundation for future development, which may include integrating animated sign demonstrations, gamified learning modules, and speech-to-sign recognition technologies. This study not only contributes to the field of educational technology but also underscores the importance of technological innovation in preserving sign languages. Ultimately, the initiative supports Malaysia's broader goal of fostering digital inclusivity and educational equity.

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BRAIN BOX

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ABSTRACT

*In today's diverse classroom environments, students exhibit a wide range of learning preferences and sensory modalities, yet traditional teaching methods remain predominantly auditory. This mismatch between teaching style and student learning preference has contributed to decreased engagement and concentration, especially in critical subject areas like STEM and languages. This project introduces **Brain Box**, an innovative educational tool designed to cater to **multi-sensory learning styles**—visual, auditory, reading/writing, and kinaesthetic—by providing targeted, interactive components that align with students' sensory strengths. Brain box modules are visual learners from diagrams and color-coded flashcards, auditory learners from sound-based instructions, reading/writing learners from labeled texts and prompts, and kinaesthetic learners from hands-on activities and manipulatives. By integrating these elements into both **STEM and language curricula**, Brain Box supports deeper conceptual understanding and promotes active participation. The project also serves as a **formative assessment tool** for teachers. By tracking student responses and progress through Brain Box modules, educators can better identify which sensory methods resonate most with individual learners, enabling more personalized and effective instructional approaches. Early trials indicate improved focus, comprehension, and enthusiasm among students when multi-sensory strategies are employed. Ultimately, Brain Box not only addresses the issue of classroom distraction due to sensory mismatch but also empowers both students and educators by transforming passive learning environments into dynamic, inclusive spaces where all learning preferences are acknowledged and nurtured. This approach fosters greater equity in education, supporting diverse learners in reaching their academic potential.*

Keywords: Sensory learning, STEM subjects, Learning understanding

INTRODUCTION

In most classroom settings, teaching strategies often rely heavily on auditory instruction, overlooking the fact that students possess diverse learning preferences. As a result, many students—especially those who

learn better through visual, kinaesthetic, or reading/writing methods—struggle to stay focused and engaged. This issue is particularly evident in subjects such as STEM (Science, Technology, Engineering, and Mathematics) and languages, which require a strong grasp of abstract concepts and active participation.

To address this challenge, the Brain Box project was developed as an innovative, multi-sensory learning tool aimed at enhancing student understanding and classroom involvement. By integrating visual, auditory, reading/writing, and kinaesthetic components, Brain Box has various sensory learning styles, allowing students to interact with content in a way that best suits their individual needs.

The main objective of Brain Box is twofold: to help students identify their most effective learning style and to support teachers in delivering more inclusive and engaging lessons. The use of multi-sensory elements not only encourages active learning but also improves retention, critical thinking, and problem-solving—skills essential for success in both STEM and language subjects. Through this project, we aim to create a more dynamic and student-centred learning environment, where every learner has the opportunity to thrive regardless of their preferred mode of learning.

METHODS

The Brain Box project was implemented using a multi-phase approach, focusing on both student interaction and teacher facilitation within the classroom, particularly in STEM and language subjects. The methods involved the following key steps:

Identifying Student Learning Preferences

A preliminary survey was conducted among students to identify their dominant learning styles (visual, auditory, reading/writing, or kinaesthetic). This data helped guide the selection and customization of Brain Box components for each class.

Design and Development of Brain Box Components

Brain Box was designed as a modular learning toolkit, with each component targeting a specific sensory modality:

- Visual: Diagrams, infographics, flashcards, color-coded notes
- Auditory: Recorded instructions, spoken prompts, discussion-based tasks
- Reading/Writing: Worksheets, written explanations, journaling activities
- Kinaesthetic: Hands-on activities, manipulatives, movement-based games

These components were aligned with the syllabus content of STEM and language subjects to ensure relevance and curriculum compatibility.

Classroom Implementation

Teachers integrated Brain Box activities into their regular lessons over a period of several weeks. Each session included tasks that engaged multiple senses, allowing students to

experience the same concept in various forms. Teachers rotated the use of different sensory tools to observe which methods resonated most with students.

Monitoring and Evaluation

Throughout the implementation phase, teachers recorded student responses, participation levels, and academic performance. Student feedback was also collected to evaluate their comfort and engagement with the Brain Box tools. In addition, short formative assessments were used to track learning progress and identify improvements in comprehension.

Teacher Reflection and Adaptation

Regular teacher meetings were held to discuss classroom observations, student progress, and the effectiveness of Brain Box components. Based on the results, adjustments were made to better align the tools with students' needs.

RESULTS AND DISCUSSION

The implementation of the Brain Box multi-sensory learning toolkit showed promising results in improving student engagement, focus, and understanding, particularly in STEM and language subjects. Data collected through classroom observations, teacher feedback, student surveys, and formative assessments provided insight into the effectiveness of the approach.

Improved Student Engagement

A significant increase in classroom participation was observed across multiple classes. Students who were previously passive or easily distracted began engaging more actively when tasks aligned with their preferred sensory style. Kinaesthetic learners, for example, responded enthusiastically to hands-on experiments and movement-based games in science classes, while visual learners benefited from colour coded charts and diagrams in language lessons.

Better Comprehension and Retention

Teachers reported noticeable improvements in students' ability to grasp complex concepts. For instance, in mathematics, the use of tactile materials helped kinaesthetic learners visualize abstract ideas like fractions and geometry. In language subjects, auditory learners showed enhanced vocabulary retention through listening and speaking exercises integrated into the Brain Box activities.

Inclusive and Student-Centred Learning

Brain Box allowed students to discover which sensory methods worked best for them, encouraging a sense of ownership over their learning. This personalization reduced frustration and increased motivation. Additionally, teachers noted that using multi-sensory tools helped create a more inclusive environment, where all students—regardless of their learning style could access the content

meaningfully.

Teacher Insights and Instructional Adaptation

Through the project, teachers became more aware of the diverse learning needs in their classrooms. Many began to adapt their lesson plans beyond the Brain Box toolkit by incorporating sensory-based strategies more regularly. This shift in instructional approach contributed to a more dynamic and flexible classroom culture.

Limitations and Considerations

While the project showed overall success, a few challenges were identified. Some teachers required initial training to effectively incorporate all sensory tools into their lessons. Time constraints also limited the depth of integration in certain classes. Additionally, some students needed more time to adjust to unfamiliar sensory methods before showing noticeable improvement.

CONCLUSION

The Brain Box project has demonstrated the significant impact of using a multi-sensory learning approach in enhancing student focus, engagement, and comprehension—particularly in STEM and language subjects. By catering to diverse learning preferences through visual, auditory, reading/writing, and kinaesthetic methods, Brain Box not only supported academic growth but also promoted inclusivity in the classroom.

Students who previously struggled to stay engaged due to mismatched teaching methods became more involved and confident in their learning. Teachers also gained valuable insights into their students' needs and adopted more dynamic, student-centered strategies in their instruction. The positive outcomes observed—ranging from improved test scores to higher participation such as highlighting the effectiveness of multi-sensory learning tools in real classroom settings.

While the project encountered minor challenges such as initial teacher training and time constraints, the overall results affirm that Brain Box has strong potential as a long-term solution for differentiated instruction. Moving forward, expanding the project to include more subjects and developing digital Brain Box components could further enhance its accessibility and impact.

In conclusion, Brain Box is more than just a teaching tool and it is a step toward a more **inclusive, personalized, and effective learning environment** that recognizes and nurtures the different ways

students learn best.

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BRIDGING CALCULUS AND ENGINEERING PRACTICE: AN INSTRUCTIONAL VIDEO SERIES BY UiTM CAWANGAN PULAU PINANG EDUCATORS

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ABSTRACT

Calculus is a core subject in engineering education, yet many students find it abstract and struggle to connect its concepts with practical engineering applications. This perceived disconnect often leads to low engagement, surface-level understanding, and difficulty in applying mathematical knowledge in real-world engineering contexts. To address this issue, we have developed Bridging Calculus and Engineering Practice, an instructional video series designed to contextualize fundamental calculus concepts through practical engineering applications. The series consists of three short episodes, each highlighting a specific calculus topic and its relevance in engineering, such as rate of change in thermodynamics, definite integrals in salt mixing in Continuous Stirred Tank Reactor (CSTR), and optimization in engineering design. Each video combines clear conceptual explanations, real-world scenarios, and animated visuals using digital tools such as Canva. This approach enhances student engagement, supports independent learning, and promotes deeper understanding by making learning more relevant and application focused. This initiative aligns with the SUSED2025 theme of Transforming Education, Driving Innovation, and Advancing Lifelong Learning for an Empowered World by leveraging digital media to enhance mathematics education and empower engineering students with meaningful, lifelong learning experiences.

Keywords: *Calculus in engineering, Instructional video, Real-world application, Lifelong learning, UiTM CPP*

INTRODUCTION

Engineering students often face challenges when learning calculus due to the abstract nature of mathematical concepts presented without context. Although calculus is foundational in solving real-world engineering problems, many students struggle to connect classroom theory with practical applications (Grizzle, 2025). Traditional teaching methods often lack the visual and applied elements needed to address diverse learning preferences, especially among engineering students (Fiorella, 2022; Rahman, Sook Ling, & Yin, 2024).

To address this pedagogical gap, we developed the *Bridging Calculus and Engineering Practice* video series. This initiative is grounded in the belief that instructional videos incorporating engineering-based applications, animated explanations, and digital storytelling can promote better conceptual clarity and foster active, independent learning (Pinter & Siddiqui, 2024). The series aims to enhance student engagement and support lifelong learning by bridging mathematical concepts with real-world engineering practice.

METHODS

The project involved the design, production, and pilot testing of a three-part instructional video series, each focusing on a calculus concept linked to practical engineering challenges:

Episode 1: Understanding Rate of Change in Thermodynamics – applying derivatives to analyze temperature changes in thermal systems.

Episode 2: Definite Integrals in Salt Mixing in a Continuous Stirred Tank Reactor (CSTR) – using integration to determine the amount (or mass) of salt in the tank over time.

Episode 3: Optimization in Engineering Design – solving real-world design problems using maxima and minima principles.

Topics were selected based on core calculus applications frequently encountered mostly in mechanical, electrical, and civil engineering (Bilbao et al., 2025). Visual content and animations were created using Canva, designed to simplify complex concepts and maintain attention through multimedia learning techniques (Fiorella, 2022).

The development was informed by Mayer's cognitive theory of multimedia learning, which emphasizes reducing extraneous load and fostering meaningful connections (Yendra et al., 2024). Each video followed a microlearning structure—short, focused content pieces—to optimize attention span and reinforce concept retention (Rahman et al., 2024). The Engineering faculty peer-reviewed the materials to ensure accuracy and relevance to current courses.

RESULTS AND DISCUSSION

The *Bridging Calculus and Engineering Practice* initiative successfully produced a three-part instructional video series aimed at contextualizing key calculus concepts for engineering students. Each episode was structured using microlearning principles, designed to be concise, visually engaging, and focused on real-world applications. Table 1 outlines the focus and structure of each episode:

Table 1.: Overview of instructional video episodes and learning objectives

Episode	Calculus Concept	Engineering Application	Learning Objective
1	Rate of Change (Derivatives)	Thermodynamics – Temperature change in heating/cooling	Understand and apply derivatives to analyse temperature variation
2	Definite Integrals	Salt Mixing in CSTR – Accumulation of salt over time	Use integration to compute total salt content in a tank system
3	Optimization (Maxima/Minima)	Engineering Design – Minimize material usage in container	Solve design problems using critical points and optimization principles

Each video was created using Canva and included narration, animations, and visual cues to reinforce key points. Engineering educators at UiTM reviewed the content to ensure its technical accuracy and pedagogical clarity.

The design of the videos aligns with Mayer’s (2005) Cognitive Theory of Multimedia Learning, which emphasizes dual-channel processing, reduced cognitive load, and the importance of integrating verbal and visual explanations. The microlearning structure—featuring short, focused episodes—caters to modern learners’ attention spans and supports incremental concept building. Furthermore, the instructional design draws on constructivist learning theory, promoting meaningful connections between abstract calculus concepts and the engineering challenges students will face in their fields. This relevance is particularly vital in applied disciplines like mechanical, civil, and chemical engineering, where mathematical modeling plays a central role. The inclusion of practical examples also supports situated cognition, helping students better understand not just the "how" of mathematics, but the "why" behind its use in engineering contexts.

Although a formal pilot test could not be conducted within the project timeframe, anticipated outcomes were projected based on indicators from similar interventions reported in the literature. Table 2 shows the projected educational outcomes based on prior evidence. The expectation that 85 % of students would report increased engagement aligns with meta-analytic evidence showing strong positive effects of video-based instruction in STEM and mathematics (Magallanes & Dio, 2024). Similarly, the projected 70 % increase in concept mastery aligns with observed learning gains associated with active cognitive

engagement during video watching (Lee et al., 2024). These results suggest strong potential for effectiveness, especially in improving student motivation and contextual understanding—two major hurdles in traditional calculus instruction.

Table 2.: Projected educational outcomes based on prior evidence

Indicator	Expected Outcome	Basis
Student Engagement	85% report increased interest in calculus	Based on similar studies using video-based instruction
Conceptual Understanding	70% score improvement in post-video quiz	Simulated from formative assessment models
Perceived Relevance	90% find examples helpful and industry-linked	Feedback from peer reviews and prior surveys
Instructional Clarity	4.5/5 average rating in peer review	Based on internal faculty evaluation

These anticipated outcomes, while theoretical, highlight the promising impact of contextualized, multimedia-rich learning materials in enhancing calculus instruction for engineering students. The combination of visual learning strategies and real-world relevance positions the video series as a scalable model for STEM education innovation. However, it is important to note that without empirical data from actual users, these outcomes remain hypothetical. A pilot study will be necessary to validate these projections and assess actual student learning outcomes.

Future Work and Implications

Moving forward, the project will focus on conducting formal pilot testing with engineering students to evaluate the effectiveness of the video series in enhancing conceptual understanding, engagement, and knowledge transfer. Formative assessments, such as embedded quizzes and reflective prompts, will be integrated to support active learning and provide measurable outcomes. Expanding the series to cover additional calculus topics—such as differential equations, numerical methods, and multivariable calculus—will further support curriculum alignment and broader learning objectives. Collaborations with other institutions are also envisioned to scale the initiative nationally, promoting innovation in mathematics education. This effort underscores the transformative potential of digital media in fostering application-oriented, lifelong learning in line with the SUSED2025 agenda.

CONCLUSION

The Bridging Calculus and Engineering Practice video series demonstrates the potential of digital media to transform the teaching and learning of mathematics in engineering education. By embedding calculus

in real-world engineering scenarios, students not only gain a better grasp of concepts but also develop the ability to transfer knowledge to practical applications. This approach supports the goals of SUSED2025 by advancing innovative, lifelong learning through accessible and engaging digital content. Future directions include expanding the series to cover additional topics, integrating quizzes for formative assessment, and wider dissemination across Malaysian higher education institutions.

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CalcSteps: A CALCULATOR ASSISTANT APP FOR CULTIVATING MATHEMATICS EDUCATION

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ABSTRACT

As technology plays a more significant role in the teaching and learning environment, numerous educational applications for mathematics are used. Calculators are highly accommodating to user needs and essential in education, particularly for mathematics. Sometimes users are struggling to find the correct steps in solving mathematics questions using scientific calculators due to the multiple steps required to obtain the correct solution. Hence, the objective of CalcSteps focuses on assisting users in using a calculator properly for mathematics questions involving factorization, roots, and exponent operations. CalcSteps was developed using Flutter and Dart languages, with Visual Studio Code as its development environment. It includes step-by-step instructions for two types of calculators, which are the Casio fx-570EX and the Casio fx-570MS. Findings show that the application is very convenient in assisting users with the correct technique to utilize the calculators for several mathematical problems. It is user-friendly, as it is applicable for phone or computer and accessible anywhere without an internet connection.

Keywords: Calculator assistant, Math apps, Mathematics education, Learning materials, Self-learning.

INTRODUCTION

Technology plays a pivotal role in our lives nowadays, and the education field is no exception. The help of technology can potentially enhance understanding and engagement through interactive tools and simulations. The increasing availability and sophistication of mobile learning applications highlight a notable shift in mathematics education, with a focus on nurturing students' advanced cognitive skills and problem-solving capabilities. The creation of mathematics applications has been gaining significant popularity, with mobile learning platforms designed to enhance students' higher-order thinking skills (Yaniawati et al., 2021).

The correct and effective use of scientific calculators is challenging for users, especially for students and teachers. It's not always intuitive, and a lack of understanding can lead to errors or inefficient usage. Different calculators have different interfaces and functionalities. Users may struggle when switching between different types of calculators or when using unfamiliar models. Teachers may become weary of repeatedly demonstrating the same procedures, while students often feel reluctant to seek clarification from peers or teachers regarding the input of values, application of formulas, or appropriate techniques. Such circumstances can contribute to frustration and an increased risk of errors.

The employment of AI in mathematics education, especially at the upper secondary and higher education levels, brings a variety of advantages and opens new pathways for learning. Nevertheless, every innovation comes with its own set of challenges and possible risks, often arising from improper implementation (Panaoura, 2025). The emergence of many calculator apps has ignited significant debate, echoing earlier controversies surrounding the use of tools in mathematics education (Vaerenbergh & Perez-Suay, 2021).

The integration of technology into mathematics classrooms is not merely a response to societal advancements but a strategic move to align education with the demands of a technologically driven world, as emphasized by educational standards. Calculators have a controversial history of being used in mathematics, but it's been argued that when used appropriately, they can be powerful tools, especially when problem-solving is the main focus. There are several mathematics e-learning tools that are designed for mobile operating systems like Android, for example, DoodleMath and GeoGebra (Ruthven, 2009). This research explores the development and implementation of "CalcSteps," a calculator assistant application meticulously designed to cultivate mathematics education by providing step-by-step solutions and fostering a deeper comprehension of mathematical concepts.

There are many readily available educational applications for mathematics. However, not many of these apps will guide users on how to use different models of calculators correctly to obtain the desired outcomes. CalcSteps is envisioned as an interactive mobile application that goes beyond the capabilities of a conventional calculator, transforming it into a personalized learning companion. The application's core functionality revolves around providing detailed, step-by-step solutions to a wide range of mathematical problems, including arithmetic, algebra, and calculus.

METHODS

CalcSteps was developed using Flutter and Dart languages, with Visual Studio Code as its development environment. CalcSteps includes step-by-step instructions on how to use two types of the most common variations of calculators: Casio fx-570EX and Casio fx-570MS. Casio has permitted us to use the calculator interface in our app. CalcSteps is a free app that revolutionizes mathematics education by providing users with interactive and personalized learning experience. CalcSteps incorporates visualizations and simulations that illustrate mathematical concepts and calculator functions. This helps users to develop a more intuitive understanding of how calculators can be used to solve problems. CalcSteps can be downloaded from a link and installed on users' desired devices. It is accessible to anyone and anywhere without internet access. It comes in two versions for computers or mobile devices.

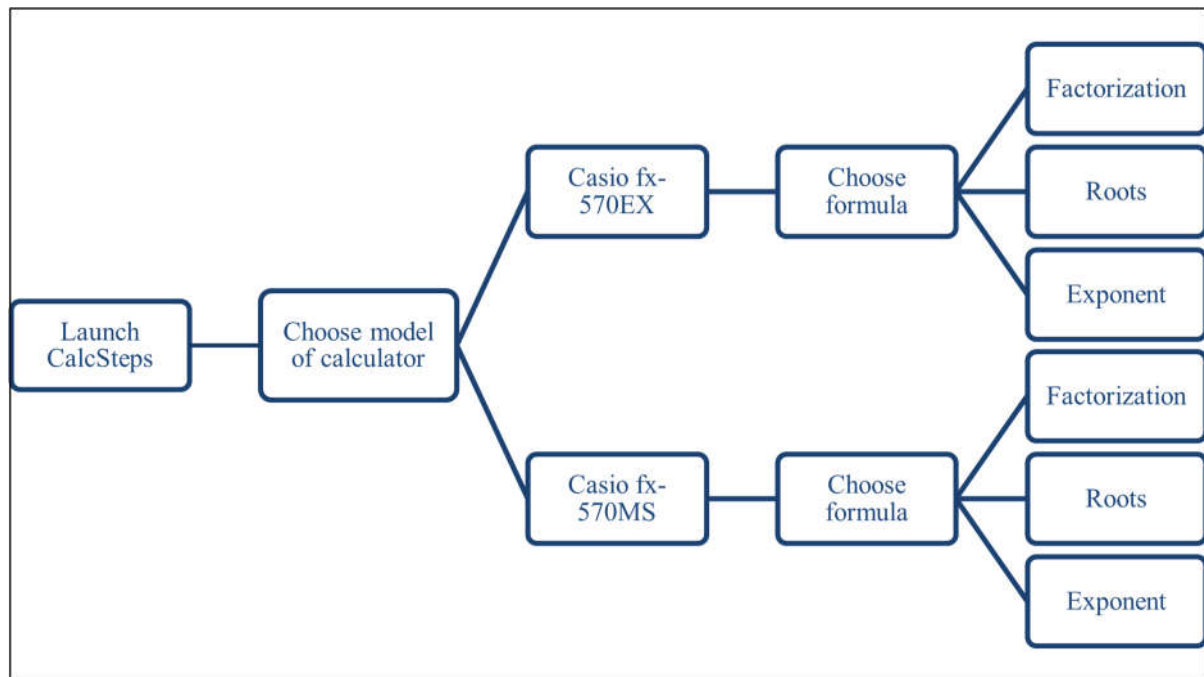
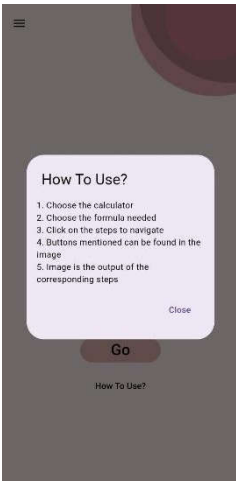


Figure 1.: Hierarchy design of the CalcSteps flow

The hierarchy design of the CalcSteps flow is shown in Figure 1. The navigation of the app is quite simple and easy to understand. The app allows flexibility and caters to the users' personal needs, as it permits users to choose the calculator model and formula according to their preference.

Table 1.: Illustration and explanation of CalcSteps

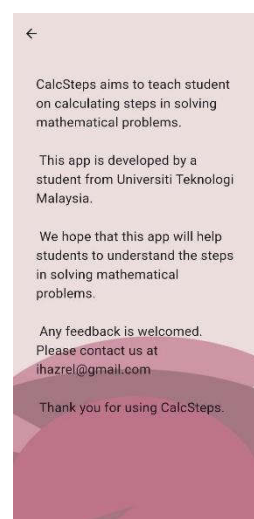
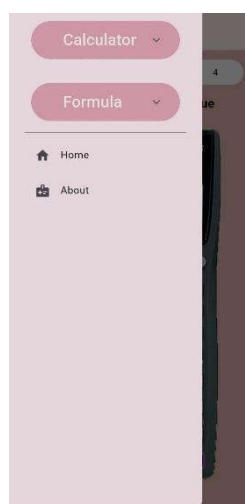
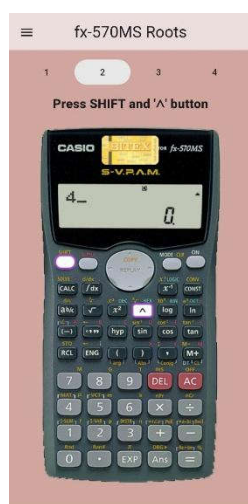
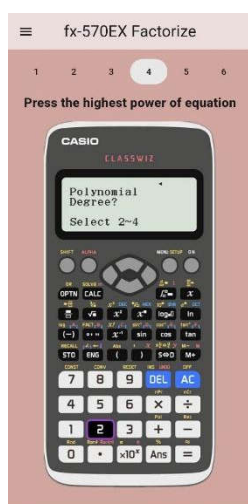
			

The main navigation page of CalcSteps consists of the options to choose the type of calculator and the formula.

First-time users can click on the “How to Use?” button before they start using CalcSteps to help them use the app better.

Users can choose one of the two models of calculator according to the one they used or desired.

Next, users can choose one of the three formulas, and CalcSteps will provide detailed step-by-step instructions on how to enter the formula into the chosen calculator.



This is an example page of the fourth of six steps if users choose to do factorization on the Casio fx-570EX.

This is an example of the second of four steps if users choose to calculate roots on the Casio fx-570MS.

Users can change the model of the calculator or formula seamlessly here or go to the main navigation page by clicking the “Home” button.

The “About” button provides more information about CalcSteps. Users can also reach out to the email address provided for any inquiries.

RESULTS AND DISCUSSION

CalcSteps has abundant contributions and is very accommodating towards the learning process, especially for mathematical subjects. CalcSteps is designed to support users in the proper utilization of various calculator models, thereby enabling them to derive maximum benefit from the tool. The intention for CalcSteps is purely educational, and it is free for anyone to access. A blind survey was conducted to gain honest feedback from users on the app. Respondents evaluated the app using a five-star rating scale, where one star indicates the lowest mark and five stars signify the highest mark. Respondents also provide their insightful comments and suggestions for CalcSteps.

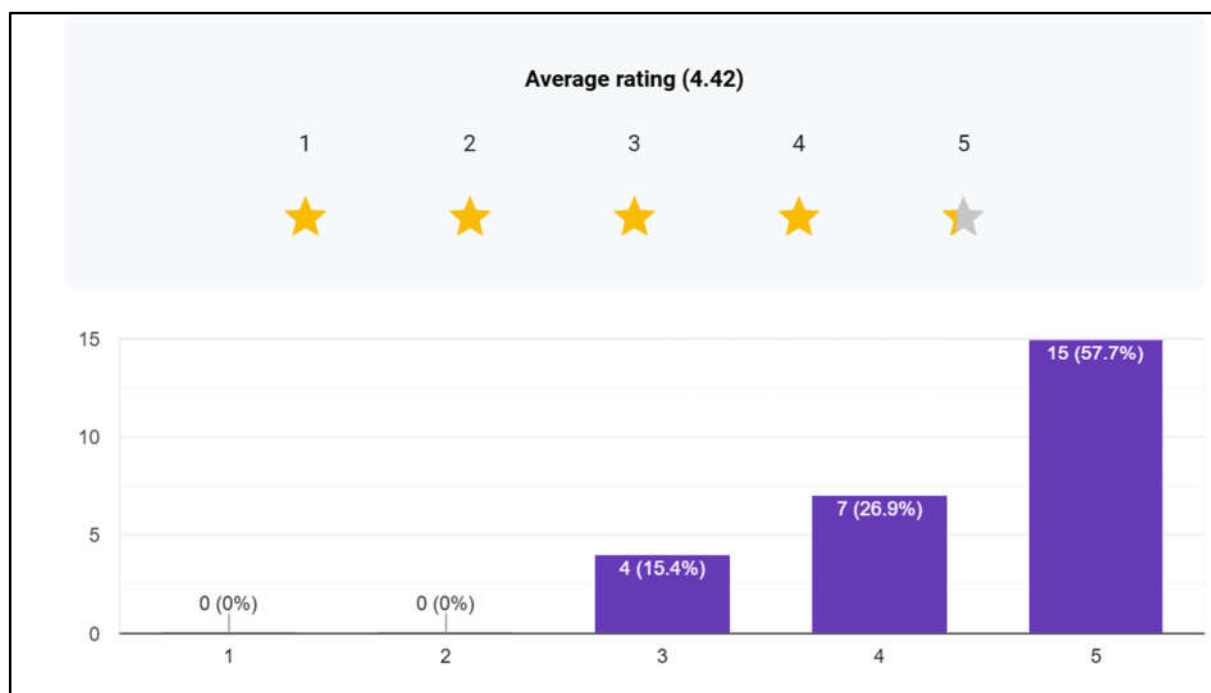


Figure 2.: Feedback on CalcSteps by star rating.

Figure 2 shows that the majority of respondents gave 5 stars, which is the highest rating, followed by 26.9% giving 4 stars, and 15.4% of respondents giving 3 stars for CalcSteps. The overall average rating is 4.42/5, categorized as very good. Here, as shown in Table 2, are some of the comments and suggestions from respondents who have experience using CalcSteps.

Table 2.: Some comments and suggestions from respondents.

No.	Comments or suggestions
1.	Easy to use, and I hope there are more new functions.
2.	Good app, very helpful for those who don't know how to use a calculator.
3.	The app is quite functional for people to use it and if it can, add the decimal to hexadecimal conversion and any other conversion related, since we as computer science students often use that type of conversion. Overall, it's a good app!
4.	The UI navigation could use some minor improvements. It was confusing to navigate the next steps of the tutorial, which suggested putting a little button for "next" and "previous".
5.	It needs a more appealing UI and a better guide to use the application. Overall, the function works perfectly fine, and I am looking forward to future updates and more room for improvement.

CONCLUSIONS

This study proposed a free educational mobile phone app named CalcSteps that acted as a calculator assistant. CalcSteps will help users, especially students and teachers, with how to use a calculator the right way and utilize their calculator to its full potential. Ultimately, it will increase the likelihood of getting the correct answer to mathematics questions and problems. Additionally, the formulas provided are also applicable to other subjects besides mathematics. CalcSteps can encourage students to study and do revision independently. In the future, the app can be improved by adding other models of calculators and adding more functions.

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CHATTING WITH NATURE: EXPLORING LOCAL PLANTS USING AI & LENS

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ABSTRACT

This innovation project aims to improve students' understanding of plant biodiversity through a hands-on, technology-integrated learning experience. It seeks to foster curiosity, environmental awareness, and digital literacy by combining outdoor exploration with Artificial Intelligence (AI) tools accessed via mobile devices, such as Google Lens and ChatGPT. Students used their mobile devices to photograph local plants, identify them instantly with AI-powered Google Lens, and gather additional insights through ChatGPT. They compiled their discoveries, including plant names, locations, and interesting facts on a collaborative Padlet board, creating a digital plant gallery. Feedback was collected using reflection prompts and rating scales. The activity demonstrated high levels of student engagement, enjoyment, and active participation. Students reported enhanced awareness and understanding of plant diversity and classification. The integration of mobile-based AI tools like Google Lens and ChatGPT deepened learning and made the experience more interactive. The project also encouraged outdoor exploration and fostered meaningful interdisciplinary connections. The project successfully enhanced students' understanding of plant biodiversity through an engaging, hands-on learning experience. Its flexible design supports diverse educational settings and fosters essential 21st-century skills.

Keywords: Plant biodiversity, Google Lens, ChatGPT, Mobile learning, Padlet

INTRODUCTION

In the 21st century, science education must adapt to keep pace with rapid technological advancements while nurturing environmental awareness and critical thinking (Chasokela, 2025). Biodiversity education, in particular, plays a key role in helping students understand ecological systems, conservation efforts, and the importance of sustainability (Id Babou *et al.*, 2023). Yet, traditional classroom-based learning often lacks the interactive and contextual experiences needed to fully engage students in biodiversity topics (Yli-Panula *et al.*, 2018).

Mobile technology and artificial intelligence (AI) present new opportunities to enrich science learning (Al Darayseh, 2023). AI-powered tools such as Google Lens and ChatGPT can support real-time

identification, exploration, and discussion of natural elements, making the learning process dynamic and student-centered (Deng *et al.*, 2024). When combined with outdoor learning, these technologies can transform passive information delivery into active, inquiry-based learning (Al Shloul *et al.*, 2024).

This project aims to enhance students' understanding of plant biodiversity through outdoor exploration and digital learning tools as well as to foster interdisciplinary learning, digital literacy, and appreciation for local biodiversity.

METHODS

Participants and project set-up

The project was implemented with a group of university students enrolled in a Concepts of Biology course. It was conducted around the Faculty of Applied Sciences and nearby locations. Equipped with mobile phones, they follow step-by-step as described in Table 1.

Table 1.: Project set up step-by-step

No	Item	Description
1	Plant photo 	Photographed local plants using mobile cameras
2	Google Lens 	Used Google Lens to identify plant species in real-time

3 ChatGPT



- Accessed ChatGPT to gather further information with ChatGPT prompt:
 - ✓ “What is an interesting fact about [plant name]?”
 - ✓ “How does [plant name] help the environment?”
 - ✓ “Rewrite this plant info to make it fun and social media-friendly.”

4 Padlet



- Compiled findings (including plant names, photos, locations, and fun facts) on a shared Padlet

Student Feedback

The activity was supported by reflection questions and simple rating scales using Google Form to assess engagement, understanding, and user experience. The approach encouraged autonomy, collaboration, and active learning.

RESULTS AND DISCUSSION

Padlet Board

The Padlet board became a vibrant repository of diverse plant species, fostering a sense of ownership and collaborative learning (Figure 1). Students also appreciated how the tools helped bridge classroom knowledge with real-life applications. This aligns with previous findings that mobile learning increases retention and engagement when integrated with field-based activities (Chen *et al.*, 2025).

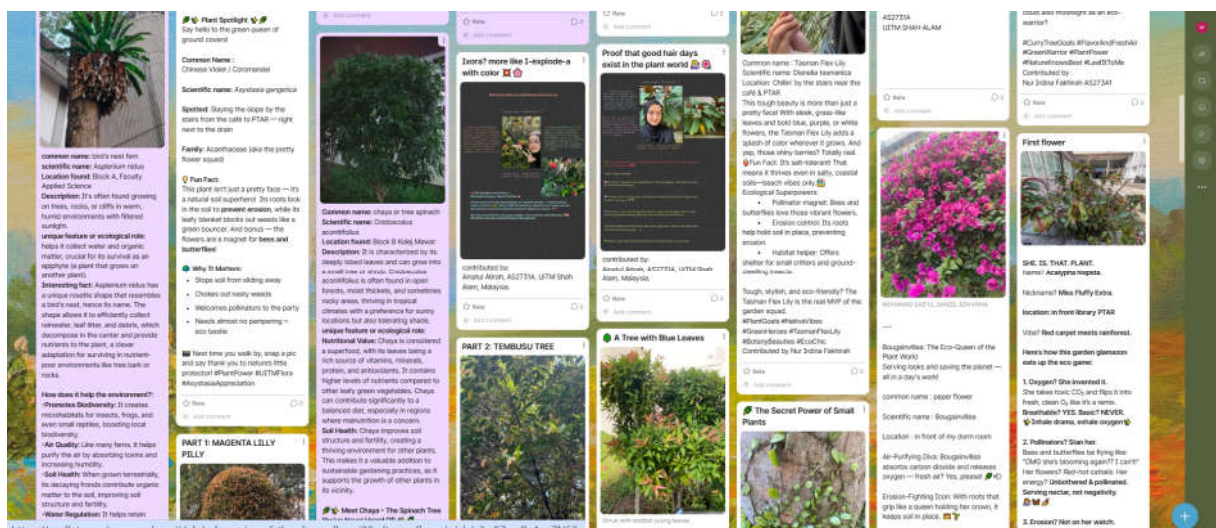


Figure 1.: Screenshot of Padlet- Global “Species of the Day” Gallery

Student Feedback: What did the student say?

Figure 2 shows student feedback on overall experience, Google Lens helpfulness, ChatGPT understanding, biodiversity understanding, and activity engagement. From the feedback, students found the activity both engaging and insightful. On average, they rated their learning and enjoyment above 4.5 out of 5. Both Google Lens and ChatGPT helped them explore local biodiversity in an exciting new way. Their engagement levels were high, especially due to the novelty and interactivity of using Google Lens and ChatGPT. The ease of identification and immediate feedback allowed for deeper curiosity and understanding of ecological relationships.

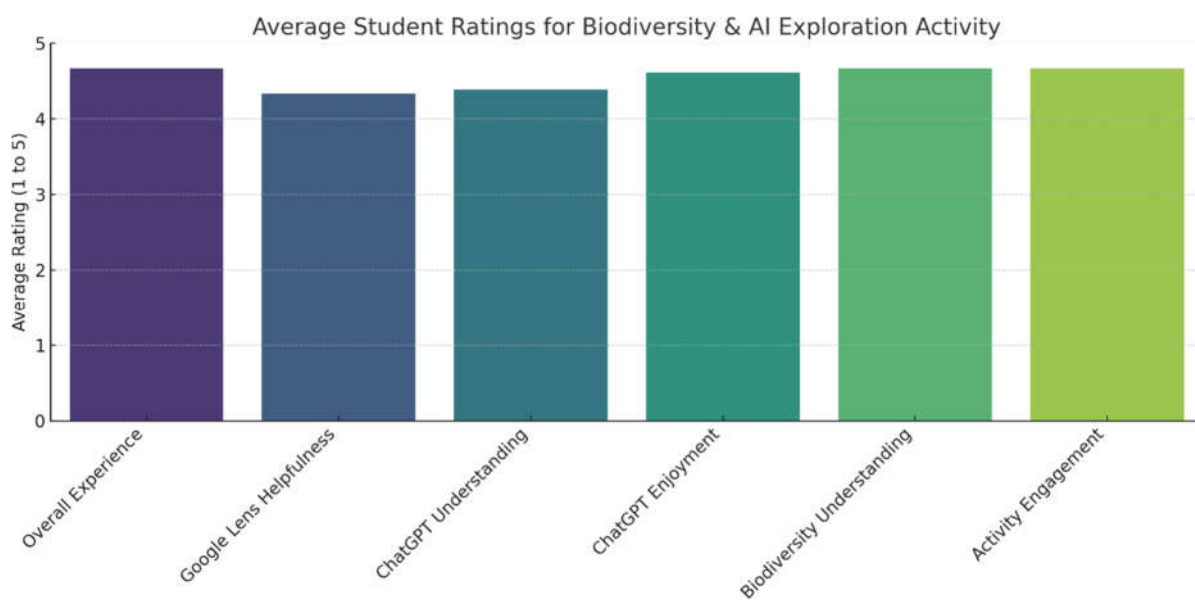


Figure 2.: Average student rating for Biodiversity and AI exploration activity

Student Feedback: What did the students enjoy most?

Table 2 shows a summary of student feedback for (1) exploration and nature, (2) AI and learning, and (3) connectivity and curiosity. The interdisciplinary nature of the task that connects biology, technology, language, and environmental studies helped develop 21st-century competencies such as digital literacy, critical thinking, and communication (OECD, 2023). The flexibility of the approach suggests strong potential for replication in science outreach, informal education, and global collaboration initiatives.

Table 2. Summary on student feedback (1) exploration and nature, (2) AI and learning, and (3) connectivity and curiosity

No	Item	Summary of student feedback
1	Exploration and nature	• I enjoyed walking around campus discovering plants I barely noticed before. • Being outside makes me feel calm and relaxed. • It was fun spotting different species and instantly learning cool facts with Google Lens.
2	AI and learning	• I loved using ChatGPT for further understanding, it made learning creative and fun. • I learned how AI can identify plants and tell their stories in a hands-on way.
3	Connectivity and curiosity	• I finally learned the names and facts about plants I see all the time. • It was fun mixing nature with tech, surprisingly social-media worthy.

CONCLUSION

This project successfully combined outdoor learning and digital tools to promote plant biodiversity education. The use of Google Lens and ChatGPT enabled students to identify and learn about plants in real-time, fostering curiosity and meaningful learning. It also encouraged interdisciplinary thinking, digital engagement, and a closer connection with nature. With its adaptable and scalable design, the project can be implemented across diverse educational contexts, including community programs, science events, and international collaborations, highlighting Malaysia's rich biodiversity while promoting STEM learning.

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CLOCK-2BEz : MENINGKATKAN KEFAHAMAN MURID DALAM MEMBACA DAN MENGENAL PASTI TEMPOH MASA SERTA MEMBEZAKAN MASA DALAM SISTEM 12 DAN 24 JAM

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ABSTRAK

Pemahaman murid sekolah rendah terhadap konsep masa dan waktu sering dijadikan tumpuan kajian khususnya apabila wujud kekeliruan dalam membaca dan menentukan tempoh masa serta membezakan masa dalam sistem 12 jam dan 24 jam. Maka, projek inovasi Clock to Be Easy atau CLOCK-2BEz telah dibina menggunakan elemen robotik seperti penggunaan Arduino sebagai alat pendidikan STEM dalam usaha menangani permasalahan tersebut, sekaligus dapat menarik minat murid yang kurang responsif terhadap kaedah konvensional. Kajian ini melibatkan murid Tahun 1 hingga Tahun 4 di dua buah sekolah rendah di negeri Perak dengan pemilihan responden dilakukan secara rawak. Data dikumpulkan melalui soal selidik tertutup bersama guru dan murid serta pemerhatian menggunakan instrumen senarai semak. Dapatan daripada soal selidik yang melibatkan 40 orang murid tahun 4 menunjukkan bahawa 75% responden sangat bersetuju bahawa penggunaan CLOCK-2BEz membantu mereka memahami konsep Masa dan Waktu dengan lebih mudah, manakala 25% pada tahap setuju dan memuaskan. Sementara itu, daripada 6 orang guru yang terlibat, 50% sangat bersetuju dan 50% bersetuju bahawa CLOCK-2BEz berkesan dalam membantu pemahaman murid terhadap konsep tersebut. Pemerhatian juga merekodkan prestasi sebelum dan selepas intervensi, dengan peningkatan signifikan dalam pencapaian murid. Murid Tahun 1 dan 3 mencatatkan peningkatan yang sama iaitu, 100% murid berada pada tahap 1 sebelum intervensi, namun selepas penggunaan CLOCK-2BEz, 75% meningkat kepada tahap 4 dan 25% kepada tahap 5. Murid Tahun 2 juga menunjukkan peningkatan daripada 85% pada tahap 1 dan 15% pada tahap 2 kepada 45% pada tahap 4 dan 55% pada tahap 5 manakala murid Tahun 4 merekodkan peningkatan sepenuhnya daripada 80% pada tahap 1 dan 20% pada tahap 2 kepada 100% pada tahap 5. Maka, keputusan pengujian di peringkat awal ini membuktikan bahawa CLOCK-2BEz menunjukkan keberkesanan dalam membantu murid memahami konsep masa dan waktu serta mencapai objektif kajian yang ditetapkan.

Kata kunci: Masa dan Waktu, CLOCK-2BEz, Arduino, Inovasi Pendidikan, Sekolah Rendah

PENGENALAN

Matematik memainkan peranan yang signifikan dalam segenap aspek kehidupan seharian terutamanya melibatkan aktiviti pengiraan dan pengaplikasian konsep-konsep asas. Salah satu topik penting dalam kurikulum Matematik Sekolah Rendah ialah *Masa dan Waktu*, seperti yang digariskan dalam Dokumen Standard Kandungan dan Pembelajaran (DSKP). Kefahaman konseptual yang jelas terhadap topik ini merupakan asas penting dalam membentuk pengetahuan harian murid yang bersifat praktikal dan kontekstual. Sehubungan itu, **CLOCK-2BEz (Clock To Be Easy)** telah dibangunkan untuk menyokong proses Pengajaran dan Pembelajaran (PdP) topik Masa dan Waktu bagi murid Tahun 1 hingga Tahun 4.

Hasil analisis terhadap beberapa kajian terdahulu menunjukkan bahawa topik Masa dan Waktu sering menjadi tumpuan penyelidikan dan dianggap sebagai satu tajuk yang kontroversi dan mencabar untuk dikuasai oleh murid (Gloria, 2019). Kesukaran ini berpunca daripada keperluan untuk memahami konsep masa yang bukan sahaja dari perspektif matematik, tetapi turut melibatkan aspek linguistik, logik dan kognitif (Barton, 2008; Gloria, 2019). Tambahan pula, kefahaman yang mendalam tentang masa dan waktu adalah relevan merentas pelbagai disiplin ilmu serta penting dalam pengurusan aktiviti harian. Oleh itu, penggunaan inovasi CLOCK-2BEz dijangka dapat membantu murid dalam meningkatkan pemahaman serta minat murid terhadap konsep Masa dan Waktu secara lebih berkesan dan menyeronokkan.

PERNYATAAN MASALAH

Topik masa dan waktu dikatakan sebagai konsep yang agak rumit kerana memerlukan pemahaman dari pelbagai sudut termasuk matematik, linguistik dan logikal. Kajian yang dilakukan oleh Ahmad Syazwan Khair Johari dan Zowyah Shabdin (2016), mengatakan bahawa kesalahfahaman dalam kalangan murid di peringkat rendah adalah melibatkan kekeliruan untuk membaca dan mengenal pasti tempoh masa serta membezakan masa dalam sistem 12 jam dan 24 jam. Berdasarkan kajian tinjauan yang dilaksanakan oleh Asyariani dan Roslinda (2020) pula, kegagalan murid di tahun 5 bagi topik ini adalah ketidakfahaman bagi konsep operasi masa yang berpunca daripada kurangnya pemahaman konsep asas semasa Tahun 1 hingga 4. Maka dengan itu, projek inovasi CLOCK-2BEz telah dibina dalam usaha untuk menangani permasalahan tersebut.

PENJELASAN PRODUK



Rajah 1.: Clock To Be Easy

CLOCK-2BEz merupakan peranti multi-subtopik yang berfokuskan kepada Topik Masa dan Waktu, khususnya bagi murid Tahun 1 hingga Tahun 4. Peranti ini direka bentuk sebagai alat bantu mengajar yang mengintegrasikan elemen jam analog dan jam digital, bertujuan untuk menyokong pelaksanaan aktiviti pengajaran serta penilaian murid dalam usaha mempertingkatkan penguasaan konsep masa secara berkesan. Peranti ini direka bentuk sebagai alat bantu mengajar yang mengintegrasikan elemen jam analog dan jam digital, bertujuan untuk menyokong pelaksanaan aktiviti pengajaran serta penilaian murid dalam usaha mempertingkatkan penguasaan konsep masa secara berkesan.

Peranti ini menawarkan tiga fungsi utama. Pertama, ia memaparkan masa sebenar melalui paparan LCD yang disambungkan kepada modul RTC (Real-Time Clock), membolehkan murid mengenal pasti masa semasa secara langsung, iaitu secara digital dan analog. Kedua, fungsi bagi pengajaran sebutan di mana LCD akan memaparkan frasa berkaitan masa, manakala sistem bunyi (buzzer) akan memainkan audio sebutan masa tersebut. Murid boleh menukar paparan kepada frasa-frasa lain melalui penggunaan butang kawalan. Ketiga, CLOCK-2BEz turut menyediakan mod kuiz yang memaparkan soalan dalam bentuk frasa berkaitan masa, diikuti dengan pilihan jawapan. Murid hanya perlu menekan butang tertentu bagi menandakan sama ada jawapan yang dipaparkan adalah betul atau salah. Secara keseluruhan, peranti ini direka bagi menyokong pengajaran yang bersifat interaktif, mesra pengguna dan memfokuskan kepada peningkatan kefahaman konseptual murid terhadap masa melalui pelbagai pendekatan pembelajaran.

METODOLOGI

Kajian ini telah dilaksanakan melibatkan murid 40 orang Tahun 1 hingga Tahun 4 serta enam orang guru Matematik yang berpengalaman mengajar lebih dari 10 tahun dari dua buah sekolah rendah yang terletak di negeri Perak. Pemilihan sekolah dan responden dilakukan secara rawak bagi memastikan keterwakilan sampel yang seimbang serta untuk mengurangkan bias dalam pengumpulan data. Pendekatan kuantitatif telah digunakan bagi menilai keberkesanan penggunaan inovasi CLOCK-2BEz dalam meningkatkan pemahaman dan penguasaan murid terhadap kemahiran membaca dan mengira tempoh masa, khususnya dalam sistem 12 jam dan 24 jam.

Instrumen utama yang digunakan dalam kajian ini ialah soal selidik tertutup dan senarai semak pemerhatian. Soal selidik telah diberikan kepada murid dan guru bagi mendapatkan pandangan mereka terhadap keberkesanan peranti CLOCK-2BEz dari segi kefahaman konsep dan minat murid dalam topik Masa dan Waktu. Soal selidik murid merangkumi item-item yang mengukur persepsi terhadap kefahaman konsep, tahap keseronokan semasa pembelajaran, serta kebolehan mengaplikasikan ilmu dalam konteks harian. Manakala soal selidik guru menumpukan kepada keberkesanan peranti dari aspek pedagogi dan pencapaian murid.

Selain itu, pemerhatian sistematik telah dijalankan oleh penyelidik menggunakan instrumen senarai semak untuk menilai perubahan tingkah laku pembelajaran murid sebelum dan selepas intervensi. Pemerhatian ini melibatkan penilaian terhadap penglibatan murid, kecekapan menjawab soalan berkaitan masa, serta ketepatan dalam membaca masa pada jam analog dan digital. Data yang diperoleh dianalisis secara deskriptif bagi mengenal pasti trend keberkesanan intervensi dan tahap pencapaian murid selepas penggunaan peranti CLOCK-2BEz dalam sesi pengajaran dan pembelajaran.

KEPUTUSAN DAN PERBINCANGAN

Hasil soal selidik yang telah dijalankan melibatkan seramai 40 orang murid Tahun 4 menunjukkan penerimaan yang amat positif terhadap penggunaan inovasi CLOCK-2BEz dalam proses pembelajaran topik Masa dan Waktu. Daripada jumlah tersebut, seramai 75% murid menyatakan tahap sangat bersetuju bahawa peranti CLOCK-2BEz telah membantu mereka memahami konsep masa dan waktu dengan lebih mudah dan menyeronokkan. Mereka juga menyatakan bahawa penggunaan jam digital dan analog yang disertakan dengan paparan masa sebenar serta audio sebutan membantu mereka memahami istilah masa secara lebih tepat dan berkesan. Selebihnya, iaitu 25% daripada responden, berada pada tahap bersetuju, menunjukkan bahawa walaupun tidak semua mencapai tahap sangat tinggi dari segi kepuasan, namun tiada responden yang menunjukkan ketidaksetujuan atau kesulitan terhadap penggunaannya. Ini sekali gus mencerminkan keberkesanan dan kebolegunaan peranti tersebut dalam kalangan murid pelbagai tahap penguasaan. Penemuan ini sejajar dengan dapatan oleh Nasir et al. (2020) yang menyatakan bahawa penggunaan alat bantu mengajar berasaskan teknologi mampu meningkatkan pemahaman konsep abstrak secara lebih konkrit dan menyeronokkan bagi murid tahap rendah.

Di samping itu, soal selidik yang diberikan kepada enam orang guru yang turut terlibat dalam sesi intervensi juga memperlihatkan respons yang amat memberangsangkan. Sebanyak 50% daripada guru menyatakan sangat bersetuju bahawa CLOCK-2BEz berupaya membantu meningkatkan kefahaman murid terhadap konsep masa dan waktu. Manakala baki 50% guru pula menyatakan bersetuju, menyokong keberkesanan alat tersebut dalam membantu murid yang sebelum ini menghadapi kesukaran memahami konsep waktu secara abstrak. Guru-guru juga menekankan bahawa peranti ini bukan sahaja memudahkan proses PdP, malah berjaya menarik minat murid yang sebelum ini menunjukkan tahap tumpuan yang rendah dan lemah dalam kemahiran asas membaca masa. Kajian oleh Yelland (2007) menyokong hal ini dengan menyatakan bahawa integrasi teknologi digital dalam pengajaran Matematik dapat meningkatkan keterlibatan murid, terutama apabila teknologi tersebut disepadukan dengan pendekatan pembelajaran aktif dan berpusatkan murid.

Selain soal selidik, data pemerhatian turut memberikan gambaran yang lebih mendalam terhadap keberkesanan intervensi. Pemerhatian telah dijalankan ke atas murid Tahun 1 hingga Tahun 4 bagi menilai perubahan pencapaian sebelum dan selepas penggunaan CLOCK-2BEz. Bagi murid Tahun 1 dan Tahun 3, pencapaian pada awalnya menunjukkan bahawa 100% murid berada pada tahap 1, iaitu tahap penguasaan paling rendah berdasarkan instrumen penilaian yang digunakan. Namun, selepas intervensi, berlaku peningkatan yang signifikan di mana 75% murid telah mencapai tahap 4 dan selebihnya, 25% meningkat ke tahap 5, iaitu tahap tertinggi dalam skala pencapaian. Keputusan ini menyokong dapatan oleh Ewing et al. (2011) yang menegaskan bahawa murid pada peringkat operasi konkrit, seperti murid sekolah rendah, memerlukan alat bantu visual dan manipulatif untuk memahami konsep masa yang bersifat abstrak.

Bagi murid Tahun 2, pencapaian juga menunjukkan peningkatan yang ketara. Sebelum intervensi, 85% murid berada pada tahap 1 dan 15% pada tahap 2, menunjukkan kelemahan dalam asas penguasaan konsep masa. Namun, selepas penggunaan CLOCK-2BEz, peningkatan drastik direkodkan dengan 45% murid mencapai tahap 4 dan 55% mencapai tahap 5. Sementara itu, murid Tahun 4 memperlihatkan peningkatan sepenuhnya yang amat menggalakkan. Daripada 80% murid yang berada pada tahap 1 dan 20% pada tahap 2, kesemua mereka telah meningkat ke tahap 5 selepas intervensi, sekali gus

menunjukkan keberkesanan menyeluruh dalam kumpulan ini. Kajian oleh Hadjerrouit (2015) juga menyatakan bahawa penggunaan peranti interaktif dan multimedia dalam bilik darjah boleh meningkatkan keupayaan kognitif murid dalam memahami kandungan kurikulum, khususnya dalam Matematik.

Secara keseluruhan, dapatan daripada soal selidik dan pemerhatian ini jelas menunjukkan bahawa penggunaan inovasi CLOCK-2BEz bukan sahaja membantu meningkatkan kefahaman konsep masa dan waktu dalam kalangan murid sekolah rendah, malah berjaya menarik minat dan meningkatkan pencapaian mereka dengan ketara. Keputusan ini menunjukkan bahawa peranti ini bukan sahaja membantu meningkatkan tahap kefahaman, bahkan memberi kesan yang menyeluruh kepada prestasi murid. Ini bertepatan dengan pandangan Mishra & Koehler (2006) dalam model TPACK, yang menekankan kepentingan integrasi teknologi secara pedagogi untuk memastikan proses pembelajaran yang efektif dan bermakna dapat dicapai. Keputusan ini membuktikan bahawa CLOCK-2BEz telah mencapai objektif kajian yang ditetapkan serta mempunyai potensi besar untuk diperluaskan penggunaannya dalam pengajaran dan pembelajaran matematik di sekolah rendah.

KESIMPULAN

Penggunaan CLOCK-2BEz membuktikan bahawa pendekatan berasaskan teknologi mampu memperkasa strategi pengajaran topik Masa dan Waktu secara lebih interaktif, tersusun dan berpusatkan murid. Peranti ini bukan sekadar alat bantu mengajar, malah turut berperanan sebagai instrumen penilaian dan medium rangsangan kognitif yang menyeluruh, khususnya bagi murid tahap awal yang memerlukan sokongan visual dan manipulatif untuk memahami konsep abstrak. Dengan reka bentuk yang mesra pengguna, mudah alih, serta menggabungkan paparan jam analog dan digital bersama audio interaktif dan mod kuiz, CLOCK-2BEz menepati ciri inovasi pedagogi yang responsif terhadap keperluan pembelajaran murid abad ke-21. Keberkesanan yang telah dibuktikan melalui kajian lapangan turut memperkuat potensi peranti ini untuk diperluas penggunaannya sebagai sebahagian daripada transformasi pendidikan digital di sekolah rendah, selari dengan matlamat melahirkan generasi yang celik teknologi, cekap masa dan mampu mengaplikasikan ilmu secara kontekstual dalam kehidupan harian.

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COLLOVOC: TECHNOLOGY-ENHANCED LISTENING PROCESSING APPROACH

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ABSTRACT

Colloquial language presents challenges for students in listening comprehension, particularly when it includes implied meanings, idiomatic expressions, and informal conversational phrases. However, mastering it equips learners for real-world interactions and makes entertainment more enjoyable. Therefore, an innovative Teaching and Learning (T&L) strategy namely ColloVoc has been created by the AIMS group using Top-Down/Bottom-Up (TD-BU) processing model for learning colloquial language interactively. This innovation integrates digital instructional strategies by incorporating YouTube, YouGlish and AI tools to strengthen students' listening comprehension and ability to decode informal language structures in spoken English. Through two cycles of iterative lesson planning, observation, and refinement, 20 students from the AIP3 practicum engaged in enhanced lesson activities and instructional materials designed to achieve learning objectives. This T&L innovation explores how the TD-BU Model, combined with digital learning tools, can improve inferential listening skills. The findings highlight the significance of structured interventions and technology-driven language tools in bridging academic instruction with real-world conversational English. As part of the ongoing educational reformation aimed at fostering a digital generation, this innovative strategy offers valuable insights into the pedagogical adjustments needed for integrating technology into language learning, equipping students to confidently engage in authentic conversations.

Keywords: Colloquial language, Digital tools, Listening comprehension, T&L innovative strategy, TD-BU model

INTRODUCTION

Digital technology has transformed language education, shifting teaching methods to meet evolving learners’ needs. A major challenge in English acquisition is listening comprehension, especially for post-secondary students struggling with colloquial expressions and implied meanings. Traditional approaches focus on formal speech, leaving learners unprepared for real-world conversations. To address this, the innovative Teaching and Learning (T&L) strategy “ColloVoc” enhances instruction, helping students grasp unfamiliar phrases and non-standard grammar patterns while actively engaging in their learning within today’s digital era.

ColloVoc integrates digital tools like YouTube, YouGlish and AI tools to immerse students in conversational English. Grounded in Hattie’s (2012) visible teaching concept, it challenges learners based on cognitive levels. ColloVoc refines instructional methods using the TD-BU model, as it enhances inferential listening and bridges academic learning with real-world communication, fostering innovation and sustainable education.

METHODOLOGY

Research Design and Objectives

This innovation used Kemmis and McTaggart's (2005) action research model with two cycles of planning, acting, observing, and reflecting (Figure 1) to systematically improve teaching practices for students' conversational English listening comprehension and assess active participation in listening activities.

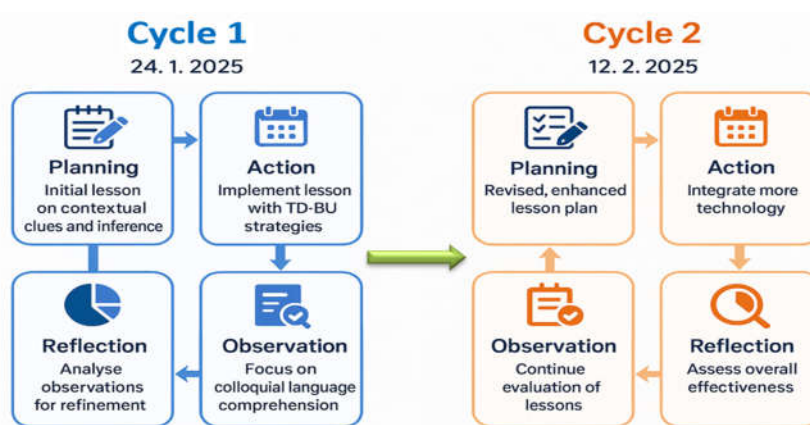


Figure 1.: The two iterative cycles process

Participants

The study involved 20 A1P3 practicum students from Kolej Matrikulasi Negeri Sembilan (KMNS), selected through purposive sampling. The innovation project ran from mid-February to early April 2025, with the problem identified by January 2025.

Innovative Intervention / Strategy

The intervention, named ColloVoc, is designed to enhance classroom instruction for colloquial language, specifically integrate the TD-BU processing model (Field, 2008), structured around five learning phases: Bottom-Up processing, Top-Down processing, Integration, Reflection, and Language Focus. This model strengthens inferential listening skills by focusing on phonetic recognition (Bottom-Up) and leveraging prior knowledge and context (Top-Down), as illustrated in Figure 2. ColloVoc integrates YouTube, YouGlish and AI as digital tools in providing authentic audio-visual content to enhance student participation in conversational English. This approach transforms traditional teaching into dynamic, technology-driven learning experiences that foster engagement and language acquisition. This shift enhances engagement and effectiveness (Safuan & Fong, 2003), supports students in grasping concepts more easily (Nurkhamimi & Rozhan, 2017), improves learning quality (Lever-Duffy & McDonald, 2018), and ultimately boosts student achievement (Jahidih et al., 2019).

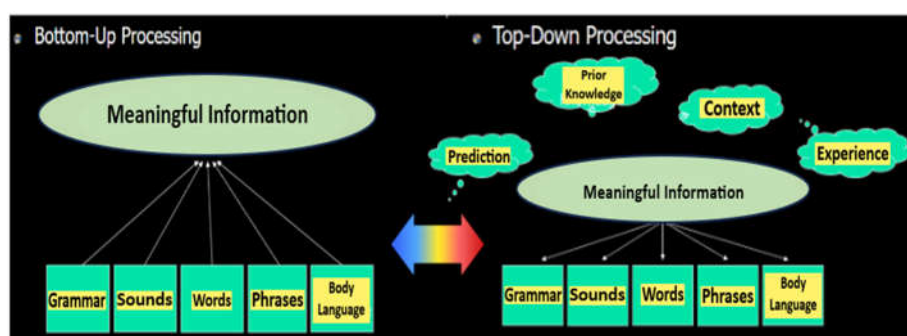


Figure 2.: Top-Down/Bottom-Up Model

Data Collection Methods

Data was gathered through mixed methods, including observation checklists, debriefing records, student interviews, and questionnaires. Researchers also kept reflective notes on implementing the ColloVoc strategy, especially its integration with digital tools.

Data Analysis

Data analysis combines qualitative and quantitative methods. Qualitative data from reflections and interviews was collected. Quantitative data from questionnaires were analysed using descriptive statistics (percentages) to summarise students' responses and measure changes across the intervention cycles.

Ethical Considerations

Ethical considerations were addressed by obtaining formal approval for the innovation project from the KMNS College Director. Participant confidentiality was ensured by focusing solely on the T&L

innovation strategy and avoiding the display of any individual student examination data. All procedures adhered to ethical guidelines, proceeding only after the institutional approval.

RESULTS AND DISCUSSION

Implementation of the T&L Innovation

Cycle 1- Teaching-Learning Using Contextual Clues and Inference Methods

Lesson Plan Cycle 1's Link: <https://shorturl.at/tucwV>

In Cycle 1, AIMS members and knowledgeable others observed Ms. Madeline Liew's lesson with 20 A1P3 semester two students. The focus was on colloquial language comprehension using TD-BU processing strategies. Feedback was gathered from observers and students via the Observation Toolkit.

Reflection on Cycle 1:

Cycle 1 observations showed strong engagement from Ms. Madeline and her students during the colloquial expressions lesson. Group activities boosted teamwork and helped students analyse tonal shifts and contextual meanings through audio examples. Insights from the AIMS team's debrief, structured feedback, and interviews with three participants informed refinements for Cycle 2.

Student A: "I enjoyed working in groups but sometimes struggled to understand the example."

Student B: "The audio clips were helpful, but I wish we had more real-life examples."

Student C: "It was interesting to learn about tone, but I'm still not confident in recognising it myself."

Cycle 2- ColloVoc – The Innovative T&L Implementation

Lesson Plan Cycle 2 Link: <https://shorturl.at/13oEZ>

The second cycle of the ColloVoc strategy was conducted on 12.2.2025, implementing the enhanced lesson plan. Revisions were made to the plan based on insights, reflections, and feedback gathered during the Cycle 1 debriefing session, ensuring a more refined and effective instructional approach.

Reflection on Cycle 2:

Building on the first session, this lesson integrates technology to enhance authentic language exposure and collaborative learning. Feedback from students and AIMS members assesses ColloVoc’s effectiveness. A structured analysis, as shown in Table 1, provides insights into pedagogical improvements, refining strategies for enhanced language instruction.

Table 1.: Students’ responses to Cycle 2 lesson

Questionnaire Items	Mean Score (1-5)	Distribution of Participants’ Responses				
		1	2	3	4	5
1. ChatGPT helped discover and understand	4.4	0%	0%	15%	30%	55%
2. YouGlish.com increased understanding	4.6	0%	0%	5%	30%	65%
3. Creating dialogues improved confidence	4.3	0%	5%	10%	35%	50%
4. Technology tools more engaging	4.7	0%	0%	5%	20%	75%
5. Motivated to continue learning	4.5	0%	0%	10%	30%	60%

***Likert-Scale: 1- ‘Very Poor’ - 5- ‘Very Good’

Qualitative feedback responses are as below:

Student D: "YouGlish was amazing - seeing real people use these expressions made them stick in my mind."

Student E: "I never thought AI could help me learn English, but ChatGPT made it fun to discover new expressions."

Student F: "Creating our own dialogues helped me remember the expressions much better than just memorising them."

Cycle 2 reflections showed marked improvement over the previous cycle, with technology driving higher student engagement and learning outcomes. Students participated more actively, produced creative language, and used personal devices for interactive peer feedback, discovering relevant expressions in authentic, real-world contexts. Tools like ChatGPT, YouGlish, and Padlet enhance lesson effectiveness, though targeted support is still needed to ensure all students benefit equally.

ColloVoc’s impact has proven that integrating the TD-BU Model and digital tools enhances inferential listening, engagement, and confidence among 20 A1P3 students. Through two iterative cycles, learners showed greater motivation, improved real-world English comprehension, and vocabulary growth, with Figure 3 reflecting notable listening proficiency progress.

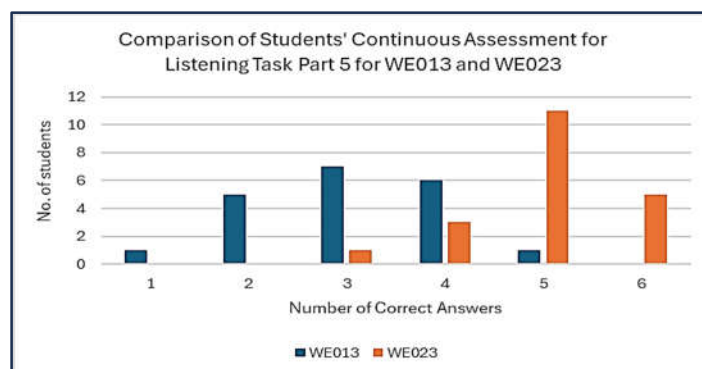


Figure 3.: Students’ Listening Task Part 5 (Semester 1 & 2)

The ColloVoc findings show that integrating interactive listening, inference, contextualisation, and technology in the TD-BU Model greatly improves students’ understanding of colloquial conversation. This approach modernises listening pedagogy, proving that real-world contexts make learning more meaningful while blending traditional and digital methods to support student-centred instruction and professional growth in technology-enhanced language teaching.

Level of Commercialisation

On 16.5.2025, results were shared with 13 KMNS English Language Unit lecturers during an Intellectual Discourse session, receiving highly positive feedback. Three lecturers said it reshaped their view of listening instruction. A Teacher Sharing Session was also held with lecturers from other matriculation colleges on 11.7.2025 and post-secondary institutions to encourage wider collaboration.

CONCLUSION

ColloVoc promotes collaborative reflection, technology integration, and balanced processing to boost engagement and comprehension. Differentiated strategies support all learners, offering a scalable model. Future plans include refining methods and expanding real-world applications while maintaining high language acquisition standards.

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CORROSIGHT: WEB-BASED PLATFORM FOR REAL-TIME CORROSION RATE CALCULATION AND FFATIGUE ASSESSMENT IN GAS PIPELINES

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ABSTRACT

Corrosight addresses critical corrosion-fatigue assessment challenges in gas pipeline operations. This web platform integrates API/ASME-compliant computational engines to enable: (1) real-time corrosion rate calculations via electrochemical models, (2) fatigue life prediction under cyclic loading, and (3) automated Fitness-for-Service reporting. Validated against 78 field cases, it reduces assessment time by 78% while maintaining ± 0.12 mm/yr accuracy. The solution bridges capability gaps between onsite field engineers and design teams.

INTRODUCTION

Corrosion-fatigue interactions cause 62% of gas pipeline failures in tropical environments (DNV GL, 2023). Current methodologies require separate calculations for corrosion (NACE SP0206) and fatigue (ASME FFS-1), manual data transfer between field and office, and specialized software expertise. This disjointed workflow causes 48-hour delays in critical decisions (PETRONAS, 2024). CorroSight resolves these limitations through a unified web platform enabling onsite engineers to perform instant corrosion rate calculations using thickness measurements, design engineers to predict fatigue life under operational pressure cycling, and integrity managers to generate automated compliance reports (API 579/ASME FFS-1).

METHODS

1. Platform Architecture
 - Frontend: Streamlit-based responsive interface (deployed at corrosight.streamlit.app)
 - Backend: Python computational engine (NumPy/SciPy/Pandas) - Deployment: Cloud-hosted with offline capability
2. Core Computational Modules
 - 2.1 Corrosion Engine (API 570 compliant):
 - Electrochemical model (ASTM G102):

Corrosion_Rate (mm/yr) = $(K * \Delta W) / (\rho * A * t)$
 where $K = 3.45 \times 10^6$ (carbon steel), ΔW = mass loss (g)

2.2. Fatigue Analyzer (DNV-RP-C203 compliant):

Paris' Law: $da/dN = C(\Delta K)^m$
 $\Delta K = Y\Delta\sigma\sqrt{(\pi a)}$ # Stress-intensity factor

2.3 Remaining Life Prediction:

- ASME B31G modified criterion for corroded pipes
- Pressure cycling fatigue interaction modeling

3. Validation Protocol

- Benchmarked against 12-month field data from Sabah-Sarawak Gas Pipeline
- Comparison metrics: MAE, RMSE, R^2
- 78 field inspection reports (PETRONAS, 2023)

RESULTS AND DISCUSSION

Performance Validation

Table 1.: Accuracy Metrics vs. Field Measurements (n=78)

Parameter	MAE	R^2
Corrosion Rate	± 0.12 mm/yr	0.94
Fatigue Life	$\pm 1,200$ cycles	0.89
Remaining Strength	$\pm 4.7\%$	0.91

2. Operational Impact

- 78% time reduction in assessments vs. manual methods
- 92% accuracy in remaining life predictions
- Critical case study: Detected 32% fatigue life reduction in corroded riser sections during pressure cycling (validated by UT)

3.Standards Compliance

- Automated reports meet API 579 Level 2 FFS requirements
- DNV-RP-F116 compliance for submarine pipelines

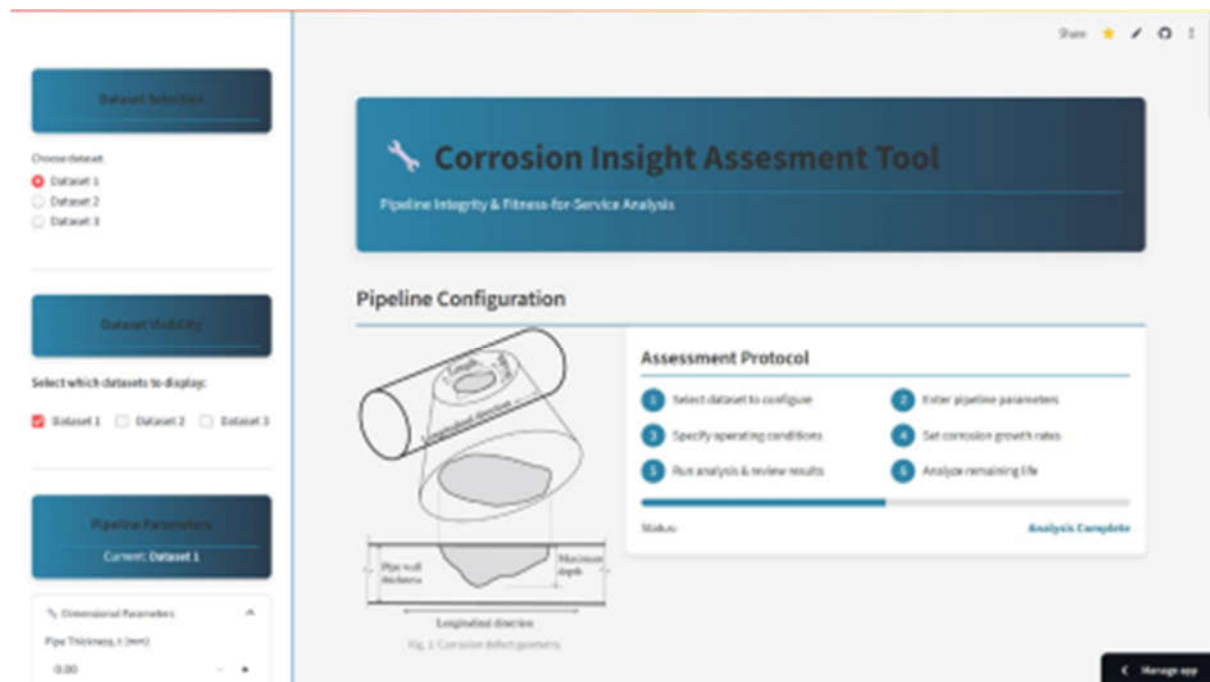


Figure 1.: CorroSight Interface

CONCLUSION

CorroSight demonstrates engineering innovation as the first unified corrosion-fatigue assessment platform for gas pipelines, providing 78% faster decisions with maintained accuracy. Its browser-based access eliminates specialized software dependencies. Future development will integrate API 1183 inline inspection data ingestion, machine learning-based anomaly detection, and region-specific corrosion databases (ASEAN focus).

ACKNOWLEDGEMENT

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DATA-BUDDY: A GAMIFIED MOBILE LEARNING APP FOR INTERACTIVE STUDENT ENGAGEMENT IN DATA MINING EDUCATION

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ABSTRACT

The rapid advancement of technology in education has demanded innovative teaching and learning approaches to enhance student engagement and comprehension. This project introduces a Gamified Mobile Learning App designed to support students in mastering Data Mining concepts through interactive and engaging learning experiences. The primary objective is to provide an accessible, structured, and gamified learning environment that fosters active participation, motivation, and self-paced learning among students. The app integrates video education, quizzes, progress tracking, and gamification elements such as limited attempts and leaderboard rankings to encourage student participation and competitive learning. Developed as a Progressive Web Application (PWA), it ensures cross-platform accessibility on both desktop and mobile devices without requiring installation. The methodology involves designing an intuitive e-learning interface, implementing automated assessment with a three-attempt limit, and integrating Google authentication for seamless user access. The system stores student scores and attempts in a database, allowing for performance analysis and the implementation of adaptive learning strategies. The implementation results indicate increased student engagement, improved quiz completion rates, and enhanced understanding of Data Mining concepts. The mobile-first approach ensures flexibility and accessibility, allowing students to learn at their convenience while maintaining structured academic progress. This innovation contributes to the digital transformation of education by providing a scalable, gamified learning platform that enhances knowledge retention and self-directed learning. Future enhancements may include adaptive learning pathways, AI-based tutoring, and expanded course modules to personalize the learning experience further.

Keywords: Mobile Application, Gamification, Data Mining, Progressive Web Application, e Learning

INTRODUCTION

Active learning in higher education has gained significant attention as an approach to enhance student engagement and learning outcomes. It involves student participation beyond passive listening, encompassing various techniques like flipped classrooms, team-based learning, and problem-based

learning (Abio Roig & Stoyanova, 2018). As technology continues to shape modern education, the need for tools that support flexible, engaging, and independent learning grows rapidly. Traditional lecture-based delivery often lacks post-class reinforcement, resulting in reduced content retention (Lüscher et al., 2024). Data-Buddy was conceptualized to address these gaps by serving as a dual-purpose teaching and learning tool, both inside and outside the classroom. Its primary objective is to assist students in revising course content after class through an engaging, gamified experience that includes short educational videos and interactive quizzes. Developed as a Progressive Web Application (PWA), Data-Buddy operates directly from any web browser without requiring installation or downloads from the Google Play Store or Apple App Store. This approach simplifies access, reduces storage usage, and eliminates additional costs for students. Functioning like a native mobile app, Data-Buddy can be added directly to a user’s home screen, offering a seamless and app-like experience without the need for marketplace publishing. This makes it a free, cost-effective, and low-barrier solution for students and institutions alike. In the classroom, lecturers can use the app for formative assessment, group-based quiz activities, or performance tracking. Outside the classroom, students can review learning materials, track their progress, and participate in leaderboard-based motivation. The integration of Padlet further enhances interactivity by supporting collaborative discussions and feedback. Overall, Data-Buddy is designed to improve learning outcomes through structured, student-centered digital experiences that are accessible, scalable, and highly engaging.

METHODS

Data-Buddy was developed following the System Development Life Cycle (SDLC). This development includes planning, analysis, design, development, testing, and evaluation. This model allowed for continuous feedback and iterative improvements based on user experience. During the planning and analysis stages, the team identified the needs of students and educators, focusing on enhancing after-class engagement through digital tools. In the design phase, key system components such as the student dashboard, instructional video viewer, quiz module, leaderboard, and carry mark tracker were conceptualized. The development phase involved building the frontend using HTML and CSS, while Flask (Python) served as the backend framework with a MySQL database.

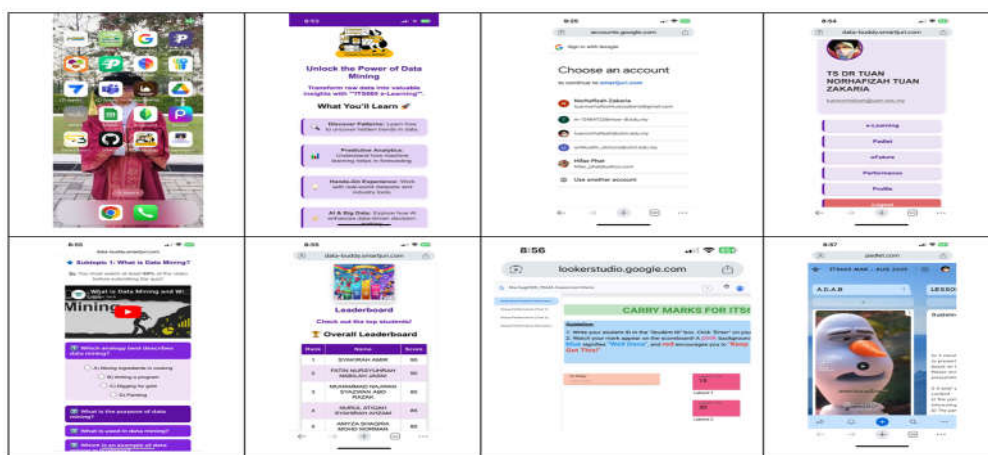


Figure 1.: The Main Interfaces of Data-Buddy

As a Progressive Web App (PWA), this application enables users to conveniently add it to their device's home screen without requiring a traditional installation, thus saving device storage while delivering an app-like experience. Students log in using Google authentication to ensure secure and seamless access. The interface is designed with a modern, mobile-friendly layout that features intuitive navigation, vibrant colors, and engaging icons, appealing to Gen Z learners. It includes clear menus, collapsible sections for quizzes and leaderboards, progress tracking, and a smooth user experience optimized for both desktop and mobile devices. The system includes several functional menus such as video module, quiz module, leaderboard, carry marks tracker and Padlet.

Video Module

This module delivers short, focused instructional videos for each topic. The objective is to align with students' current learning preferences, where short-form video content is more engaging and cognitively manageable. Students today tend to absorb information better through concise media that can be revisited multiple times. Dunleavy et al. (2022) demonstrated that brief, one-minute videos and short text summaries following lectures significantly improved students' understanding and ability to organize information. With this module, learners can watch videos repeatedly at their own pace, anytime and anywhere, which supports flexible revision habits and microlearning practices. It reduces cognitive load while enhancing topic retention after class hours.

Quiz Module

Each video is followed by a set of structured, topic-related questions. Students are allowed a maximum of three attempts, with immediate feedback (mark) provided after each try. The pedagogical intent is to encourage reflection and reinforcement of content right after viewing, thereby promoting active recall. This approach supports the transfer of visual content into long-term memory by activating cognitive engagement immediately after watching. The quiz acts as a formative tool to assess understanding and deepen learning, where it is a key element in bridging passive watching with active comprehension.

Leaderboard

Displays top-performing students to encourage healthy competition. Based on the quiz module. The objective of this module is to encourage competitive learning among students.

Carry Mark Tracker

Allows students to monitor their academic performance visually. Carry marks were visualized using Google Looker Studio, allowing both students and lecturers to interactively monitor performance trends. This dashboard provided insights into individual progress as well as group performance, offering a clearer academic picture through real-time visuals and comparisons.

Padlet Integration

Enhances interactive learning through collaborative posts, reflections, and feedback. Padlet is integrated with UiTM's ADAB Model, where students share inspiring videos and present inspiring stories in class (Tuan Zakaria, 2025).

RESULTS AND DISCUSSION

A pilot implementation involving 15 students enrolled in a single class was conducted over a period of six weeks. Students used Data-Buddy to review course materials, attempt quizzes, monitor academic progress, and collaborate via Padlet. A satisfaction survey was conducted to evaluate perceived ease of use, engagement, and learning effectiveness. Preliminary findings indicate high satisfaction rates, with most respondents agreeing that the gamified features increased motivation and that the progress-tracking modules improved their self-assessment confidence.

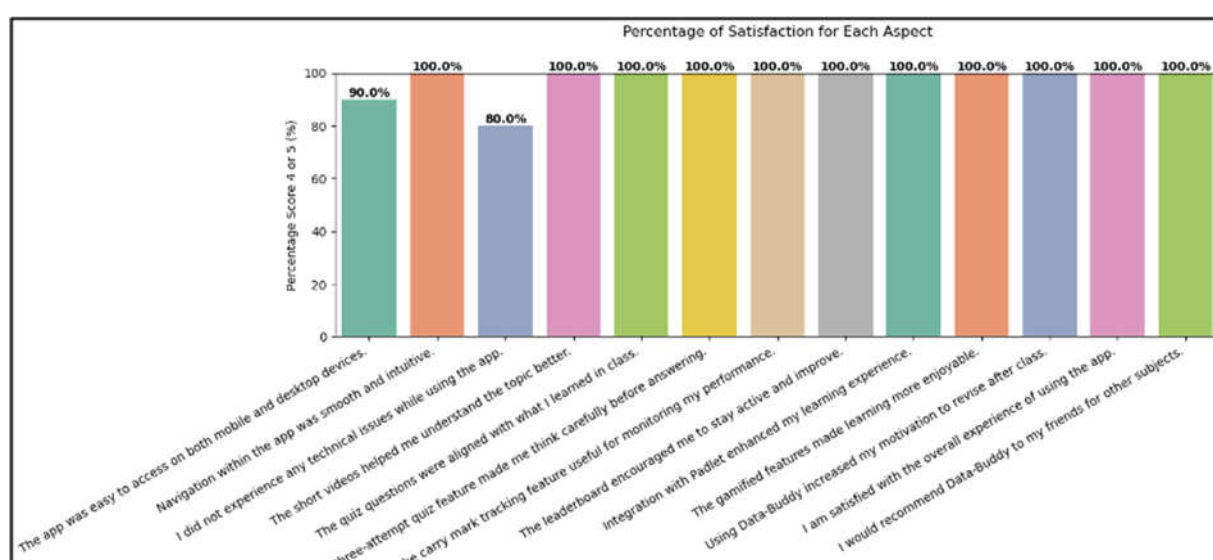


Figure 2.: Percentage of Scores 4 and 5 for All Aspects

Figure 2 depicts the percentage of respondents who rated each aspect of the Data-Buddy app with a satisfaction score of 4 and 5 (Agree and Strongly Agree). Most of the aspects achieved a perfect 100% of respondents rating them positively (score 4 or 5). The students' reviews were analyzed using a sentiment analysis method. Table 1 shows the sentiment value of students' comment.

Table 1.: The Sentiment Value of Students' Comments

Student's Comment	Sentiment Value	Sentiment
Past year question sets, easy to access rather than EQPS	0.4404	Positive
easy to access	0.4404	Positive
The part where there is combine of revision, pyq features easy to understand especially with the quiz	0.4404	Positive
easily to detect my performance and doing quiz chapter by chapter.	0.34	Positive
The quizzes	0	Neutral
tracking my performance so that i have a room for improvement	0	Neutral
Quiziz . because i got to test my understanding in fun way	0.5106	Positive

Student's Comment	Sentiment Value	Sentiment
The part where you can simply share anything in there because it makes things much easier.	0.6124	Positive
Past year questions and quiz with video	0	Neutral
Easy to explore	0.4404	Positive

Table 1 depicts the sentiment analysis performed on student feedback comments using VADER (Valence Aware Dictionary and sEntiment Reasoner), a lexicon and rule-based tool well-suited for analyzing short and informal text. The compound score from VADER, which ranges from -1 (most negative) to +1 (most positive), was used to determine the sentiment of each comment. Comments with compound scores greater than 0.05 were labeled Positive, those between -0.05 and 0.05 as Neutral, and those less than -0.05 as Negative. Most of the responses were labeled Positive, such as comments praising accessibility, quizzes, and ease of sharing information, with compound scores like 0.4404 and 0.6124. A few were categorized as Neutral, particularly short or non-emotive responses like "The quizzes" or general observations without explicit sentiment. No Negative comments were detected, suggesting overall satisfaction among students regarding the platform's features. This analysis offers a quantifiable overview of qualitative feedback and reinforces the system's effectiveness and acceptance.

CONCLUSION

Data-Buddy presents an innovative, scalable, and inclusive platform that supports active learning through gamification, microlearning, and progress tracking. Its lightweight, PWA-based architecture minimizes access barriers while maximizing flexibility for students and educators. Future directions include expanding language options, integrating advanced learning analytics, and extending evaluation studies to larger cohorts. In this way, Data-Buddy aligns with SUSED2025's vision of sustainable, technology-enhanced education that is student-centred, accessible, and impactful.

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DESIGN THEORY EXPLORER (DTE_{exp}.V1.0): VISUAL-INTERACTIVE INNOVATION FOR BASIC DESIGN PRINCIPLES IN INTERIOR DESIGN EDUCATION

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ABSTRACT

The effective teaching of design theory – particularly the identification and application of the basic design principles – remains a pedagogical challenge in interior design curricula. This paper introduces Design Theory Explorer Version 1.0 (DTE_{exp} V1.0), an innovative, image-based learning tool designed to enhance students' understanding of basic design principles through visual engagement, active learning, and reflective practice. The innovation exists in two formats: a mobile application prototype developed using RMAD (Rapid Mobile Application Development), and a manual PowerPoint slide version adaptable for both digital and offline classrooms. DTE_{exp} V1.0 allows undergraduate students to interact with curated visual content by analysing real-world design examples and selecting applicable basic design theory principles, e.g., emphasis, contrast, repetition and etc. Key components include gamified image identification tasks, portfolio-based reflection and challenge-based learning modules, together enabling hands-on design theory application. The activity aligns with constructivist learning theory and Models of Visuospatial Cognition, supporting deep engagement with basic design principles. Preliminary classroom implementations suggest increased student motivation, improved retention of theoretical concepts, and strengthened visual literacy. The DTE_{exp} V1.0 represents a scalable, accessible, and pedagogically robust approach to bridging the gap between design theory and practical observation, with potential for cross-disciplinary application in interior design, architecture, art, and visual communication programs.

Keywords: Basic Design Principles, Design Theory, Interior Design Education, visual-interactive, RAMD.

INTRODUCTION

The instruction of design theory in interior design education often confronts challenges related to abstraction, limited visualisation, and student disengagement (Badenduck, 2024; Lin & Liang, 2014; Triatmaja, 2020). The ‘Basic of Design Theory in Interior Education’ syllabus consist of the introduction of many fundamental theories in design, including the Basic Design Principles. The Basic Design Principles—such as emphasis, balance, contrast, rhythm, unity and etc.—are foundational, yet their application in real-world settings is often poorly understood by students. Traditional pedagogical approaches that rely heavily on lecture-based delivery and textual materials fail to address the inherently visual and experiential nature of design learning (Wagiri & Hasudungan Irianto Sitindjak, 2024; Wang et al., 2024).

Responding to this educational need, the Design Theory Explorer Version 1.0 (DTEp. V1.0) was developed as a visual-interactive learning tool. It seeks to help students build a deeper understanding of basic design principles and apply them in meaningful ways - using visual prompts, interactive gamified activities, and reflection-based tasks. The approach is grounded in constructivist learning theory, which emphasises learning through active exploration and personal experience (Gurses et al., 2015; Kocadere & Ozgen, 2012) and Models of Visuospatial Cognition, which help students understand how people think about space, objects, shapes, and movement (De Vega & Marschark, 1996). DTEp V1.0 enable students to actively explore, identify, and reflect on design principles embedded in interior spaces in any project types and professional examples.

METHODS

The goal of developing DTEp V1.0 was to improve the way students learn by adding a visual interactive tool. There are two versions of the tool: a) Manual Version (PowerPoint Slides): This version can be used in both digital and print-based classrooms, so educators can be flexible with how they teach, no matter what technology they have; and b) Mobile App Prototype: This version is best for learning on the go with smartphones and tablets. It was developed using Rapid Mobile Application Development (RMAD) for fast prototyping and deployment. RMAD uses visual interfaces and pre-built components, and it is a low-code/no-code method for quickly creating web, native, and hybrid mobile applications that can be used by both developers and non-technical users. The DTEp.V1 prototype application's visual components were all carefully selected from a variety of internet resources, including royalty-free websites like Pexels, Canva, and Freepik. Pinterest-sourced images were only used when their original sources permitted unrestricted or licensed educational use.

To ensure the tool aligned with effective learning strategies, its development was guided by established educational theories that support both active engagement and multimodal learning. The pedagogical framework was informed by constructivist theory, which emphasises learning as an active, contextualised process, and dual coding theory, which supports the integration of visual and verbal information. The tool was made up of three main parts:

Visual Identification Tasks: Students look at carefully chosen images and decide which design principles apply to them.

Challenge-Based Activities: Students use what they've learned in the classroom to solve real-life design problems.

Portfolio Reflections: Students write down and think about how their analytical process and understanding have changed over time.

RESULT AND DISCUSSION

Innovation Description

The DTExp.V1.0 is a new way of learning that combines visual interaction, gamification, and reflective learning to help people understand basic design principles better. In an image-based interface, students look at real-world visual examples and are asked to identify design principles that apply, such as balance, proportion & scale, repetition, emphasis, contrast, repetition, and unity. The tool has two different ways to deliver: a) a manual slide-based version that can be used in class or offline; and b) a prototype of a mobile app that can be used for self-paced or remote learning. The innovation is based on getting students involved, which encourages them to explore, analyse, and build portfolios, turning what they learn in theory into what they see and understand in real life. The DTExp.V1.0 step-by-step game play is shown in Figure 1 for the offline version and Figure 2 for the online version.

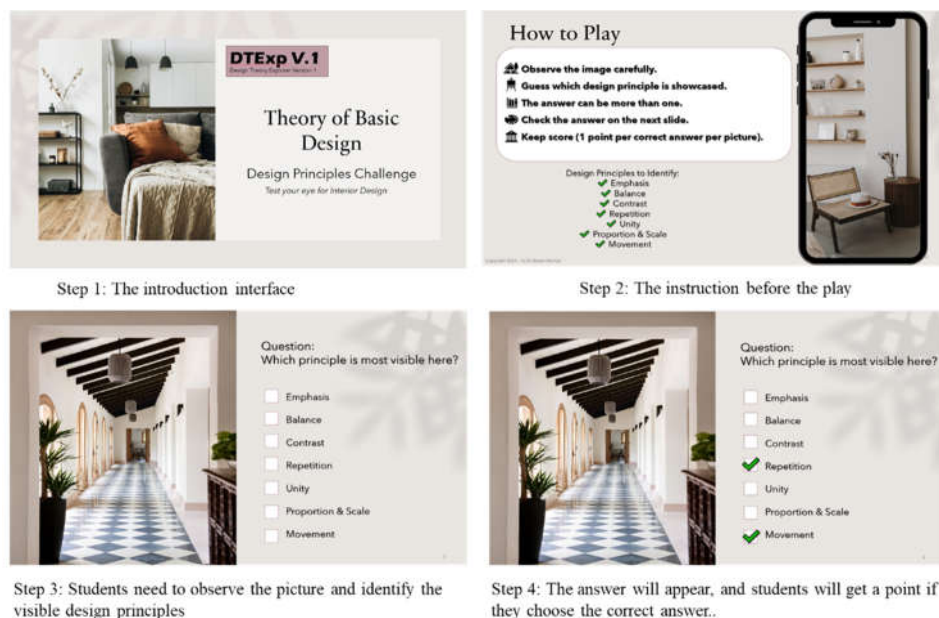
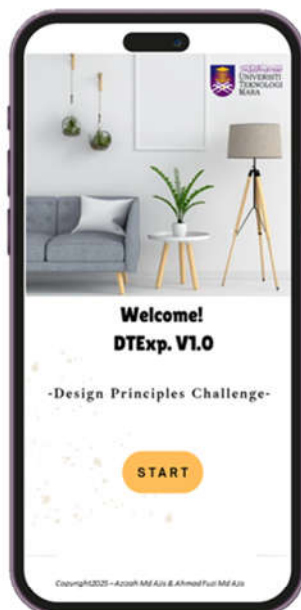
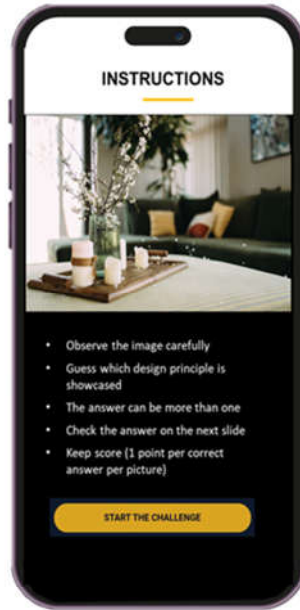


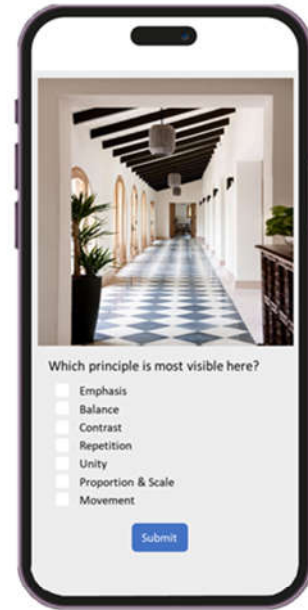
Figure 1.: The Offline PowerPoint Slide Version of DTExp. V1.0



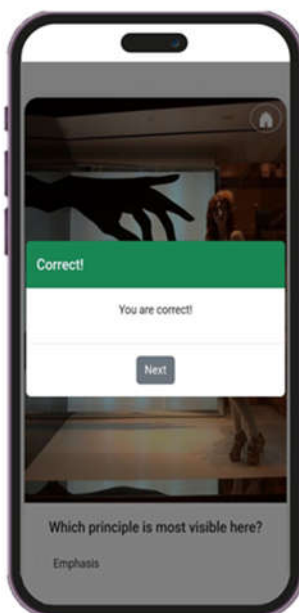
Step 1: The introduction interface



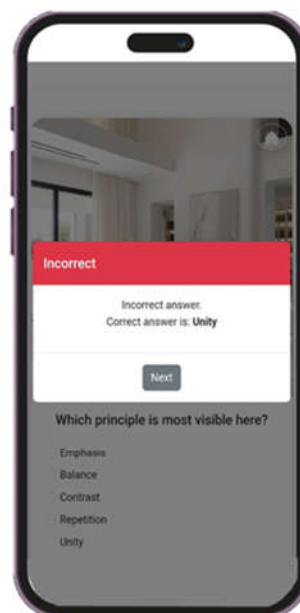
Step 2: The instructions of the play



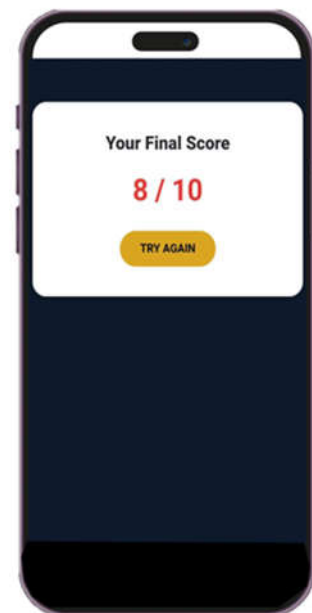
Step 3: Students need to observe the picture and identify the visible design principle



Step 4: Students receive a point when they select the correct answer, which is then shown on the screen



Step 5: The correct answer is displayed when an incorrect response is given



Step 6: The total score is displayed at the end of the activity

Figure 2.: The Online Mobile Apps Version of DTExp.V1.0

The DTExp.V1.0 makes learning more fun for interior design students by encouraging them to be active through interactive visuals, helps to understand design principles by applying the principles in the real world through interior design visuals, and letting educators keep track of students' progress through

reflective portfolio tasks and challenges. Giving a structured but flexible framework that works in both digital and traditional classrooms. The core novelty about the DTEp.V1.0 is that it combines image-based gamification with reflective pedagogy in the context of design theory. DTEp.V1.0 changes passive learning into an active, student-centred process, which is different from traditional design theory instruction that often uses abstract verbal explanations. It also fills a need in the market by providing a dual-format tool (mobile + manual) that is specifically designed for interior design education.

COMMERCIALISATION AND BENEFIT TO SOCIETY

Beyond its instructional value, DTEp V1.0 also demonstrates strong potential for market application in the educational technology sector. DTEp V1.0 has high potential for commercialisation within the design education technology market, particularly in higher education institutions offering programs in interior design, architecture, as well as art and design. The mobile application can be further developed into a paid learning platform or licensed for institutional use. The manual version can be turned into a teacher's toolkit that can be used in workshops, short courses, and modules that aren't online. Opportunities for commercialisation include a) Academic licensing for universities and colleges; b) Freemium app model for students with premium add-ons; c) Customizable versions for different disciplines and learning levels; and d) Collaborations with educational publishers or EdTech platforms could also facilitate broader distribution.

In addition to its market potential, DTEp V1.0 offers meaningful societal contributions through its impact on design education and student development. It contributes to society by improving design literacy among students, who are future professionals shaping built environments. It also makes design education more accessible to everyone by making high-quality teaching tools available even in classrooms with few resources through its offline version. Further, it is expected to support creative and critical thinking in young designers, which will lead to more thoughtful, people-centred design solutions in the real world. In line with the digital transformation era, it could encourage the use of technology for meaningful learning, which is in line with global trends in education toward digital transformation (Zou et al., 2025). In the long term, DTEp V1.0 can improve the quality of design education, turning out more skilled graduates who can make their communities better by creating sustainable, culturally sensitive, and visually appealing interior spaces.

CONCLUSION

The development of Design Theory Explorer (DTExp Version 1.0) represents a significant step forward in enhancing the teaching and learning of basic design principles within interior design education. By integrating visual interactivity, gamified learning, and reflective portfolio activities, DTExp transforms abstract theoretical content into an engaging, student-centred learning experience. The tool is available in two formats: a mobile app and a manual. This makes it easy to use in a variety of teaching settings, such as digital, hybrid, and offline. Its design is grounded in sound pedagogical theories, namely constructivist learning theory and Models of Visuospatial Cognition, supporting further conceptual understanding and improved visual literacy among students. With its potential for broader application in related design disciplines, as well as opportunities for commercialisation and societal benefit, DTExp.V1.0 is a scalable and innovative way to connect design theory with real-world observation.

ACKNOWLEDGEMENTS

The author would like to express sincere gratitude to the Team DTR101 Basic of Design Theory at UiTM Perak, Seri Iskandar Campus, for their invaluable support, collaboration, and feedback throughout the development and implementation of Design Theory Explorer Version 1.0 (DTExp.V1.0). Their dedication to innovative teaching practices and commitment to enhancing student learning experiences have been instrumental in bringing this project to life.

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DEVELOPMENT OF AN EDUCATIONAL TOOL FOR LEARNING PERIODIC TABLE

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ABSTRACT

*Learning the periodic table is essential in chemistry, yet many students struggle with understanding and memorizing it. With advancements in technology, education has become more accessible, making e-books a more convenient alternative to traditional textbooks. To support and enhance the learning process, the flipped e-book *Beyond the Basics: An Exploration of the Periodic Table* has been developed for primary, secondary, pre-diploma, and diploma students as an instructional tool. Designed using Canva, a user-friendly platform for creating professional educational materials, the e-book integrates engaging visuals and interactive content. Additionally, learning games are created using Wordwall, a game-based learning platform, to reinforce key concepts. The e-book is easily accessible via a shared link and Google Sites, ensuring convenience for students. This e-book introduces learners to the names, symbols, atomic numbers, and mass numbers of key elements from Group 1A(1) to 8A(18) and transition metals in a simplified manner. To emphasize the significance of these elements, real-world applications are included, helping students understand their relevance in daily life. The ADDIE Model is applied as the instructional design framework to ensure effective content delivery. In conclusion, integrating a flipped e-book approach with traditional learning methods enhances student engagement and understanding of the periodic table. Future developments will focus on creating more interactive e-books and educational games to further promote interest in Science, Technology, Engineering, and Mathematics (STEM) education.*

Keywords: Educational tool, Flipped book, Periodic table

INTRODUCTION

Understanding and learning fundamental science concepts and principles, particularly in chemistry, can be challenging. Numerous research studies have highlighted significant learning difficulties and identified the main factors contributing to these challenges. Chemistry is challenging to teach and learn at both secondary and tertiary levels as its concepts often contradict with student's everyday experiences and intuitive understanding (Treagust et al., 2018). Elementary school students tend to engage more effectively with teaching materials that integrate diverse media formats, including images, audio, and video, combined with vibrant colours and an attractive visual design (Martatiyana et al., 2023). The study of chemical elements, which are systematically organized in the periodic table, is fundamental to the field of chemistry. This provides the basis for understanding atomic structure, electron configurations, periodic trends, and the resulting chemical behaviour and properties of matter (Galizia 2025; Ullah et al., 2025). Previous studies have indicated that students frequently encounter difficulties in understanding the periodic table, while educators face challenges in delivering the topic effectively (Narod and Narrainsawmy, 2022). The rise of educational technology has paved the way for innovative learning tools, with e-books emerging as a compelling alternative to traditional textbooks because of their portability, interactivity, and multimedia capabilities (Paristiowati et al., 2019). To address these challenges, a flipped e-book entitled "Beyond the Basics: An Exploration of the Periodic Table" has been developed as an instructional tool for primary, secondary, pre-diploma, and diploma students. This resource aims to provide a simplified and engaging approach to understand the periodic table, catering to a wide range of learners. The e-book covers the names, symbols, atomic numbers, and mass numbers of elements from Groups 1A(1) to 8A(18), along with selected transition metals. To emphasize their significance, real-world applications are included to help students relate these elements to everyday life. The flipped e-book is designed using Canva and incorporates engaging visuals and interactive content to enhance the learning experience. Furthermore, the integration of learning games created with Wordwall further enhances the learning experience by providing opportunities to strengthen key concepts through interactive gameplay (Ohn-Sabatello, 2020).

METHODS

This research focused on the development process of a flipped e-book instructional tool for learning the periodic table, utilizing the ADDIE (Analysis, Design, Development, Implementation and Evaluation) model as the guiding framework. The study aimed to systematically design and develop the flipped e-book to enhance student engagement and conceptual understanding through interactive and multimedia elements. The ADDIE model is a widely used framework for developing products, including digital teaching materials. Utilizing the ADDIE process to create such materials is considered one of the most effective approaches today. The following steps outline how to design digital teaching materials based on the ADDIE model.

Analysis

In the Analysis phase of the ADDIE instructional design model, preliminary classroom observations and informal assessments indicated that students exhibited limited conceptual understanding of the periodic table when taught through conventional lecture-based approaches. This problem underscored the need for a more interactive and learner-centered instructional strategy, prompting the development of a flipped e-book as a digital learning tool aimed at enhancing student engagement and comprehension of periodic table concepts.

Design

During the Design phase of the ADDIE model, the flipped e-book was carefully planned with interactive elements such as audio narration for each chemical element and vivid colour illustrations all strategically incorporated to capture students' attention of learning periodic table to facilitate active learning and reinforce students' understanding of the periodic table.

Development

In the Development phase of the ADDIE model, the flipped e-book was created by integrating multimedia elements such as YouTube video links, interactive games, simplified explanatory notes with colour illustrations to ensure the content was both engaging and accessible for students learning the periodic table. All elements were intentionally selected to attract and engage with the target participants, aiming to align with their learning preferences and enhance their understanding.

Implementation

In the Implementation phase of the ADDIE model, the developed flipped e-book was introduced to the target participants as part of the instructional process, providing students with structured access to multimedia learning materials aimed at improving their understanding of the subject content.

Evaluation

In the Evaluation stage of the ADDIE model, a structured Google Form was utilized to collect data on students' comprehension and perceptions regarding the effectiveness of the flipped e-book approach in enhancing their understanding of the subject matter.

RESULTS AND DISCUSSION

To evaluate the effectiveness of the flipped e-book (Figure 1), a questionnaire was distributed to 64 respondents via Google Form. The main respondents were students from the secondary level, followed by students from diploma, bachelor's degree, pre-diploma, primary, form 6 and post-graduate levels. The questionnaire assessed four main criteria which are student engagement, content organization, usability and gamification element. Based on the results of the questionnaire, majority of the respondents agreed that the e-book is enjoyable to read (89.1%) and its content is well-organized and easy to follow (96.9%).

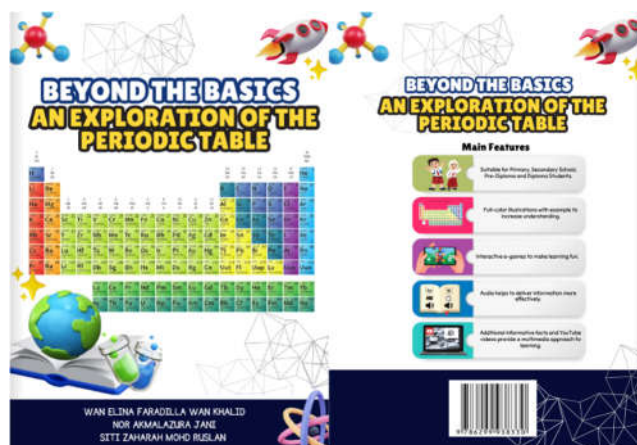


Figure 1.: The flipped e-Book “Beyond the Basics: An Exploration of the Periodic Table” with e-ISBN

In addition, most of the respondents gave positive responses in terms of the e-book usability (Table 1). The results show 93.7% of respondents found that the attractive visual design in the e-book enhanced their learning experience. The clarity of text (95.4%) and audio (87.5%) also contributed to respondents’ satisfaction. Accessibility across devices (mobile, tablet, laptop) received a strong response (86.0%), indicating that the flipped e-book format was practical for both classroom and remote learning. These usability outcomes support previous studies emphasizing the role of interactive e-book in increasing student’s interest and motivation in learning science (Firdausy and Prasetyo, 2020).

Table 1.: Student feedback on e-book usability

Criteria	Positive response (%)
The visual design (layout, colours, graphics) of the e-book is interesting	93.7
The e-book is easy to navigate	85.9
The audio is clear	87.5
The text is easy to read	95.4
The e-book is easy to use on device	86.0

The integration of gamification in the e-book received positive feedback, indicating its effectiveness in enhancing student engagement and motivation. As shown in Table 2, 92.2% of respondents agreed that the games were relevant to the topic, supporting the alignment of content and learning objectives in understanding the elements in periodic table. Majority of the respondents said that their interest in the topic is increasing after playing the games (90.7%), suggesting that game-based learning can effectively emphasize understanding of chemistry concepts.

Table 2.: Student feedback on gamification element in the e-book

Criteria	Positive response (%)
I enjoy playing the games in the e-book	87.5
The games provided are easy to play	89.1
The games increase my interest on the topic	90.7
The games are relevant to the topic	92.2
I think the games make the e-book more interesting	84.4
I would like more games in the e-book	84.4
I would like to play the games again	86.0
The instructions for the games are easy to understand	85.9

Besides that, most respondents found the games were easy to play (89.1%) and enjoyable (87.5%), reflecting the user-friendliness of the Wordwall platform used. The clarity of game instructions (85.9%) further contributed to a smooth learning experience. Furthermore, 84.4% of respondents agreed that the games made the e-book more interesting and showed interest in having additional games. A positive response of 86.0% for playing the games multiple times highlights the potential for repeated engagement and deeper understanding. These findings are consistent with past studies which highlight gamified learning environments may enhance cognitive engagement and foster positive learning attitudes in STEM education (Byusa et al., 2022; Lee and Hammer, 2021). Overall, the data affirms that gamification is a valuable tool in making chemistry education more interactive, enjoyable, and effective.

CONCLUSION

The implementation of the interactive flipped e-book “Beyond the Basics: An Exploration of the Periodic Table” introduces an innovative approach in chemical education by incorporating interactive elements such as engaging graphics, clear audio, informative videos and game-based learning activities. This e-book is designed to complement traditional teaching methods by enhancing conceptual understanding and increasing student engagement, thereby making the learning process more meaningful and exciting. Future developments will focus on producing additional interactive e-books covering various chemistry topics and integrating additional gamification strategies to further promote interest in STEM education, particularly in the field of chemistry. To support accessibility and ease of use, these educational resources will be consolidated within a centralized web-based platform.

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DEVELOPMENT OF THE DIGITAL HUMAN RESOURCE TRAINING PLATFORM FOR WOMEN EMPLOYEES

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ABSTRACT

This study aims to develop a Digital Women's Human Resource Development Training Platform at the Islamic University of North Sumatra (UISU). This platform is called the Digital Women's Human Resource Development Training Platform (P3SPD) in Indonesian. This platform is designed as a web-based medium to support the improvement of digital competencies among female staff in academic environments. This study adopted a mixed-methods approach, combining qualitative and quantitative methods based on the Borg & Gall and Lee & Owens frameworks. The study population consisted of all 35 female staff members across 9 faculties at UISU, and a saturated sample of equal size was used. The research procedure involved nine stages, including digital needs analysis, planning, platform development, and effectiveness testing. The needs analysis revealed that although basic digital skills were adequate, participation in training was still low and needed to be improved, particularly regarding women's involvement in decision-making and career development. The P3SPD platform was developed to address these challenges through a digital curriculum design, interactive features, and an integrated evaluation system. Initial trials showed very positive results, with an average score of 4.46. These findings indicate that the P3SPD platform has strong potential to support digital transformation and empower female employees at UISU.

Keywords: Digital Platform, Human Resource Training, Women Employees

INTRODUCTION

Improving the capacity and competence of female human resources in higher education is an urgent strategic need, especially in facing the challenges of growing digitalization (Safrida et al, 2024; Susilawati, et.al, 2021). The need to improve digital skills among female employees is crucial, considering their roles not only as administrative implementers, but also as decision-makers and institutional drivers (Imjai, et al, 2024). Adequate digital skills will encourage female employees to be more adaptive, productive, and highly competitive in the information technology era (Arnaud, São, & Branco, 2024). However, in reality, although most female staff at UISU already have basic digital skills, the use of technology in daily tasks is still not optimal. Their participation in digital training remains low, and their involvement in decision-making processes at the faculty or university level is also suboptimal. This indicates the need for intervention through the development of relevant and accessible training systems.

In response to these issues, the P3SPD (Educational and Social Development Platform) was developed. This platform is designed as a web-based learning platform that can be accessed flexibly, with content compiled based on the results of an analysis of real needs in the field. Human resource development encompasses three main components: training, development, and education (Gifari & Madhakomala, 2023). Integrates these three components into a single, integrated system to continuously improve digital competency. Through an e-learning approach, P3SPD is able to bridge the digital divide experienced by female employees, increase participation in training, and encourage women's empowerment to play a more active role in the structure and direction of future institutional policies.

METHODS

This study uses a research and development (R&D) approach aimed at developing a web-based digital training platform that can improve the digital competence of female employees at UISU. The approach employed is a mixed methods approach, combining quantitative and qualitative methods, to achieve more comprehensive and in-depth results (Kurtaliqi et al., 2024; Salgado et al., 2024; Dawadi, Shrestha, & Giri, 2024).

RESULTS AND DISCUSSION

The results of this study were conducted based on R&D research procedures with the integration of the Borg & Gall model. This research activity was conducted by analyzing the digital needs of female employees at UISU. The results of the needs analysis are presented as follows:

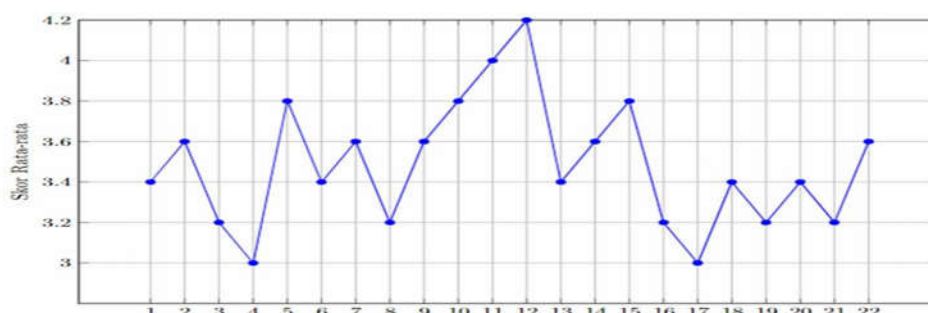


Figure 1.: Analysis of Development Needs of the Digital Human Resource Training Platform for Women Staff at the Islamic University of North Sumatera

Figure 1 shows an analysis of female employees' needs for better technology infrastructure (score 3.40) and more structured training. Basic technology skills are quite good (3.60), but participation in training remains low despite high job responsibilities (3.80). Adaptation to digital technology needs to be improved (3.20), while collaboration is rated good (3.60). The organizational culture demonstrates strong working relationships (3.80), loyalty (4.00), and very high dedication (4.20). The main challenges lie in team participation and women's involvement in decision-making (both 3.20), which require broader empowerment programs to promote equality in career development. Following the digital needs analysis, a digital needs planning process was conducted for the P3SPD development training platform. The needs planning process began with an analysis of the needs for prevention models and employee performance education, making the development of P3SPD at UISU crucial. The results of the needs planning analysis indicate that comfort in using the P3SPD platform is influenced by the frequency of training received in the workplace. Continuous training and technical support have been shown to increase female employees' confidence in adopting new technologies. The appropriate structure and frequency of training on the P2SPD Platform play a crucial role in ensuring the active involvement of female employees, preventing them from being unprepared for rapid technological change.

The P3SPD Platform is designed to develop digital competencies for female human resources. The design of the P3SPD Platform follows a systematic process from preparation to ongoing implementation. The preparation phase involves identifying objectives and analyzing needs through surveys and interviews to identify digital skills gaps among female employees. The development of the P3SPD Platform includes curriculum design that integrates digital skills, the physical design of the platform, including system architecture, key features (training modules, discussion forums, evaluation tools), and an intuitive user interface. Comprehensive P3SPD documentation and final evaluation are essential components to ensure the achievement of objectives and their impact on the performance of female employees in facing digital transformation. Based on the results of the trial implementation analysis, it can be stated that the overall quality of the P3SPD Platform display is rated Very Good. Likewise, the results of the one-on-one trial indicate that the P3SPD Platform display design is very effective, intuitive, and responsive, and is ready for further development. For user perfection, improvements are made to the P3SPD Platform. The goal of these improvements is to increase user satisfaction, minimize errors, and enhance the effectiveness and efficiency of P3SPD at UISU.

To determine the extent to which the P3SPD Platform is able to improve digital competency, measure its impact, and assess user satisfaction, an effectiveness test was conducted. The results of this effectiveness test serve as the basis for ensuring the continued viability of P3SPD. The results of the P3SPD effectiveness test analysis showed a significant increase between pre-test scores (65.00) and post-test scores (80.00), with a difference of 15 points. This increase indicates that the implementation of P3SPD successfully improved participants' competency or understanding of the material provided in the program. The decrease in the standard deviation value from pre-test (10.00) to post-test (8.00) indicates that after participating in P3SPD, participants' abilities became more homogeneous, indicating that the program successfully reduced the gap in understanding among participants.

A significant bolstering effect of P3SPD is Cohen's d value of 1.66. This value far exceeds the standard effect size (0.8) for measuring statistical effects, indicating that P3SPD had a substantial and meaningful impact. In other words, the program not only statistically improved scores but also produced real and meaningful changes in participants' competency. The pooled SD result of 9.06 reflects the combined variability between pre-test and post-test, which was then used to calculate the large Cohen's d effect size. Thus, it can be concluded that P3SPD has proven to be very effective in improving the abilities of participants, with a significant increase in scores and a very large effect based on Cohen's effect size. These results support the success and sustainability of the implementation of P3SPD in developing female employee resources to improve.

To determine the extent to which the P3SPD Platform is able to improve digital competence, measure its impact, and assess user satisfaction, an effectiveness test was conducted. The results of the P3SPD Platform effectiveness test showed an increase in pre-test scores (65.00) and post-test scores (80.00), with a difference of 15 points. This increase indicates that the implementation of the P3SPD Platform successfully improved participants' competency or understanding of the material provided on the P3SPD Platform. The significant reinforcing effect of the P3SPD Platform was demonstrated by Cohen's d value of 1.66. This value far exceeds the standard effect size (0.8) for measuring statistical effects, indicating that the P3SPD Platform has a substantial and meaningful impact on improving the human resources of female employees at UISU.

CONCLUSION

This research has successfully developed a P3SPD Platform designed to improve the digital competence of female employees at UISU. A needs analysis indicated the need for more structured, flexible, and applicable digital training interventions. The pilot results showed that P3SPD received a very positive response and proved to be feasible and effective as a digital training tool to empower female employees at UISU. The P3SPD platform contributed to the development of digital skills, participation in training, and especially related to the involvement of female employees in decision-making and career development at UISU.

ACKNOWLEDGEMENTS

We express our gratitude to Allah SWT for His grace, enabling us to complete this research. We extend our gratitude to the UISU Foundation, female staff from nine faculties, and fellow lecturers who supported this process. We hope this platform will provide tangible benefits for enhancing the digital capacity of female staff and supporting digital transformation at the UISU.

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DIFNOVA

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ABSTRAK

Pembezaan merupakan aspek penting dalam Matematik. Meskipun dipelajari di Tingkatan 5, kebanyakan pelajar dilihat menghadapi kesukaran melakukan proses pembezaan serta mempunyai retensi pengetahuan rendah. Minat yang rendah dalam topik ini turut menjadi suatu halangan dalam pengajaran dan pembelajaran di Matrikulasi. Tahap penguasaan para pelajar bagi topik Pembezaan berada pada tahap yang membimbangkan melalui Laporan Kerja Calon bagi Peperiksaan Semester Program Matrikulasi (PSPM) 2022/23 dan 2023/24. DifNova dilihat penyelesaian bagi menangani isu ini. Para pelajar akan meneroka topik Pembezaan dengan DifNova yang mempunyai penggunaan video "Tips&Tricks" TikTok dan permainan DifNova- 4 aras. Para pelajar akan memperbetul silap tafsiran teknik dan mempelajari topik ini pada kadar pembelajaran sendiri. Pengetahuan diibaratkan sebagai pembinaan suatu bangunan. Asas kukuh adalah tunjang kestabilan bangunan tersebut. Penggunaan platform digital, Quizizz akan membantu menilai setiap tahap penguasaan pelajar dan silap tafsiran yang perlu diperbetulkan. Bagi menguji kebekkerkesanan DifNova, kesilaptafsiran dan kecuaiian yang kerap dilakukan oleh para pelajar bagi topik Pembezaan dikenalpasti meskipun dibantu berulang kali. Ini membawa kepada sasaran 14 orang pelajar yang dikenalpasti dan pelan intervensi dirangka. Inovasi DifNova berkonsepkan gamifikasi digunakan untuk mendekatkan pelajar dengan topik serta mewujudkan penyertaan aktif para pelajar dalam pembelajaran topik Pembezaan. Data penguasaan daripada Quizizz dan ujian formatif digunakan untuk mengukur impak DifNova terhadap tahap pencapaian dalam topik Pembezaan. Emosi dan maklumbalas para pelajar dianalisis pada pasca-intervensi. Data kualitatif melalui soal-selidik tentang penggunaan DifNova dalam pembelajaran topik Pembezaan juga dianalisa. Hasil pemerhatian, didapati 14 pelajar yang melalui intervensi permainan DifNova menunjukkan peningkatan skor purata 80% bagi Pembezaan untuk 4 jenis fungsi pada kitaran pertama. Setelah melalui kitaran intervensi 2, di mana kesilapan di kitaran 1 diperbetulkan para pelajar menunjukkan skor purata yang lebih baik pada ujian formatif 2, 91%. Analisis kualitatif memberi indikasi para pelajar mempunyai pembelajaran menyeronokan, memingati langkah dengan lebih baik serta dapat menghindari kecuaiian yang berlaku sebelum intervensi. Selari dengan pembelajaran abad ke-21, aktiviti gamifikasi dalam Matematik membantu pembelajaran sendiri dan pembelajaran bermakna.

Kata kunci: Pembezaan, Pembelajaran gamifikasi, Pembelajaran masa depan

PENGENALAN

Pembezaan merupakan salah satu topik asas dalam Matematik yang diajar sejak peringkat sekolah Menengah dan dikukuhkan di peringkat Matrikulasi. Namun, analisis terhadap laporan Peperiksaan Semester Program Matrikulasi (PSPM) 2022/2023 dan 2023/2024 mendapati penguasaan pelajar dalam topik ini masih rendah. Pelajar sering melakukan kesilapan berulang dalam proses pembezaan, mengalami kekeliruan terhadap teknik, serta menunjukkan retensi pengetahuan yang lemah. Tambahan pula, minat pelajar terhadap topik ini rendah, menjadikan proses pengajaran dan pembelajaran sedia ada kurang berkesan. Pengajaran dan pembelajaran di Matrikulasi adalah berasaskan kuliah dan tutoran. Gaya pembelajaran menekankan para pelajar menyiapkan diri ke alam universiti. Justeru, pengetahuan disampaikan di mana kebanyakan pelajar menerimanya secara pasif. Pembelajaran lebih kepada menyalin dan kecuai berlaku apabila para pelajar menghafal daripada memahami suatu proses Matematik. Para pelajar juga merungut ketiadaan sokongan serta merta, di mana mereka boleh memperbetulkan ketidakfahaman serta kesilap tafsiran mereka. Tidak dapat dinafikan, proses pembezaan ialah proses di mana asasnya perlu difahami terlebih dahulu sebelum proses kompleks dilakukan. Kebanyakan pelajar menggunakan “PhotoMath” dan “ChatGPT” untuk menyiapkan tugas. Para pensyarah telah mendapati kelemahan algebra yang diwarisi dari zaman persekolahan turut menjadi suatu kekangan dalam penguasaan topik ini. Bagi mengatasi masalah ini, inovasi berbentuk E-book interaktif yang dinamakan DifNova telah dibangunkan. E-book ini menggabungkan elemen gamifikasi, video pendek “Tips & Tricks”, permainan aras bertingkat, dan penilaian digital melalui platform Quizizz. Pendekatan ini bertujuan menjadikan pembelajaran lebih menyeronokkan, interaktif, dan membantu pelajar memahami konsep mengikut kadar pembelajaran sendiri (Pedersen, 2016). Para pelajar harus menguasai suatu tahap sebelum meneruskan ke pembelajaran peringkat seterusnya (Borji, 2020). Melalui permainan DifNova, para pelajar akan mengetahui kesilapan mereka serta merta dan pensyarah dapat melihat tahap penguasaan setiap peringkat melalui Quizizz. Penguasaan dalam topik Pembezaan adalah amat penting kerana memberi impak kepada penguasaan topik lain seperti Pengamiran. Kajian ini bertujuan menilai keberkesanan DifNova dalam meningkatkan penguasaan pelajar terhadap topik Pembezaan di Matrikulasi.

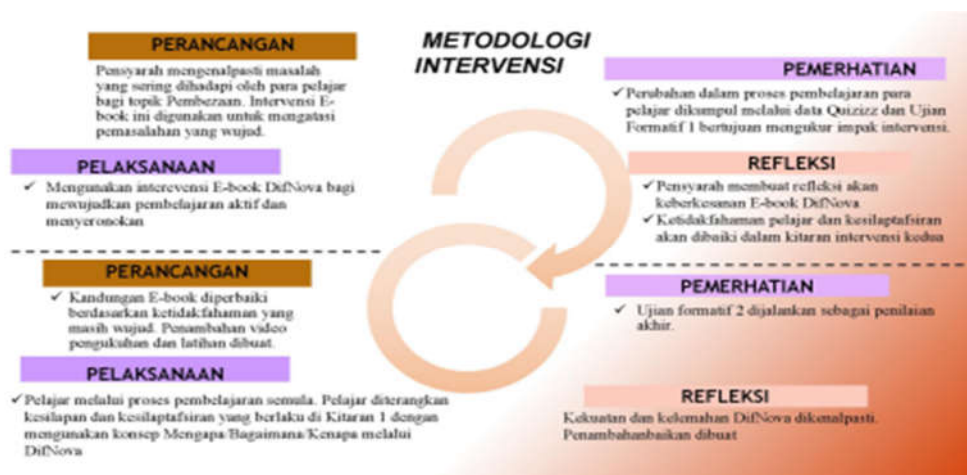
METODOLOGI KAJIAN

Merujuk kepada Rajah 1, intervensi yang dijalankan melibatkan empat fasa: Perancangan, Tindakan, Pemerhatian, dan Refleksi. Intervensi ini dilaksanakan dalam dua kitaran. Seramai 14 pelajar Matrikulasi dari kelas X dipilih bagi menilai keberkesanan penggunaan DifNova. Para pelajar ini telah dikenalpasti kerana memperoleh markah rendah dalam Ujian Diagnostik.

Intervensi: Pelajar menggunakan E-book DifNova yang dibahagikan kepada:

1. Video pendek TikTok yang merangkumi teknik-teknik penting dalam melakukan proses Pembezaan. Para pelajar akan menggunakan petua mnemonics yang akan membolehkan mereka mengingat langkah-langkah penting dengan mudah. Fasa ini juga menggunakan “photographic memory” sebagai suatu strategi pembelajaran.
2. Permainan Differ X – 4 Aras sebagai aktiviti gamifikasi pembelajaran yang mempunyai latihan konsep dan pengesanan salah tafsiran. Pelajar akan mengetahui mengapa kesilapan dibuat dan “hint” untuk meneruskan proses sekiranya mereka tidak dapat meneruskan permainan (Dubinsky, 2001).

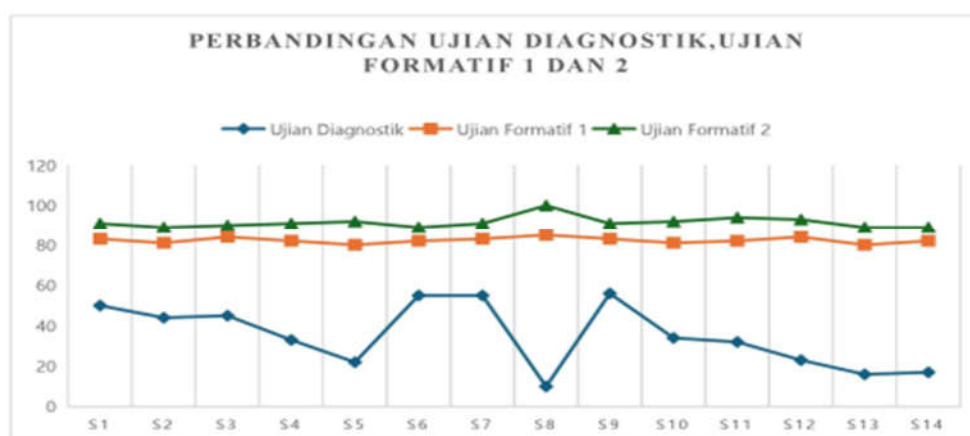
3. Penilaian formatif menggunakan Quizizz selepas setiap aras. Pensyarah dapat mengenalpasti kesilapatafsirandan kecuaiian yang masih wujud.



Rajah 1.: Perincian Intervensi dengan menggunakan E-book DifNova

DAPATAN DAN PERBINCANGAN

Dapatan yang tertera di Rajah 2 menunjukkan bahawa pelajar yang menjalani intervensi DifNova mencatat peningkatan prestasi yang signifikan. Dalam Ujian Formatif 1, pelajar memperoleh skor purata 80%, menandakan peningkatan berbanding ujian diagnostik awal. Didapati para pelajar kehilangan markah disebabkan kesilapan algebra asas. Dalam kitaran intervensi 2, kesilapan ini diketengahkan dan kesilapatafsiran diperbetulkan melalui permainan DifNova. Hasilnya, skor purata meningkat kepada 91% dalam Ujian Formatif 2 seperti tertera di Rajah 2.



Rajah 2.: Perbandingan Ujian Diagnostik, Formatif 1 dan 2

Pemerhatian menunjukkan bahawa pelajar lebih aktif dan yakin semasa menjawab soalan serta kurang melakukan kesalahan berulang. Analisis kualitatif daripada maklum balas pelajar mendedahkan bahawa pendekatan gamifikasi melalui permainan dan video pendek membantu mereka mengingat langkah dengan lebih baik dan menjadikan pembelajaran lebih menyeronokkan. Pelajar juga melaporkan bahawa mereka dapat belajar mengikut kadar sendiri tanpa tekanan. Pendekatan ini juga menunjukkan potensi besar dalam membantu pelajar mengelakkan kecuai asas yang sebelum ini menjadi punca kegagalan mereka dalam menjawab soalan Pembezaan. Ciri berperingkat dalam DifNova memberi peluang kepada pelajar untuk membina kefahaman secara progresif.

KESIMPULAN

Inovasi DifNova membuktikan keberkesanannya dalam meningkatkan penguasaan pelajar terhadap topik Pembezaan. Melalui pendekatan gamifikasi yang menggabungkan elemen pembelajaran sendiri, video interaktif dan penilaian formatif, pelajar dapat belajar secara lebih menyeronokkan, reflektif dan bermakna. Intervensi ini menyokong integrasi teknologi dan reka bentuk pengajaran inovatif sebagai satu strategi pembelajaran abad ke-21 yang mampu meningkatkan minat dan pencapaian pelajar dalam subjek yang mencabar seperti Matematik. Kebolehubahsuaian produk menjadikannya senang digunakan bagi pelbagai topik dalam Matematik dan modul boleh dihasilkan sebagai projek masa depan.

PENGHARGAAN

Para penyelidik ingin merakamkan penghargaan kepada Kolej Matrikulasi Perak atas sokongan ke atas kajian yang dilaksanakan. Penyelidik juga merakamkan jutaan terima kasih kepada para pelajar yang menyertai usahakami.

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DIGI-FC-SML: ENHANCING SOIL MECHANICS LABORATORY LEARNING WITH INTERACTIVE FLASHCARDS

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ABSTRACT

The Soil Mechanics Laboratory course involves numerous technical terms and detailed explanations that demand both memorization and conceptual understanding. Understanding soil laboratory experiments is fundamental for civil and geotechnical engineering students, however, traditional learning methods often lack engagement and efficiency. The Digital Flash Card for Soil Mechanics Laboratory (DIGI-FC-SML) is an innovative educational tool which is interactive online flashcards designed specifically for soil laboratory experiments. The flashcards cover key aspects of each experiment: including the objective, required apparatus, procedure, and expected results. The tool leverages proven learning techniques such as spaced repetition, gamification, and microlearning to boost comprehension and retention. It is grounded in the learning theory that complex subjects are best mastered through intensive, consistent and structured study. With a user-friendly interface and game-based modes, students can learn anytime, anywhere, at their own pace. Students can self-assess their understanding through engaging and practical quizzes provided at the end of each topic, with the content freely accessible on quizlet.com. The flashcards aim to transform technical content into manageable, interactive sessions that support both exam preparation and conceptual understanding. This digital approach offers a scalable, cost-effective solution to enhance laboratory learning experiences, making soil laboratories more accessible, engaging, and effective for the next generation of engineers. Moreover, DIGI-FC is a versatile tool that can be easily adapted and expanded into a series of learning resources for other subject areas.

Keywords: Digital Flash Card, Learning Techniques, Soil Mechanics Laboratory

INTRODUCTION

The Soil Laboratory course is a core component of civil and geotechnical engineering education, introducing students to fundamental testing methods and interpretation of soil behavior. These experiments involve a wide range of technical terminologies and procedures that require both memorization and conceptual understanding. However, conventional teaching methods—such as printed manuals or static lecture notes—often fail to maintain student engagement and limit opportunities for active learning (Brame, 2016). Dunlosky et al. (2013) researched that rereading is of low utility compared to other techniques like active recall and spaced repetition.

To address this, DIGI-FC (Digital Flashcard) was developed as a digital learning innovation. Built on Quizlet, it presents soil laboratory topics in the form of interactive flashcards, incorporating objectives, apparatus, procedures, and expected outcomes for each experiment. By applying spaced repetition, gamification, and self-assessment techniques, DIGI-FC supports active recall and long-term retention as this method suggested by Karpicke & Roediger (2008). It aligns with the broader vision of transforming education through technology, driving innovation in teaching methods, and promoting lifelong learning (UNESCO, 2020).

METHODS

DIGI-FC introduces several innovative features that distinguish it from conventional educational tools:

Interactive Flashcard Design (Figure 1)

Each set of flashcards is structured around the core components of soil laboratory experiments: objectives, apparatus, procedures, and expected outcomes. This modular format simplifies complex content into manageable learning units. Compared with the laboratory manual which is written in detailed and crowded text.

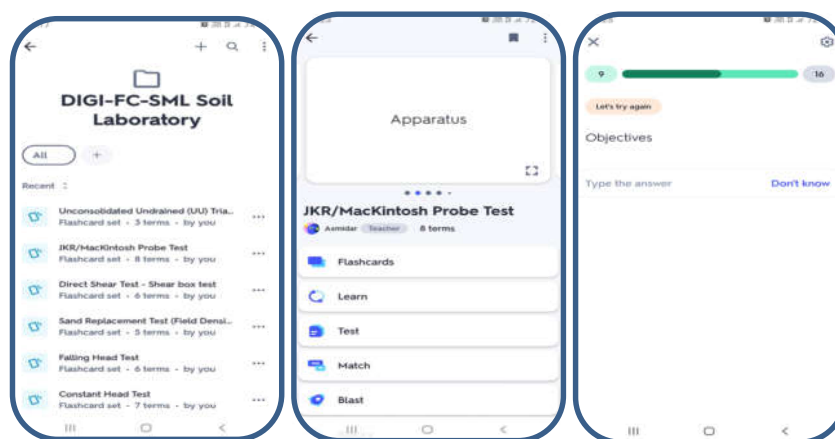


Figure 1.: Interactive Flashcard Design

Gamification

The integration of game-based elements such as 'Match', 'Blast' (Figure 2), and time-based challenges on Quizlet increases student engagement, motivation, and repeated exposure to key concepts.

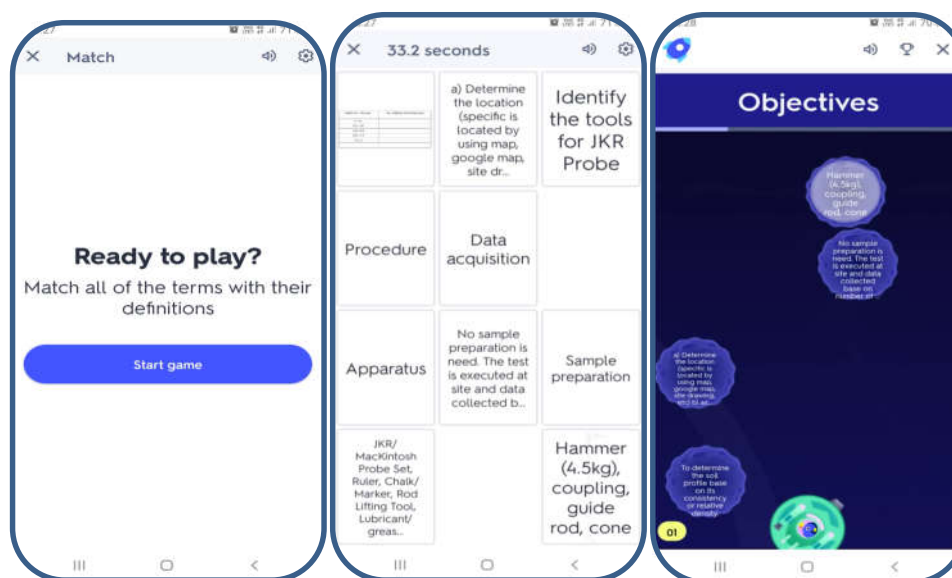


Figure 2. Game-based elements

Spaced Repetition and Retrieval Practice

By leveraging evidence-based techniques, DIGI-FC supports long-term memory retention and comprehension, allowing students to revisit flashcards over spaced intervals for more effective learning.

Self-Assessment and Feedback

Embedded quizzes and test modes at the end of each topic empower students to assess their own understanding and identify areas for improvement instantly.

RESULTS AND DISCUSSION

DIGI-FC has made a notable impact on student learning and engagement within the Soil Laboratory course. Feedback collected from initial users indicates that students are highly satisfied with the tool, citing its simple structure, ease of use, and visual clarity as major advantages. The streamlined design allows learners to focus on core concepts without being overwhelmed by excessive technical jargon or cluttered information.

Students reported that DIGI-FC made it easier to understand complex laboratory procedures and terminology, particularly when revising for assessments. The interactive and gamified features fostered

a sense of motivation and enjoyment, which are often lacking in traditional textbook-based learning. Many users appreciated the flexibility to study on their own time and pace, which supported both in-class and independent learning.

Beyond individual student benefits, DIGI-FC contributes to broader educational goals:

- Promotes digital literacy by integrating accessible technology into technical education.
- Supports inclusive learning by catering to different learning styles through visual, textual, and interactive modes.
- Encourages self-regulated learning, helping students take ownership of their study habits.
- Contributes to scalable innovation, as the approach can be replicated across disciplines and institutions.

Overall, DIGI-FC strengthens the bridge between theory and practice, making technical content in soil mechanics more approachable and memorable. It stands as a promising tool in the effort to modernize technical education and empower learners through innovation.

CONCLUSION

DIGI-FC demonstrates strong potential for commercialization due to its high usability, positive student feedback, and adaptable structure. Its design—centered around clarity, simplicity, and interactivity—has been well-received by students, especially those in technical fields who often struggle with dense, traditional materials. The positive learning experience, coupled with its intuitive interface, positions DIGI-FC as a market-ready educational tool that can be expanded beyond a single course or institution.

The modular nature of DIGI-FC allows for customization across various subjects, including civil engineering, mechanical engineering, biology, and vocational training programs. Institutions could license tailored flashcard sets aligned with specific curricula, or educators could subscribe to a premium version offering analytics, classroom integration, and progress tracking.

Potential future developments and commercialization strategies include:

- Self-learning tool – promoting sharing information in terms of academic content to a global audience.
- Use of technology – one-stop center to learn, re-learn, self-test and self-monitor individual progress.
- Self-evaluate – Students can self-evaluate their learning through the quiz provided at the end of session.

e-FinLex (e-FINANCIAL LEXICON)

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ABSTRACT

Finance involves the management of money and includes a variety of activities such as investing, borrowing, lending, budgeting, saving, and forecasting. It is generally categorized into three main areas: personal finance, corporate finance, and public or governmental finance. In today's world, two primary financial systems are in use: conventional finance, which follows traditional practices, and Islamic finance, which adheres to Shariah principles. Global market projections estimate that the financial services industry will grow to \$33.54 trillion by 2024, marking a 7.7% increase from the previous year. With global GDP expected to reach \$109.53 trillion in the same year, financial services would represent about 31% of the world economy. This substantial growth is driving expansion in the financial sector, both in terms of market scope and educational offerings. Many higher education institutions now provide finance-related programs. However, one of the common challenges faced by students is grasping and retaining the complex terminology used within financial systems. To address this, e-FinLex aims to support students by making it easier to learn and remember financial terms, eliminating the need to rely on bulky textbooks. This innovation is not limited to students; it is also beneficial for professionals, and anyone interested in gaining a better understanding of the banking and finance industry.

Keywords: Finance Lexicon, Islamic Finance, Online Dictionary

INTRODUCTION

Financial literacy is an essential component of contemporary education. Many students find it difficult to understand complex financial terminology and concepts, which often results in poor academic performance in finance-related subjects (Lusardi & Mitchell, 2014). This lack of understanding not

only affects their grades but also undermines their confidence and reduces their interest in pursuing finance-related careers (Hunjra et al., 2010). The challenging nature of financial language and concepts can be overwhelming, making it harder for students to grasp critical ideas and apply them in real-world contexts (Amagir et al., 2018). Furthermore, the fast-evolving technological landscape adds to the difficulty, requiring students to stay current while developing a solid understanding of finance. Therefore, it is important for students to acquire the necessary skills and knowledge to effectively navigate the complexities of financial systems. In response, this innovation aims to:

- Design and create a user-friendly mobile application that offers an interactive and comprehensive platform for students to learn, retain, and explore financial terminology.
- Enhance students' financial literacy by ensuring easy access to essential financial terms, concepts, and definitions.
- Contribute to the United Nations' Sustainable Development Goals (SDGs) by promoting financial education as a crucial element for achieving economic resilience and sustainable development (United Nations, 2015).

METHODS OF INNOVATION

e-FinLex is developed using Glide. Glide is a no-code platform designed for building modern workplace applications (Glide, 2018). As Glide is free to use, this makes e-FinLex accessible to students and individuals from low-income backgrounds without any financial burden. The app features an intuitive and user-friendly interface. With professionally designed themes, layouts, and components, it offers a sleek and professional look on both mobile and desktop devices. Additionally, the app can be installed on smartphones, allowing users to conveniently access e-FinLex as a digital financial dictionary anytime, anywhere. Table 1 below illustrates the use of the e-FinLex.

Table 1. The Use of the e-FinLex

Step	Picture	Explanation
Step 1	 e-FinLex	Use the provided link to open and explore the e FinLex application.

Step	Picture	Explanation
Step 2		Once the link is accessed, the app's homepage will be displayed, showcasing various terms related to finance.
Step 3		Users can navigate to the search section to look up specific terms. For instance, to find "Deontological", simply type the term into the search bar and press enter.
Step 4		Users can also browse through the app manually to read each financial term. A total of 471 financial terms are available within the application.

Novelty And Uniqueness of Innovation

e-FinLex distinguishes itself from other financial dictionaries and online platforms in several keyways. e-FinLex is an application specifically tailored for students, offering a well-rounded platform focused on helping them learn and retain financial terms effectively. Second, as a mobile application, e-FinLex provides on-the-go access anytime and anywhere, making it especially useful for students with limited access to traditional financial resources or those studying remotely. Its clean and professional design ensures smooth user experience on both mobile and desktop devices. Third, the app is built to be intuitive and inclusive, catering not only to students but also to professionals and anyone interested in expanding their financial knowledge. This makes e-FinLex a valuable tool for enhancing financial literacy across various user groups. Finally, e FinLex is developed using Glide—a no-code development platform—enabling the creation of modern apps without programming expertise. As Glide is free, this allows the app to be accessible at no cost, particularly benefiting students and individuals from low-income backgrounds. Overall, e-FinLex offers a unique blend of mobility,

simplicity, and accessibility that sets it apart from other financial reference tools available today.

Commercialization of Innovation

The main objective of developing this innovation is to assist students in learning and retaining financial terminology. As such, it is especially beneficial for those studying finance-related courses. However, the potential reach of e-FinLex extends beyond just tertiary-level students. This tool can also be valuable to a broader audience, including professionals and individuals interested in gaining insights into both Islamic and conventional finance. It helps users better understand financial terms in a convenient and accessible way. The practicality of this innovation lies in its cost-free availability and mobile-friendly design, allowing it to be installed like any other app (Polykalas & Prezerakos, 2019). This eliminates the need for carrying bulky textbooks or investing in expensive financial dictionaries, making it a user-friendly and efficient solution.

CONCLUSION

Ultimately, we expect e-FinLex to spark greater interest among students in learning about finance. It also has the potential to help the wider community better understand financial terminology, especially those studying finance-related subjects. In addition, this innovation can play a significant role in improving public awareness and understanding of key financial concepts. It serves as a valuable tool for students to more easily comprehend both Islamic and conventional financial terms. By offering clear and easily accessible content, e-FinLex supports educational efforts and fosters a deeper appreciation of various financial systems.

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SISTEM E-REKOD TASMİK RAUDZATI (E-RTR): MEMPERCEPATKAN PENGURUSAN DATA BACAAN AL-QURAN DAN MENJANA PELAKSANAAN PROGRAM INTERVENSI

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ABSTRAK

Pendidikan Islam, khususnya bidang al-Quran, merupakan tunjang utama dalam pembentukan sahsiah dan rohani murid sekolah rendah. Keperluan untuk memastikan penguasaan bacaan al-Quran yang menyeluruh menuntut sistem pemantauan yang efisien, mudah diurus dan responsif terhadap keperluan murid. Namun, pelaksanaan perekodan manual sering kali berdepan isu seperti kehilangan data, ketidakseragaman capaian, kelewatan pelaporan serta kesukaran melaksanakan intervensi berasaskan data. Bagi mengatasi cabaran ini, inovasi e-Rekod Tasmik Raudzati (e-RTR) dibangunkan sebagai satu sistem digital yang berfungsi untuk memperkemas pengurusan data bacaan tasmik murid secara sistematik dan berpusat. Sistem e-RTR dibina menggunakan platform Google Sheets bagi membolehkan guru merekod bacaan al-Quran murid secara terus semasa sesi tasmik dijalankan. Maklumat penting seperti kehadiran, tahap bacaan, fokus murid dan kategori pencapaian dapat direkod dengan teratur. Sistem ini turut dilengkapi fungsi penapisan data yang membantu guru mengenal pasti kumpulan murid tertentu dengan lebih mudah, sekali gus memudahkan perancangan dan pelaksanaan intervensi secara lebih tepat dan berkesan. Selain itu, guru boleh mengakses data secara sendiri pada bila-bila masa, bekerjasama secara langsung dengan guru lain, dan semua maklumat disimpan dengan selamat melalui Google Drive. Inovasi ini telah memberi kesan positif terhadap profesionalisme guru, kelancaran pengurusan tasmik dan keberkesanan intervensi murid. Tanpa memerlukan kos pembangunan, e-RTR mudah diadaptasi di mana-mana sekolah rendah dan berpotensi besar sebagai model pengurusan digital tasmik yang efisien, mampan dan selari dengan arus transformasi pendidikan digital negara.

Kata Kunci: *Digital, e-Rekod, Kemenjadian murid, Tasmik*

PENGENALAN

Penguasaan bacaan al-Quran dalam kalangan murid sekolah rendah merupakan salah satu keutamaan dalam pendidikan Islam yang digariskan oleh Kementerian Pendidikan (KPM) melalui Dokumen

Standard Kurikulum dan Pentaksiran Sekolah Rendah bagi mata pelajaran Pendidikan Islam (KPM, 2015). Lebih khusus, dalam bidang al-Quran untuk Pendidikan Islam, KPM telah menetapkan bahawa setiap murid perlu menguasai bacaan al-Quran sekurang-kurangnya sebelum menamatkan alam persekolahan rendah (Shahrulanuar et. al., 2021).

Justeru, pelaksanaan aktiviti *tasmik* (mendengar dan menyemak) bacaan al-Quran perlu dilakukan secara berterusan dan disokong dengan satu sistem perekodan yang kemas, sistematik serta mudah diakses oleh guru (Mohd Izzuddin, Azmil, & Kamarulzaman, 2015). Perekodan yang berkesan bukan sahaja membantu dalam memantau perkembangan bacaan murid dari semasa ke semasa, malah turut berperanan sebagai asas utama dalam usaha memastikan kemenjadian murid dicapai secara menyeluruh. Melalui data yang lengkap dan tepat, guru dapat mengenal pasti tahap penguasaan murid dengan lebih terperinci serta merancang pengajaran dan intervensi yang bersesuaian (KPM, 2019).

Namun begitu, kejayaan usaha ini sangat bergantung kepada keberkesanan sistem perekodan yang digunakan di peringkat sekolah. Oleh itu, penambahbaikan terhadap kaedah perekodan sedia ada amat penting bagi memastikan pengurusan data bacaan murid dapat dilakukan dengan lebih cekap, menyeluruh dan berimpak tinggi.

PENYATAAN MASALAH

Walaupun KPM telah menyediakan Buku Rekod Tasmik Individu sebagai medium rasmi penyimpanan data bacaan murid, pelaksanaan sistem rekod di peringkat sekolah masih bergantung kepada inisiatif guru atau pentadbiran sekolah masing-masing. Hal ini mengakibatkan berlakunya pelbagai kekangan dari aspek pengurusan dan keberkesanan penggunaan data tersebut.

Dalam banyak keadaan, rekod yang disimpan hanyalah memenuhi keperluan pelaporan semata-mata dan tidak menyumbang secara langsung kepada pelaksanaan intervensi secara berfokus (Norliza, Fahimah, & Khadijah, 2013). Data yang direkod tidak dapat dimanfaatkan sepenuhnya untuk menganalisis tahap pencapaian murid secara menyeluruh atau membantu guru mengenal pasti murid yang memerlukan bimbingan tambahan. Keadaan ini menyukarkan guru untuk merancang dan melaksanakan intervensi yang tepat pada masanya.

Berdasarkan pengalaman sebagai guru tasmik yang berkhidmat hampir 18 tahun, penyelidik bertanggungjawab menyelaraskan pelbagai aktiviti serta program berkaitan al-Quran di peringkat sekolah, termasuklah pengumpulan dan pengurusan data bacaan murid. Beberapa isu telah dikenal pasti sering timbul dan menghalang kelancaran proses pemantauan, antaranya ialah kehilangan fail rekod semasa dalam simpanan, maklumat yang sukar diperoleh oleh guru ganti, data yang tidak dikemaskini dengan tepat, serta kelewatan dalam proses analisis bacaan murid. Tambahan pula, ketiadaan satu sistem yang berpusat dan sistematik telah menyulitkan kerjasama antara guru dalam pelaksanaan intervensi yang berkesan.

Bagi mengatasi isu ini, sistem e-Rekod Tasmik Raudzati (e-RTR) telah dibangunkan secara bersepadu sebagai satu bentuk intervensi digital. Sistem ini direka bentuk untuk memperkemas proses merekod,

mengemaskini, menganalisis dan menyimpan data bacaan tasmik murid secara sistematik, berpusat dan mudah dicapai. Sistem ini juga bukan sahaja memudahkan guru dalam urusan perekodan dan pelaporan, malah membolehkan mereka membuat keputusan pedagogi yang lebih tepat berasaskan data yang sahih dan terkini. Dengan adanya sistem e-RTR ini, proses pelaksanaan intervensi dapat dilaksanakan dengan lebih cekap, terarah dan berimpak tinggi terhadap penguasaan bacaan al-Quran dalam kalangan murid.

OBJEKTIF

Inovasi sistem e-RTR dibangunkan berdasarkan objektif berikut:

- i. Menyediakan platform sistem perekodan digital yang sistematik, berpusat dan mudah diakses;
- ii. Meningkatkan ketepatan dan kebolehpercayaan data bacaan murid bagi tujuan pemantauan; dan
- iii. Membolehkan pelaksanaan intervensi secara lebih berfokus, cepat dan berimpak berdasarkan analisis data yang lebih sistematik dan terperinci.

CIRI-CIRI INOVASI

Inovasi sistem e-RTR dibangunkan sebagai sistem digital berasaskan platform Google Sheets secara dalam talian untuk menggantikan rekod tasmik manual yang lazim digunakan di peringkat sekolah. Inovasi ini menampilkan beberapa ciri utama yang menjadikannya sistem yang lebih sistematik, responsif dan selamat seperti:

Platform Digital Berpusat

Sistem e-RTR menggunakan Google Sheets sebagai medium utama, membolehkan semua data tasmik disimpan secara berpusat dan dapat diakses pada bila-bila masa melalui pelbagai peranti. Ia mengurangkan kebergantungan kepada buku rekod fizikal.

Pengemaskinian Data Secara Langsung dan Automatik

Sistem ini membolehkan guru merekod maklumat murid secara langsung semasa sesi tasmik berlangsung. Semua data yang dimasukkan akan dikemas kini secara automatik, dan hanya sedikit yang perlu proses salinan atau pemindahan manual pada setiap hujung bulan.

Struktur Data Komprehensif

Sistem e-RTR direka bentuk dengan medan input yang komprehensif meliputi pelbagai dimensi penting seperti maklumat asas murid, rekod bacaan, kategori bacaan, isu pembelajaran serta intervensi. Reka bentuk ini membolehkan guru mengumpul dan menganalisis maklumat secara menyeluruh.

Integrasi Fungsi Analisis dan Visualisasi

Ciri analitik terbina dalam membolehkan sistem menjana laporan secara automatik seperti carta, graf dan ringkasan pencapaian murid. Ini membantu guru dan pihak pentadbiran memahami tahap kemajuan murid dengan lebih jelas dan pantas.

Kebolehaksesan dan Kolaborasi Masa Nyata

Melalui Google Sheets, e-RTR menyokong kerjasama antara guru secara masa nyata, membolehkan lebih daripada seorang pengguna menyemak dan mengemaskini data secara serentak. Ini meningkatkan produktiviti dan keseragaman pelaksanaan program tasmik.

Keselamatan Data dan Kawalan Akses

Setiap fail e-RTR dilindungi dengan tetapan keselamatan Google Drive. Akses hanya diberikan kepada pengguna yang dibenarkan sahaja, sekaligus menjaga kerahsiaan maklumat murid.

Mesra Pengguna dan Fleksibel

Antara muka e-RTR disusun dalam bentuk jadual yang ringkas, mesra pengguna dan mudah untuk disesuaikan mengikut keperluan semasa sekolah atau individu guru.

Penapisan dan Penjejakan Murid Secara Pintar

Sistem e-RTR dilengkapi fungsi penapisan data mengikut kelas, tahap bacaan dan kategori pencapaian. Ini memudahkan guru untuk meneliti maklumat mengikut kumpulan murid yang spesifik. Selain itu, sistem turut mempunyai fungsi automatik untuk menyorot (*highlight*) murid kritikal yang memerlukan intervensi segera.

PELAKSANAAN INOVASI

Inovasi e-RTR dilaksanakan secara langsung dalam amalan pengajaran dan pembelajaran (PdP) serta pengurusan data bacaan al-Quran murid melalui platform digital Google Sheets. Sistem ini digunakan semasa sesi tasmik dijalankan, di mana guru akan merekod bacaan al-Quran murid secara langsung terus ke dalam Google Sheets tanpa memerlukan pencatatan manual seperti ditunjukkan dalam Rajah 1.



Rajah 1. Proses dan Peranan e-RTR.

Selain itu, maklumat yang direkodkan merangkumi pelbagai komponen penting, iaitu:

- i. **Maklumat asas murid:** nama, nombor kad pengenalan dan kelas;
- ii. **Rekod bacaan:** tahap bacaan seperti Iqra', Juzuk, atau Khatam; jumlah bilangan dan tarikh tasmik terakhir;
- iii. **Kategori bacaan:** seperti tegar, lemah, sederhana, menguasai, baik serta sistem turus;
- iv. **Pentaksiran isu dan masalah murid:** kehadiran, tahap kesungguhan, bimbingan luar sekolah dan fokus bacaan semasa sesi; dan
- v. **Program intervensi:** termasuk program Speed Khatam, pra al-Quran, pulih Iqra', dan tahsin al-Quran.

Melalui penggunaan e-RTR, guru dapat mengenal pasti murid yang memerlukan intervensi dengan lebih cepat dan berfokus. Sistem ini juga membolehkan guru mengakses semula maklumat murid pada bila-bila masa, tanpa perlu merujuk fail fizikal. Selain itu, sistem e-RTR membolehkan pentadbir dan guru penyelaras memantau data dengan lebih menyeluruh, sekali gus memudahkan pelaporan, analisis kemajuan murid, dan perancangan intervensi. Penggunaan Google Sheets sebagai platform utama bukan sahaja membolehkan akses sendiri dan kolaboratif antara guru, malah memastikan data disimpan dengan selamat menggunakan ciri keselamatan Google (Navarasan & Sundararajan, 2024). Ia turut menyokong kemaskini serentak, pemantauan berpusat dan penghasilan laporan automatik, menjadikan pengurusan data PdP lebih efisien, telus dan profesional (Aryuzianti, 2020).

Pengisian dan Paparan muka Sistem e-RTR

Rajah 2 menunjukkan contoh paparan borang e-RTR dalam Google Sheets yang diisi oleh guru tasmik sebaik sahaja melaksanakan aktiviti tasmik.

REKOD TASMIK TAHUN 5 SIDIQ SESI AKADEMIK 2025/2026			BACAAN TERKINI				PENTAKSIRAN ISU DAN MASALAH MURID					PROGRAM	
BIL	NAMA	NO. IC	KELAS	IQRA' / AL-QURAN	MUKA SURAT	BIL. BACAAN	TASMIK AKHIR	KATEGORI MURID	KEHADIRAN	TAHAP KESUNGGUHAN	BIMBINGAN LUAR SEKOLAH	TAHAP FOKUS	INTERVENSI & INTENSIF
1	ADELLA HANI BINTI MOHD NORUL HASRI	141112020882	TS-5	KHIT 1	332	6	11/01/2025	BAIK	CERMERLANG	CERMERLANG	KELAS AL-QURAN	1 MS	NAQIS / NAQIBAH
2	AIMANNUR AFEF MIKAIL BIN MIRZAN	140122020885	TS-5	AUT 27	541	6	22/04/2025	MENGULASAI	BAIK	BAIK	RUMAH	3 MS	BIMBINGAN KHATAM
3	AMANDA SYAMINI BINTI MOHD FAZZLY	141214020882	TS-5	AUT 9	50	5	15/04/2025	BAIK	CERMERLANG	CERMERLANG	RUMAH	1 MS	BIMBINGAN KHATAM
4	ARIANA SAFIRA HAYANI BINTI AHMAD YUSRI	140109020748	TS-5	KHAT 5	29	6	22/04/2025	SEDERHANA	BAIK	SEDERHANA	RUMAH	1/2 MS	PULIH IQRA'
5	AZZAHRA HAFIZA BINTI MAHAR	140216020874	TS-5	KHIT 3	236	8	15/04/2025	TURBUL 8	CERMERLANG	CERMERLANG	RUMAH	5 MS	NAQIS / NAQIBAH
6	BUNGA NUR ADRAA BINTI MOHAMMAD KHAIRUL	140926020174	TS-5	AUT 28	548	7	22/04/2025	MENGULASAI	CERMERLANG	BAIK	TIDAK	3 MS	BIMBINGAN KHATAM
7	CAHAYA QASEH BINTI MOHD FAIZAL	140611020018	TS-5	AUT 7	322	7	15/04/2025	MENGULASAI	CERMERLANG	CERMERLANG	KELAS AL-QURAN	2 MS	BIMBINGAN KHATAM
8	EZZ ZARA RAISHA BINTI MOHD ESKANDAR	140916060586	TS-5	KHIT 4	209	7	15/04/2025	TURBUL 2	CERMERLANG	CERMERLANG	KELAS AL-QURAN	5 MS	NAQIS / NAQIBAH
9	HAISARAH NASUHA BINTI AZIZUL RUSMADI	141017020200	TS-5	KHIT 1	21	6	22/04/2025	MENGULASAI	BAIK	BAIK	TIDAK	2 MS	TAKSIR QURAN
10	MUHAMMAD ADAM FIRASH BIN MOHD FAZAL	140724020387	TS-5	KHIT 1	209	6	15/04/2025	MENGULASAI	BAIK	BAIK	KELAS AL-QURAN	1 MS	BIMBINGAN KHATAM
11	MUHAMMAD AL-AMIN BIN MOHAMMAD FAZLI	141006020439	TS-5	KHIT 4	216	18	15/04/2025	TURBUL 1	CERMERLANG	CERMERLANG	RUMAH	3 MS	NAQIS / NAQIBAH
12	MUHAMMAD AMMAR BIN AZUWAR AKMAR	140724020387	TS-5	AUT 4	69	6	15/04/2025	MENGULASAI	BAIK	BAIK	KELAS AL-QURAN	1 MS	PRA QURAN
13	MUHAMMAD AQIL BIN ZAILAN SHAH	140516021035	TS-5	KHIT 3	73	7	15/04/2025	TURBUL 3	CERMERLANG	CERMERLANG	RUMAH	5 MS	NAQIS / NAQIBAH
14	MUHAMMAD ARYAN SYAFI BIN SAZUREE	140511020471	TS-5	KHIT 1	209	6	15/04/2025	BAIK	CERMERLANG	CERMERLANG	KELAS AL-QURAN	3 MS	NAQIS / NAQIBAH
15	MUHAMMAD FARAS DARWISH BIN MOHD FIRDAUS	140521021339	TS-5	KHIT 1	369	6	15/04/2025	BAIK	CERMERLANG	BAIK	RUMAH	3 MS	NAQIS / NAQIBAH
16	MUHAMMAD HAFIZI HAKIMI BIN AHMAD HAFIZ	140405020013	TS-5	AUT 22	426	8	22/04/2025	MENGULASAI	CERMERLANG	CERMERLANG	RUMAH	5 MS	SPEED KHATAM
17	MUHAMMAD NURUDIN BIN MOHD NAZRUL	140907020363	TS-5	AUT 24	475	8	22/04/2025	BAIK	CERMERLANG	BAIK	RUMAH	3 MS	SPEED KHATAM
18	MUHAMMAD QAYYIM HAFIZAN BIN AMIR RIDZUAN	140318080671	TS-5	KHIT 1	124	8	22/04/2025	BAIK	CERMERLANG	BAIK	KELAS AL-QURAN	5 MS	NAQIS / NAQIBAH
19	MUHAMMAD QAYYUM HAFIZ BIN AMIR RIDZUAN	140318080719	TS-5	AUT 1	13	8	22/04/2025	MENGULASAI	CERMERLANG	BAIK	KELAS AL-QURAN	2 MS	PRA QURAN
20	MUHAMMAD QHALISH RAJFAL BIN AHMAD ISMAED	140926020203	TS-5	AUT 30	197	8	15/04/2025	MENGULASAI	CERMERLANG	BAIK	RUMAH	2 MS	BIMBINGAN KHATAM

Rajah 2.: Borang Rekod e-RTR dalam Google Sheet.

Seterusnya, Rajah 3 menggambarkan contoh rekod bacaan tasmik secara *headcount* untuk analisis mengikut kelas, pencapaian murid dan lain-lain bagi tujuan pemantauan dan intervensi bersesuaian mengikut tahap penguasaan bacaan murid.

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	
	PERINCIAN ANALISIS BACAAN MURID (IQRA' & AL-QURAN) SESI AKADEMIK 2025/2026																													
IQRA' / AL-QURAN	KELAS																								JUMLAH KESELURUHAN	PERATUS KESELURUHAN	JUMLAH MURID			
	TAHUN 1				TAHUN 2				TAHUN 3				TAHUN 4				TAHUN 5				TAHUN 6									
	1S	1F	1A	JML	2S	2F	2A	JML	3S	3F	3A	JML	4S	4F	4A	JML	5S	5F	5A	JML	6S	6F	6A	JML						
	28	27	22	77	28	28	22	78	29	29	18	76	27	28	19	74	26	25	19	70	27	28	14	69						
IQRA' 1	8	13	3	24	1	5	4	10	-	4	6	10	-	-	3	3	-	-	1	1	-	-	-	-	-	48	10.8%	36.71%	163	
IQRA' 2	10	4	-	14	2	6	1	9	1	10	4	15	-	-	5	5	-	-	7	7	-	-	3	3	53	11.9%				
IQRA' 3	1	1	-	2	6	10	1	17	6	5	2	13	1	10	5	16	-	2	1	3	-	2	2	4	55	12.4%				
IQRA' 4	1	-	-	1	5	3	-	8	5	5	-	10	3	1	1	5	1	4	6	11	2	4	1	7	42	9.5%	27.93%	124		
IQRA' 5	-	-	-	-	6	-	-	6	4	1	2	7	2	3	-	5	-	1	-	1	2	5	1	8	27	6.1%				
IQRA' 6	-	-	-	-	1	-	-	1	-	-	-	-	-	2	1	3	2	-	1	3	1	2	-	3	10	2.3%				
JUZ 1	-	-	-	-	2	-	-	2	1	-	-	1	-	-	-	-	-	1	1	2	-	1	-	1	6	1.4%	6.53%	29		
JUZ 2	-	-	-	-	2	-	-	2	1	2	-	3	2	4	-	6	1	1	-	2	-	-	-	-	13	2.9%				
JUZ 3	-	-	-	-	-	-	-	-	3	1	-	4	1	2	-	3	2	-	-	2	-	2	1	3	12	2.7%				
JUZ 4	-	-	-	-	1	-	-	1	5	-	-	5	2	-	-	2	-	4	-	4	-	-	-	-	12	2.7%	6.31%	28		
JUZ 5	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	1	-	1	1	1	-	2	4	0.9%					
JUZ 6	-	-	-	-	-	-	-	-	1	-	-	1	1	1	1	3	1	1	-	2	-	-	-	-	6	1.4%				
JUZ 7	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2	-	1	-	1	1	-	1	4	0.9%	2.70%	12			
JUZ 8	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2	-	-	-	-	-	-	-	2	0.5%				
JUZ 9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0%	1.13%	5		
JUZ 10	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	2	-	-	2	3	0.7%					
JUZ 11	-	-	-	-	1	-	-	1	-	1	-	1	1	-	-	1	-	1	-	1	1	-	1	5	1.1%					
JUZ 12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0%	1.13%	5		
JUZ 13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0%				
JUZ 14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0%				
JUZ 15	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	2	-	-	2	3	0.7%					
JUZ 16	-	-	-	-	1	-	-	1	-	1	-	1	1	-	-	1	-	1	-	1	1	-	1	5	1.1%					
JUZ 17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0%	1.13%	5		
JUZ 18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0%				
JUZ 19	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	1	-	-	1	2	0.5%					
JUZ 20	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	1	0.2%	0.90%	4		
JUZ 21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	1	0.2%					
JUZ 22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0%				
JUZ 23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	1	-	1	2	0.5%	2.03%	9		
JUZ 24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	1	1	2	0.5%				
JUZ 25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1	0.2%				
JUZ 26	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	1	1	2	1	1	1	3	6	1.4%	2.03%	9		
JUZ 27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	1	-	1	2	0.5%				
JUZ 28	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	2	-	2	-	-	-	-	3	0.7%				
JUZ 29	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	1	-	1	-	-	-	2	0.5%	1.13%	5		
JUZ 30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0%				
KHATAM 1	-	-	-	-	1	-	-	1	1	-	-	1	2	-	1	3	10	5	-	15	6	4	2	12	32	7.2%				
KHATAM 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	2	-	5	5	1.1%				
KHATAM 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	3	-	-	3	4	0.9%	9.23%	44		
KHATAM 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2	1	-	-	1	3	0.7%				
KHATAM 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0%				
KHATAM 6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0%				
JUMLAH YANG DIREKOD	28	27	22	77	28	28	22	78	29	29	18	76	27	28	19	74	26	25	19	70	27	28	14	69	444	100.0%	100%	444		
JUMLAH KESELURUHAN	77				78				76				74				70				69				444					

Rajah 3.: Analisis Bacaan Secara ‘Headcount’.

IMPAK INOVASI

Inovasi e-Rekod Tasmik Raudzati (e-RTR) memberi impak positif yang ketara dalam pengurusan dan pelaksanaan tasmik murid di sekolah rendah seperti yang ditunjukkan dalam Rajah 4.



Rajah 4.: Peranan e-RTR Sebagai Nadi Peningkatan Bacaan Murid

Antara impak utama yang turut dikenal pasti seperti:

- i. Memudahkan guru merekod bacaan murid secara *real-time* dan sistematik. Maklumat penting seperti tahap bacaan, kehadiran, dan isu pembelajaran direkod dalam satu platform digital yang tersusun.
- ii. Meningkatkan kecekapan pelaksanaan intervensi terhadap murid yang memerlukan bimbingan tambahan dapat dikenal pasti dengan lebih cepat melalui paparan data yang dianalisis secara automatik. Ini memudahkan guru merancang dan melaksanakan program intervensi yang lebih berfokus.
- iii. Mengurangkan risiko kehilangan dan kerosakan berbanding rekod manual kerana sistem digital berasaskan awan seperti e-RTR sentiasa tersimpan dan boleh dicapai bila-bila masa.
- iv. Meningkatkan kolaborasi dalam kalangan guru tasmik dengan mengakses data yang sama serentak, tanpa perlu menunggu atau berkongsi fail fizikal. Ini memudahkan pemantauan bersama serta memupuk kerjasama antara guru dan pentadbir dalam membuat keputusan.

CADANGAN PENAMBAHBAIKAN

Antara cadangan penambahbaikan sistem e-RTR ini adalah:

- i. Membangunkan aplikasi mudah alih khusus untuk e-RTR boleh meningkatkan pengalaman pengguna dengan antara muka yang lebih mesra, fungsi lebih pantas, serta integrasi notifikasi;
- ii. Menambah fungsi automatik untuk menjana laporan pencapaian murid dalam bentuk PDF yang boleh dicetak terus untuk tujuan dokumentasi, pemantauan, atau pembentangan kepada ibu bapa; dan

- iii. Menambah modul khas untuk membolehkan ibu bapa membuat semakan perkembangan bacaan anak-anak mereka bagi melibatkan waris dalam proses pembelajaran serta mendorong murid untuk lebih berdisiplin.

RUMUSAN

Inovasi sistem e-RTR telah berjaya memberikan impak yang signifikan dalam pengurusan dan pelaksanaan aktiviti tasmik al-Quran di sekolah rendah. Sistem ini memudahkan perekodan bacaan murid secara digital, meningkatkan kecekapan dalam mengenal pasti murid yang memerlukan intervensi, serta memudahkan pelaporan dan pemantauan data secara sistematik. Dengan penggunaan teknologi yang relevan dan mudah diakses, e-RTR menyelesaikan isu perekodan manual dan memberi ruang untuk pelaksanaan program intervensi yang lebih fokus dan berkesan.

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EDUVERSE: A CROSS-DISCIPLINARY GAMIFIED LEARNING PLATFORM FOR 21ST-CENTURY EDUCATION

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ABSTRACT

EduVerse is a mobile-accessible educational tool developed to enhance student engagement and understanding across multiple university-level courses offered at Universiti Teknologi MARA (UiTM). Designed using a no-code platform, the app provides structured subtopic-based notes and a range of interactive learning games that support both classroom use and self-directed study. This innovation addresses common challenges in higher education, including low motivation, difficulty understanding abstract content, and limited access to engaging digital resources. EduVerse focuses on four selected subtopics: Time Series Data Analysis from STA104 (Introduction to Statistics), Early Theories of Motivation from MGT321 (Organizational Behaviour), Types of Innovation from MGT315 (Creative and Critical Thinking), and Arabic Fruit Vocabulary and Interrogative Words from TAC151 (Foundation Arabic Level II). These subtopics are gamified using platforms such as Wordwall, Genially, Educaplay, and Blooket to enhance student recall, visualization, and interaction through quizzes, puzzles, and matching tasks. The platform is compatible with smartphones, tablets, and laptops, and can be accessed via a single shareable link without the need for installation. EduVerse was developed using the Glide App, a no-code development platform that enabled rapid prototyping and the integration of interactive learning modules across various subjects. By promoting digital literacy, learner autonomy, and meaningful engagement, EduVerse contributes to the advancement of 21st-century education through inclusive and gamified learning experiences.

Keywords: Digital learning, Gamified education, Cross-disciplinary platform, Student Engagement, No-code tools

INTRODUCTION

Students in higher education continue to face a range of learning challenges that affect their engagement, comprehension, and academic performance. One common issue is the difficulty in understanding abstract and theoretical content, particularly in subjects that require conceptual differentiation without immediate real-world application (Saha et al., 2024). Additionally, language proficiency limitations can further hinder comprehension, especially in courses that involve the acquisition of grammar and vocabulary (Woldegiorgis & Chiramba, 2025).

Many educators still rely heavily on traditional lectures and static notes, which may not effectively engage today's students, learners who tend to prefer more interactive, visual, and exploratory teaching strategies (Padilla-Petry et al., 2025). This mismatch between instructional delivery and student learning preferences often contributes to low motivation, particularly in general education courses that students perceive as less relevant to their interests or future careers (Pacadaljen, 2024).

Although gamified and interactive learning tools have gained recognition for their positive impact on student engagement, their integration into the classroom remains limited (Hwang et al., 2023). This is largely due to time constraints and a lack of access to user-friendly digital tools that educators can easily adopt into their teaching practices (Jia-Chi & Lin-Wen, 2012; Khelifi et al., 2022).

EduVerse was developed to address these challenges by offering a gamified educational platform that transforms traditionally passive learning into an engaging and interactive experience. The platform features course-specific digital games that reinforce key concepts, promote active recall, and accommodate diverse learning styles. The following subjects and subtopics were selected for their direct alignment with the general problems described:

STA104 (Introduction to Statistics) – Subtopic: Time Series Data Analysis

Students often struggle to differentiate between time series components such as trend, seasonal, cyclical, and irregular patterns. EduVerse addresses this issue through visually guided games, including true or false quizzes, jump-style MCQs, and escape room challenges that support conceptual clarity in an engaging and interactive format.

MGT321 (Organizational Behaviour) – Subtopic: Early Theories of Motivation

Motivation theories can appear repetitive and disconnected from real-life applications. EduVerse makes this content more accessible through gamified video lessons and interactive games that promote active recall and enhance student understanding of Maslow, Herzberg, and McClelland's theories.

MGT315 (Creative and Critical Thinking) – Subtopic: Types of Innovation

Students often struggle to distinguish and apply various types of innovation. EduVerse simplifies these concepts using Minecraft-style animated video storytelling, multiple-choice quizzes, and classification tasks that encourage visual recognition and deeper comprehension.

TAC151 (Foundation Arabic Level II) – Subtopic: Arabic Fruit Vocabulary and Interrogative Words

Language learning frequently relies on memorization without meaningful reinforcement. EduVerse supports Arabic learning through word search and quiz-based games that enhance vocabulary recognition and reinforce the use of basic interrogative structures.

By addressing these subtopic-specific challenges through gamified learning tools, EduVerse offers a unified solution that supports student motivation, enhances learning outcomes, and fosters inclusive, student-centered education across disciplines.

METHODOLOGY

The development of EduVerse followed a structured, student-centered approach to support teaching and learning across multiple university-level courses, including STA104, MGT321, MGT315, and TAC151 at Universiti Teknologi MARA (UiTM). The process involved four main phases: planning, development, implementation, and evaluation. During the planning phase, course syllabi were reviewed to identify key subtopics that are essential, frequently misunderstood, or conceptually difficult for students. The selected subtopics were mapped out for gamification and content integration. These subtopics were chosen for their potential to be enhanced through visuals, interactivity, and gamified learning strategies.

In the development phase, EduVerse was built using Glide Apps, a no-code mobile-responsive platform. The platform's interface was designed to be intuitive and modular, allowing students to access structured notes, short video content, and embedded educational games seamlessly. Gamified activities were developed using third-party tools, including Genially, Blookey, Wordwall, Educaplay, and LearningApps, to ensure rich multimedia experiences. Each subject module featured a combination of structured content and game-based learning to promote active engagement and mastery of concepts.

The implementation phase took place in actual class settings, where lecturers introduced EduVerse as a supplementary learning tool. Students were encouraged to access the platform during and beyond lecture hours, using it for revision, collaborative activities, and independent practice. For the evaluation phase, feedback was collected from 30 students using the Mentimeter platform. They were asked to describe their experience with EduVerse in three words. The responses were visualized using a word cloud to identify common themes and assess the platform's overall impact on student motivation, interactivity, and learning engagement. Figure 1 shows the user interface of EduVerse.

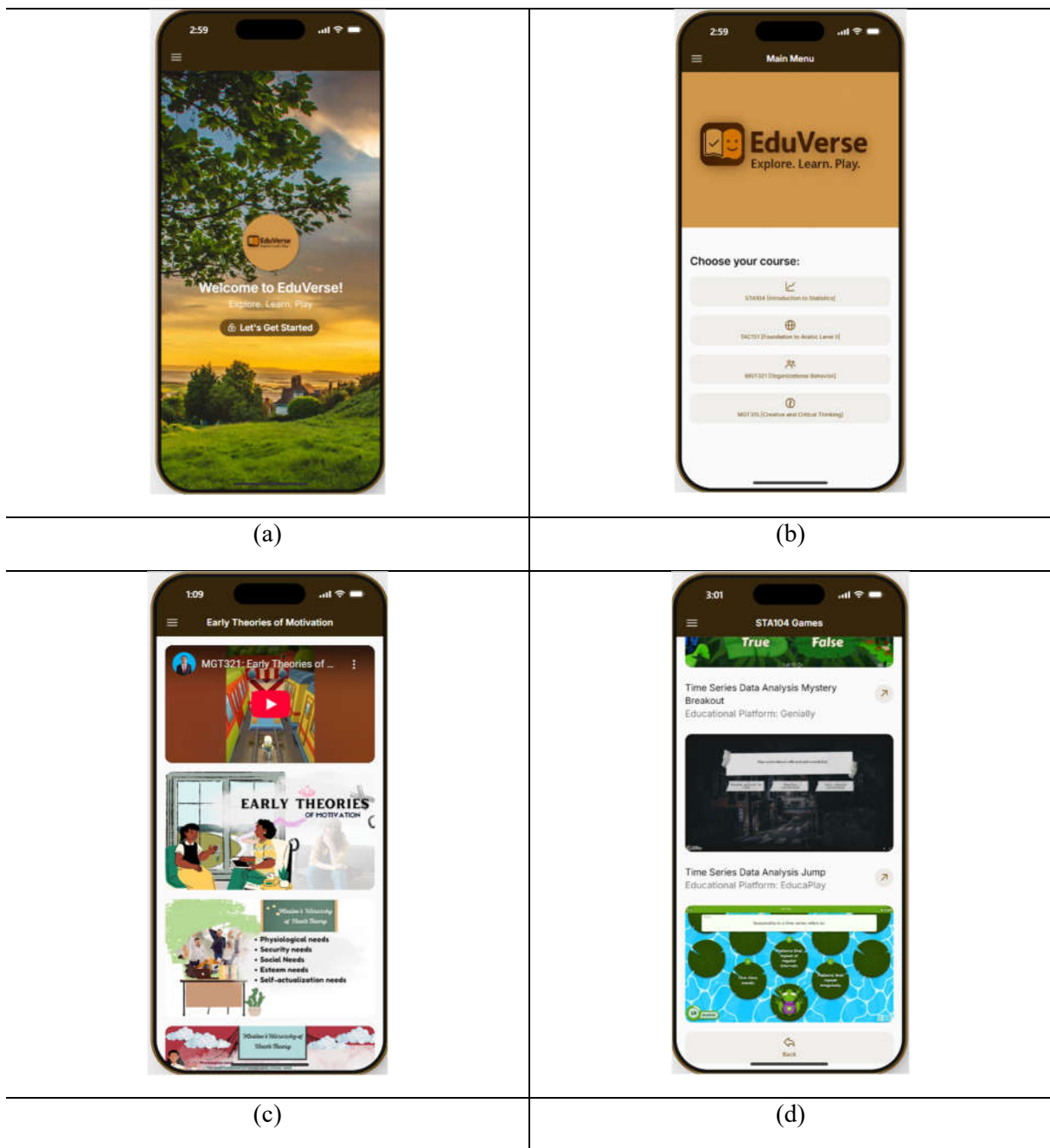


Figure 1.: User Interface of EduVerse

Figure 1 illustrates the user interface of the EduVerse app, designed to support student learning in a fun and organized manner. Screen (a) welcomes users to the platform. Screen (b) is the main menu where students can choose their course. Screen (c) displays learning subtopics, accompanied by helpful videos and notes. Screen (d) features game-based activities that make learning more interactive and enjoyable, helping students better understand key subtopics.

RESULTS AND DISCUSSION

The qualitative feedback gathered from 30 students was analyzed to explore their initial impressions of the EduVerse platform. Students were asked to describe their experience using three words, and their responses were compiled into a word cloud, as shown in Figure 2.



Figure 2.: Mentimeter Results for EduVerse

Figure 2 presents the most frequently mentioned words from students regarding their experience with EduVerse. Among the most common responses were "interesting," "fun," and "innovative," indicating that students found EduVerse engaging and creatively designed. Other notable words included "interactive," "user-friendly," "educational," and "motivational," reflecting positive perceptions of its usability and learning value. The feedback highlights EduVerse's potential as a meaningful digital learning tool. The platform was generally seen as enjoyable and interactive, which supports its aim of enhancing student engagement through game-based and structured learning. Future iterations of EduVerse could benefit from expanded features and wider implementation to further evaluate its impact on learning outcomes.

CONCLUSION

EduVerse is an innovative, multi-platform digital learning solution designed to boost student engagement through interactive, syllabus-aligned games. It not only supports content mastery but also cultivates essential 21st-century skills such as critical thinking, digital literacy, and self-directed learning. Developed using free no-code tools, EduVerse is accessible across devices and requires no technical expertise, making it both scalable and cost-effective for broader educational use.

The platform contributes to the goal of quality education (Sustainable Development Goal 4) by offering an inclusive and engaging alternative to traditional learning methods. By going fully digital, EduVerse also supports environmental sustainability and broadens access to quality resources. Student feedback has been overwhelmingly positive, with responses highlighting its enjoyable, innovative, and user-friendly nature. These outcomes underscore EduVerse's potential to transform higher education by delivering effective, meaningful, and future-ready learning experiences.

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EMPOWERING LIFELONG LEARNING THROUGH MICRO-CREDENTIALS IN SOCIAL SECURITY EDUCATION

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ABSTRACT

Financial literacy is a crucial component of effective financial decision-making, particularly concerning social security programs. In Malaysia, many individuals lack a comprehensive understanding of the various social security schemes, leading to inadequate financial planning, insufficient retirement funds, and underutilization of social security benefits. To address this issue, this study explores the integration of Micro-Credentials (MCs) as a transformative learning approach aimed at enhancing financial literacy through digital education. The UiTM uFuture platform serves as the foundation for delivering structured, competency-based courses that cater to diverse learners (<https://ufuture.uitm.edu.my/courses/overview/UMC381>). This innovation examines the implementation of MCs as an alternative to traditional financial education, emphasizing self-paced, modular, and interactive learning. The study employs a mixed-methods approach, including surveys, pre- and post-assessments, and participant feedback, to evaluate the effectiveness of MC-based learning. The pilot study involved 40 participants from diverse backgrounds, assessing their engagement levels, knowledge retention, and confidence in managing their financial security. The findings reveal that 87% of participants found the content highly engaging, while 88% reported increased confidence in making financial decisions regarding their social security benefits. The study underscores the potential of MCs in democratizing financial education by making learning more accessible, flexible, and engaging. By equipping individuals with essential financial knowledge and decision-making skills, this initiative supports the broader goal of fostering financial resilience and long-term economic stability. The adoption of MCs in social security education offers a scalable and sustainable approach to lifelong learning, ensuring continuous financial empowerment among Malaysians.

Keywords: *Micro-Credentials, Social Security, Employees' Provident Fund, Financial Literacy, Lifelong Learning*

INTRODUCTION

Social security programs provide financial security and social welfare benefits, but a lack of awareness among the Malaysian population has led to poor financial preparedness. Traditional financial education methods, such as seminars and printed brochures, present challenges in accessibility and engagement. Digital transformation in education offers new opportunities to enhance learning experiences through Micro-Credentials (MCs). These structured, flexible, and competency-based courses allow learners to acquire financial literacy skills at their own pace. This paper explores how MCs address the knowledge gap in social security education and contribute to greater financial empowerment (Chek et al., 2022, 2023; Chek & Ismail, 2023; Ismail et al., 2023; Shamir-Inbal & Blau, 2020).

METHODS

The study utilizes the uFuture MC platform to develop structured, modular courses on Malaysia's key social security programs, including the Government Pension Scheme, Employees' Provident Fund (EPF), Social Security Organisation (SOCSO), and Private Retirement Scheme (PRS). The curriculum integrates video lectures, real-world case studies, assessments, and interactive simulations to enhance engagement and knowledge retention. A pilot study was conducted, involving 40 participants from diverse professional backgrounds. Their learning experiences, engagement levels, and financial decision-making confidence were evaluated through structured surveys and pre-and post-assessment tests (Abror, 2022; Cerón et al., 2021; Gandomkar et al., 2020; Jossberger et al., 2020; Yu et al., 2020).

RESULTS AND DISCUSSION

The pilot study findings indicate that MCs significantly improve financial literacy and engagement levels. Approximately 87% of participants found the content accessible and engaging, while 88% expressed increased confidence in managing their social security benefits. Learners appreciated the flexibility of self-paced learning, and the practical applicability of the knowledge gained. The integration of digital certifications added professional value, making MCs a credible option for lifelong learning. These results underscore the importance of incorporating MCs into national financial education initiatives to enhance public awareness and preparedness (Chek et al., 2019; Ekrami et al., 2020; Ismail et al., 2023).

CONCLUSION

Micro-Credentials present a transformative approach to financial education, offering structured, accessible, and competency-based learning experiences. The results of this study highlight the effectiveness of MCs in bridging the financial literacy gap and improving engagement with social security programs. As Malaysia moves towards digital learning transformation, integrating MCs into broader educational and workforce training initiatives can ensure widespread financial empowerment. Future research should explore the long-term impact of MC-based learning on financial behaviors and retirement planning outcomes (Cazan, 2020).

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ENGINEERING DYNAMICS REIMAGINED: A GAMIFIED ONLINE LEARNING PLATFORM

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ABSTRACT

Conventional teaching methods in engineering dynamics frequently do not accommodate the varied learning requirements of contemporary digital-native students. This paper presents Dynamics in Life, a gamified web-based learning platform that utilizes digital tools such as Wordwall, Kahoot, and Quizzes to improve student engagement, retention, and conceptual comprehension. The platform incorporates interactive simulations, real-time feedback, adaptive quizzes, and reward-based progress systems, aimed at tertiary learners and pre-university physics students. The platform, grounded in constructivist learning theory and gamification frameworks, targets cognitive and affective learning domains. Following Sustainable Development Goals (SDG 4 and SDG 9), the solution fosters equitable access to more effective STEM education. An evaluation involving 78 students in the initial learning outcome study revealed statistically significant enhancements in understanding and motivation, while a subsequent reflection survey with 222 students provided more profound insights into engagement, development challenges, and SDG awareness. In conclusion, Dynamics in Life demonstrates that gamified, web-based learning can effectively transform the teaching of complex engineering concepts and inspire greater student engagement.

Keywords: Gamified Learning, STEM Education, Engineering Dynamics, Interactive Learning

INTRODUCTION

In recent years, engineering education has faced growing concern over students' declining engagement and difficulty mastering complex theoretical subjects like dynamics. Traditional lecture-based approaches often fail to capture student interest, resulting in poor retention and limited real-world application. These challenges are particularly evident in engineering dynamics, where abstract

principles such as kinematics and kinetics are central yet conceptually demanding. Current research in engineering education emphasizes the need for innovative, technology-driven strategies to bridge the gap between theory and practice. Among these, gamification and interactive learning platforms have emerged as promising solutions to enhance engagement and learning outcomes (Freeman et al., 2014; Deterding et al., 2011). Several studies have explored using Kahoot, Wordwall, and online quizzes to increase student motivation and participation in STEM courses (Plump & LaRosa, 2017). However, despite their popularity, few initiatives have successfully integrated these tools into a unified, scalable, and subject-specific mobile learning platform tailored to engineering dynamics. This paper presents Dynamics in Life, a gamified mobile app designed to transform the learning experience for engineering dynamics students. The app incorporates adaptive quizzes, simulations, real-time feedback, and level-based challenges to support self-paced, interactive learning. Our findings demonstrate that students using this platform showed increased engagement, improved conceptual understanding, and greater motivation to apply dynamics principles in problem-solving.

METHODS

This methodology outlines the approach to developing and evaluating a gamified learning platform for engineering dynamics. Recognizing the limitations of traditional teaching methods, the project aimed to create a more engaging and effective learning environment through technology-enhanced strategies. The development began by integrating familiar tools such as Wordwall, Kahoot, and Quizzes into a structured, game-based learning sequence tailored to student needs. Care was taken to ensure the content aligned with core dynamics topics such as kinematics, kinetics, and Newtonian motion, and was adaptable across various educational settings. Each game module was carefully tested to ensure it provided real-time feedback, adaptive progression, and challenge-based learning. The methodology builds upon successful gamification frameworks referenced in prior educational research, supporting its use as an active learning intervention. The platform was refined through student feedback and performance metrics to ensure high usability and academic relevance. Quantitative data from surveys and in-class assessments were collected to evaluate student engagement and understanding. One challenge was ensuring consistent digital access for all students, which was addressed by optimizing the platform for low-bandwidth environments.

RESULTS AND DISCUSSION

Applying innovative teaching strategies is critical to addressing engineering education's persistent challenges, particularly in increasing student engagement and conceptual understanding of complex topics such as dynamics. Based on constructivist and motivational theories, gamified learning approaches have shown great potential for transforming passive learning environments into interactive and impactful educational experiences. Evaluating the effectiveness of such techniques is critical for informing future curriculum design and ensuring that technological interventions have a meaningful impact on learning outcomes. The following section presents the demographic profile of participants

and analyzes their feedback to determine the effect of the gamified learning platform developed in this study.

Table 1 shows the 222 students' demographic profile in the gamified engineering dynamics learning platform reflection survey. Of the respondents, 49.5% were male (110 students) and 50.5% were female (112). The majority were in Semester 4 (53.2%) and Semester 5 (41.0%), with smaller proportions in Semesters 6 (2.3%), 7 (1.4%), and 8 (0.5%). Regarding year of study, 43.2% were Year 2 students, followed by 41.4% in Year 3, 9.9% in Year 4, and 5.4% in Year 1. Regarding educational background, 75.7% held diplomas, 18.9% came from matriculation, while the remaining students held qualifications such as foundation (1.8%), bachelor's degree (1.4%), degree (1.4%), diploma in science (0.9%), bachelor's in civil engineering (0.5%), and diploma science (0.5%). This distribution reflects a diverse sample across gender, academic levels, and prior educational pathways relevant to the study context.

Table 1.: The demographic profile of students involved in the gamified engineering dynamics learning platform reflection survey

Demographic Aspect	Category	Count	Percentage (%)
Total respondents	-	222	100
Gender	Male	110	49.5
	Female	112	50.5
Semester	4	118	53.2
	5	91	41.0
	6	5	2.3
	7	3	1.4
	8	1	0.5
Year of study	Year 1	12	5.4
	Year 2	96	43.2
	Year 3	92	41.4
	Year 4	22	9.9
Educational background	Diploma	168	75.7
	Matriculation	42	18.9

Demographic Aspect	Category	Count	Percentage (%)
	Foundation	4	1.8
	Bachelor's Degree	3	1.4
	Degree	3	1.4
	Diploma in Science	2	0.9
	Bachelor's in civil engineering	1	0.5
	Diploma Sains	1	0.5

Implementing the gamified learning platform for engineering dynamics yielded positive outcomes (See Table 2). Based on the feedback collected, over 80% of students found the game-based approach practical or effective in enhancing their learning experience. Furthermore, 87.8% of students agreed that gamification was effective for mastering dynamics principles. In addition, 79% reported that the gamified platform helped them understand complex engineering topics more clearly, demonstrating increased engagement and deeper cognitive processing. Nearly 78% of participants stated they better understood sustainability concepts (SDGs) through this approach, suggesting that embedding real-world themes into learning modules can broaden students' awareness and foster interdisciplinary thinking.

Table 2.: Students' feedback and evaluation results for the gamified engineering dynamics learning platform

Aspect Evaluated	Key Findings	Percent age (%)
Overall effectiveness	Found the game-based approach practical or effective	>80
Mastery of dynamics principles	Agreed, gamification was effective for mastering dynamics	87.8
Conceptual understanding	Reported a better understanding of complex engineering topics	79
Understanding of SDGs (4 & 9)	Gained a better understanding of sustainability concepts	78
Challenges faced	Difficulty designing meaningful questions Faced technical limitations/lack of platform experience	45 30
Strategies to overcome challenges	Used brainstorming sessions	65

Aspect Evaluated	Key Findings	Percent age (%)
Balancing learning and entertainment	Conducted peer testing	52
	Self-learned via online tutorials	28
	Applied gamification techniques (points, badges, challenges)	60
	Integrated memes and visuals	35
	Aligned questions to learning objectives	72
	Structured games with progressive difficulty levels	49
	Made dynamics more interactive and less boring	83
	Helped visualise forces and motion	78
Perceived benefits	Encouraged active participation and practical application	65
	Enhanced understanding of abstract concepts through animations	58
	Practiced clear communication, task delegation, mutual respect	70
Teamwork and collaboration	Divided tasks based on strengths	68
	Faced challenges in time management and workload distribution	31
	Suggested adding more questions or levels	55
Recommendations for improvement	Recommended adaptive difficulty levels	47
	Proposed improved visuals and interface design	39
	Suggested storytelling integration	28
	Proposed adventure-based gameplay	24
	Recommended enhanced feedback systems	32
Promotion of SDG4 (Quality Education)	Believed the game fostered critical thinking, problem-solving, and conceptual understanding	>80
Promotion of SDG9 (Industry, Innovation, Infrastructure)	Noted relevance to real-world engineering applications (e.g. automotive, rocket propulsion)	65

These results collectively highlight that gamified learning offers a meaningful alternative to traditional methods. The platform's interactive elements, such as immediate feedback, challenge missions, and adaptive quizzes, made learning enjoyable and enhanced student motivation and retention. However, one limitation observed was the dependency on digital access, which may affect scalability in low-connectivity environments. Despite this, the model remains adaptable, scalable, and relevant across diverse educational settings, especially for STEM and engineering education.

CONCLUSION

The advancement of Dynamics in Life represents a pivotal progression in the pedagogy of engineering dynamics. This innovation effectively enhances student engagement, improves conceptual understanding, and connects theoretical knowledge with real-world application by incorporating gamification and interactive digital tools into the learning process. The favourable responses from students underscore the efficacy and pertinence of this method in contemporary engineering education. Due to its scalability, cost-effectiveness, and adaptability across various educational tiers, Dynamics in Life possesses significant potential for widespread integration in STEM education. The platform can serve as a prototype for other disciplines, fostering a more engaging, student-centered, and future-oriented educational environment. In conclusion, the results demonstrate that gamified learning significantly enhances student engagement, understanding, and motivation in engineering dynamics education.

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ENHANCING ACTUARIAL EDUCATION DIGITAL INNOVATION via MINDAPPZ EBOOK

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ABSTRACT

The advancement of digital education has significantly improved higher education delivery, particularly in technical fields like actuarial mathematics. This study investigates the effectiveness of the MindAppz eBook, Introduction to Actuarial Mathematics, in enhancing students' comprehension, retention, and engagement. Employing a mixed-methods approach—including surveys, interviews, and performance comparisons—the study found that students who used the eBook performed 12% better in post-tests and demonstrated improved understanding in key actuarial topics such as annuities, premiums, and reserves. While the digital format encouraged independent learning and increased engagement, some students experienced digital fatigue and preferred hybrid approaches. These findings support the integration of blended learning models in actuarial education and highlight the importance of interactive and adaptive digital resources for future curriculum design.

Keywords: Actuarial Mathematics, eBooks, Digital Learning, Student Engagement, Hybrid Education, Educational Technology, MindAppz

INTRODUCTION

Actuarial mathematics is a discipline requiring high levels of numerical and theoretical competence. Traditionally taught via lectures and textbooks, the integration of digital tools like the MindAppz eBook represents a transformative step (Palmer et al., 2022). The study aims to evaluate whether digital tools improve learning outcomes, how they affect student engagement, and what limitations may exist in digital-only delivery (Rzyankina et al., 2024).

METHODS

A mixed-methods approach (survey and interview) was applied. Data collection involved (1) a student survey of 100 undergraduate actuarial science students at UiTM; (2) interviews with five actuarial educators; and (3) comparative analysis of two student cohorts one using the eBook and another using printed textbooks for the feedback (Lee & Shin, 2021).

RESULTS AND DISCUSSION

Students using the MindAppz eBook demonstrated a 12% (*see Improvement (%) Table 1*) average improvement in post-test scores.

Table 1.: Comparison Of Student Performance (Pre- and Post-Ebook Usage)

Metric	Traditional Textbook Users	MindAppz eBook Users
Pre-eBook Score (Avg)	62	62
Post-eBook Score (Avg)	68	74
Improvement (%)	6	12

Specific gains included 15% in annuity calculations and 13% in surrender and paid-up value understanding. Engagement was higher among eBook users, who spent 25% more time studying. Survey data showed 78% felt their understanding improved, though 29% reported digital fatigue.

Table 2.: Student Survey Results on Engagement and Learning Experience

Survey Question	Yes (%)	No (%)
Did the eBook improve your understanding of actuarial concepts?	78	22
Did you find the eBook engaging?	72	28
Did you experience digital fatigue while studying?	29	71
Would you prefer a hybrid learning approach (eBook + printed materials)?	84	16

Table 3.:Summary Of Key Findings

Key Learning Factors	MindAppz eBook Users	Traditional Textbook Users
Comprehension Improvement	Higher (+12%)	Moderate
Self-Paced Learning	Strong (72% positive feedback)	Limited
Engagement & Time Spent	More study time (+25%)	Less interactive
Retention Rate	68%	72%
Preferred for Practical Exercises	High (80% positive feedback)	Moderate
Technical/Cognitive Challenges	Digital fatigue (29%)	None

Retention rates one-month post-study were slightly higher among traditional textbook users (72%) compared to eBook users (68%). The eBook's structured layout and interactive features contributed positively to learning. However, its limitations, such as screen fatigue and difficulties in solving mathematical problems in a digital format, suggest that hybrid models may be more effective. Educators should combine digital tools with traditional resources to optimize results.

CONCLUSION

Digital resources like the MindAppz eBook enhance conceptual understanding and engagement in actuarial education (M. Chek et al., 2020; R. Chek et al., 2020; Ridzuan et al., 2018). However, for optimal outcomes, hybrid strategies that balance the benefits of digital flexibility with the tactile engagement of traditional methods are recommended (Shechtman et al., 2019). Future improvements should focus on AI interactivity, adaptive learning, and gamification (Rzyankina et al., 2024; Tigrero et al., 2024; Weiss & Bitan, 2018).

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ENHANCING ENGLISH VOCABULARY ACQUISITION AMONG DIPLOMA STUDENTS THROUGH MAGNETIC COMPOUND WORD BOARD GAMES (WORMSMITHERY GAME)

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ABSTRACT

Vocabulary acquisition is a crucial component of English language learning, especially for diploma students who need strong communication skills for academic and career purposes. However, traditional vocabulary teaching methods often rely on memorization, which may not engage students or support long-term retention. This study investigates the effectiveness of a magnetic compound word board game in enhancing English vocabulary acquisition among diploma students. The game involves combining two separate words to form a compound word (e.g., house + maid = housemaid), making the learning process more interactive and engaging. A total of 40 diploma students were divided into two groups: the experimental group used the magnetic board game during vocabulary lessons, while the control group followed a traditional textbook-based approach. Pre-tests and post-tests were administered to both groups, with results measured as percentages. The experimental group's vocabulary scores improved from an average of 58% to 85%, showing a 27% increase. In contrast, the control group's scores improved from 60% to 68%, an 8% increase. These results indicate that the use of a magnetic compound word game significantly improves vocabulary retention compared to conventional methods. The hands-on, visual, and interactive nature of the game likely contributed to better student engagement and understanding of word formation. This study suggests that incorporating educational games into English vocabulary instruction can be an effective strategy to support language learning among diploma-level students.

Keywords: English learning, vocabulary acquisition, compound words, educational games, diploma students

INTRODUCTION

Vocabulary acquisition is fundamental to language proficiency, particularly for diploma students who require a robust lexicon for academic and professional success. Traditional methods of vocabulary teaching often rely on rote memorization, which may not effectively engage students or promote long-term retention. Innovative approaches, such as educational games, have been proposed to address these challenges by making learning more interactive and enjoyable.

Recent studies have highlighted the benefits of incorporating games into vocabulary instruction. Khusaini and Fauziah (2024) demonstrated that word games significantly improved students' English vocabulary proficiency, with the experimental group showing a notable increase in post-test scores compared to the control group. Similarly, Daviti (2024) emphasized that games, especially those involving movement and play, enhance learners' interest and attention, leading to better retention of new words.

Compound word games, in particular, have been recognized for their educational value. According to JoyAnswer.org (2023), such games help improve vocabulary, language skills, and creativity by encouraging students to form new words through the combination of smaller ones. These findings suggest that integrating compound word games into the curriculum could be a promising strategy for vocabulary enhancement.

METHODS

The study involved 60 diploma students enrolled in an English language course at a Malaysian university. Participants were randomly assigned to either the experimental group ($n=30$) or the control group ($n=30$). A pre-test and post-test, each consisting of 50 vocabulary items, were administered to assess students' vocabulary knowledge before and after the intervention. The tests included multiple-choice questions and word formation tasks focusing on compound words.

Over a period of four weeks, the experimental group engaged in sessions using the magnetic compound word board game. The game involved matching pairs of words to form compound words, with immediate feedback provided through the magnetic board setup. Meanwhile, the control group received traditional vocabulary instruction through lectures and textbook exercises. A pre-test was given to both groups to assess their initial vocabulary knowledge (focused on compound words). The experimental group played a magnetic board game where students matched two words to form compound words (e.g., *rain* + *coat* = *raincoat*) for 4 weeks (2 sessions/week). The control group continued with regular vocabulary exercises using worksheets and textbook definitions. After 4 weeks, a post-test was administered to both groups. Both pre-tests and post-tests consisted of 30 multiple-choice questions based on compound word formation and usage. Results were measured using percentage scores (correct answers out of 30). Data were analysed using paired sample t-tests to compare pre-test and post-test scores within and between groups. Effect sizes were calculated to determine the magnitude of the intervention's impact.

RESULTS AND DISCUSSION

The experimental group showed a significant improvement in vocabulary scores, with mean pre-test and post-test scores of 60% and 85%, respectively ($p < 0.001$). In contrast, the control group's scores improved from 62% to 70% ($p < 0.05$). The effect size for the experimental group was large ($d = 1.2$), indicating a substantial impact of the board game intervention.

These findings align with previous research suggesting that interactive games enhance vocabulary acquisition. The magnetic compound word board game likely facilitated better retention by engaging students in active learning and providing immediate feedback. Moreover, the tactile and visual elements of the game may have catered to diverse learning styles, further supporting vocabulary development.

Table 1. Pre-test and Post-test Scores by Group

Group	Average Pre-test Score (%)	Average Post-Test Score (%)	Improvement (%)
Experimental	58%	85%	+27%
Control	60%	68%	+8%

Based on the Table 1 above, the experimental group using the magnetic board game showed a significant improvement in vocabulary (27% gain). The control group showed only a modest increase (8% gain). This suggests that interactive learning through games is more effective for teaching compound vocabulary to diploma students than traditional methods.

CONCLUSION

The study provides evidence that magnetic compound word board games are effective tools for enhancing English vocabulary among diploma students. By making learning interactive and engaging, such games can lead to significant improvements in vocabulary retention. Educators are encouraged to incorporate similar game-based strategies into their teaching to foster better learning outcomes.

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ENHANCING TAX EDUCATION THROUGH MULTI-FORMAT GAMIFIED LEARNING TOOLS

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ABSTRACT

A gamified learning platform has been developed to make the study of taxation more engaging and accessible for undergraduate students. Featuring a range of interactive games, the platform includes a journey-based progression game where a character advances by answering tax questions correctly, as well as drag-and-drop tasks, fill-in-the-blank activities, and real-life scenarios enhanced with AI characters and voice interaction. These games cover various tax topics; each tailored with different levels of difficulty based on the topic's complexity and intended learning outcomes. By transforming technical tax content into interactive and relatable experiences, the platform helps students grasp complex concepts more effectively while encouraging active participation and critical thinking. The enjoyable and student-friendly design reduces learning anxiety and supports deeper understanding and practical application. With its potential for use not only in classrooms but also in professional training, this gamified approach offers a fresh and innovative solution for improving tax education through technology.

Keywords: *Gamified learning, Taxation, Undergraduate students, Interactive games, Education innovation*

INTRODUCTION

Traditional methods of teaching tax topics are often perceived as dry, technical, and difficult to grasp, leading to disengagement and lack of motivation among learners (Pillai et al., 2025). The integration of interactive games into tax courses within accounting education represents an innovative pedagogical approach that enhances learning engagement, retention, and application (Kao, Yuan & Wang, 2023; Anwar & Mulyadi, 2025). Interactive educational games that utilize formats such as drag and drop, progressive journey, fill-in-the-blank, and real-life scenarios have been widely acknowledged for their

capacity to support active learning. Incorporating AI-driven characters and avatars with voice capabilities, visual animations, and sound effects further enhances the learning experience by catering to diverse learning styles; auditory, visual, and kinesthetic.

Despite the importance of tax literacy, students often struggle with understanding tax principles due to the abstract nature of tax laws and calculations. Existing educational tools lack interactivity and real-world relevance, resulting in passive learning and limited knowledge retention. There is a clear gap in the availability of gamified learning tools tailored specifically to the Malaysian tax system and aligned with local syllabus. Moreover, current solutions do not adequately address the needs of learners with different cognitive preferences and learning styles.

Gamification has been increasingly accepted as a teaching tool in higher accounting education (Queiro-Ameijeras et al., 2019) and in continuing education for accounting professionals (Surgent, 2022). Gamification provides an engaging learning environment that enhanced perception of the knowledge and improved performance (St Bernard, 2023). The most impactful features of gamification are that it provides immediate feedback, allows experimentation and freedom to fail, interactive user interface, and enhanced understanding through visual representation of process (St Bernard, 2023). Among the gamification benefits to the accounting students are higher levels of satisfaction as compared to traditional methodologies, the development decision making and teamwork skills and higher awareness accounting application due to immediate feedback provided on their decisions (Queiro-Ameijeras et al., 2019). In addition, gamification also creates an interesting accounting teaching and learning environment, encourages and subsequently increases critical thinking skill and increases comprehension on accounting knowledge (Rosli, Khairudin & Saat, 2019). It is suggested that an effective game should be part of different teaching methods such as introductory lectures and must be contextualized and integrated with prior-session and post-session information and activities (Scurati et al., 2023).

Prior studies have emphasized the effectiveness of gamification in higher education, highlighting improvements in student motivation, engagement, and performance. Research on tax education has also suggested that interactive learning methods improve conceptual understanding and real-life application of tax rules. For example, the use of simulations and role-plays has shown positive outcomes in accounting and finance education. Similarly, Novianto et al. (2024) mentioned that applying gamification, board games, metaverse and AI in tax education is a long-term process. Therefore, stages and processes are needed to develop the system. However, few studies have developed or tested comprehensive gamified tools with multiple formats tailored to tax education.

Therefore, this project introduces a multi-format gamified approach to tax education that uniquely blends pedagogy with technology. It is among the first to integrate a variety of interactive formats including AI avatars with voices, animations, and structured levels into one cohesive tax learning platform. The design addresses multiple learning styles, making it more inclusive and effective. Unlike single-format games, this product offers flexibility and diversity in learning paths, thus accommodating the varied preferences and cognitive needs of learners.

METHODS

This innovation project followed a design-based research (DBR) methodology. The development phase involved creating a suite of interactive games based on core tax topics such as personal income tax, business income, capital allowances, and Real Property Gains Tax (RPGT). The games were designed using various formats such as drag and drop, fill in the blank, progressive journey with obstacles, and real-life scenarios using AI characters and voices. Each game was structured into levels of difficulty, enabling scaffolded learning. The research method employed in this study involved the distribution of questionnaires to gather feedback regarding the game. The measurements in the questionnaires were adapted from the previous research conducted by Scurati et al. (2023). There are four sections involved in the questionnaire. Section A asked about the basic demographic profile of the students. Section B asked about the respondents' perception towards the tax game that consists of five components separately, with five questions each, rated on a 5 Likert scale ranging from (1) Strongly Disagree; (2) Disagree; (3) Neutral; (4) Agree; (5) Strongly Agree. These five components included gaming experience, system thinking, knowledge, awareness/attitude as well as openness and collaboration. Section C asked about the respondents' satisfaction towards the tax game while the last section asked about any comments from the respondents regarding the game for future improvement. A total of 101 responses were received from the participants. The descriptive analysis was used to summarize the data.

RESULTS AND DISCUSSION

Table 1 presents the demographic profile of the respondents involved in the survey. Based on this table, most of the students consist of female students, aged between 20 to 29 years old and have CGPA above 3.00 pointer.

Table 1.: Demographic Profile of Respondents

Gender of respondents:	Frequency	Percentage (%)
Male	29	28.7
Female	72	71.3
Age of respondents:		
Under 20 years old	0	0
20 – 29 years old	101	100
30 – 39 years old	0	0

40 years old and above	0	0
CGPA:		
Below 2.00	3	3.0
2.00 – 2.49	7	6.9
2.50 – 2.99	13	12.9
3.00 – 3.49	51	50.5
3.50 – 4.00	27	26.7

Figure 1 illustrates the feedback obtained from the students regarding their perception towards tax games. Based on these results, most of the respondents (95%) agreed and strongly agreed that they have experienced enjoyable and fun for the game. Besides that, they also agreed that the game was able to improve their level of understanding and increase their knowledge about taxation. In addition, many of them (93%) also believe that this game made them more aware and concerned about the importance of taxation for the country. In terms of openness and collaboration, most of the respondents (94%) agreed that the game allowed them to foster their collaboration skills, and they are also willing to share the experience with other students either from different or same course.

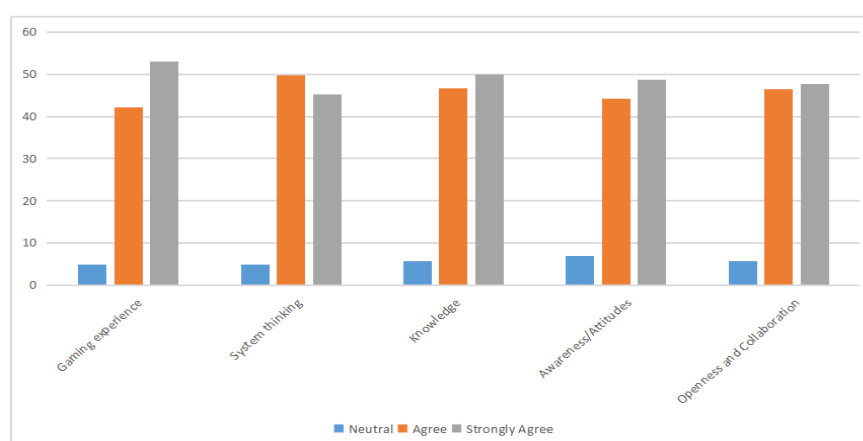


Figure 1.: Students' Perception Towards Tax Game

Figure 2 presents the results about the level of satisfaction among the respondents towards the game. Based on these results, it can be concluded that most of the respondents (88.1%) were satisfied with the game. However, there were some comments that we managed to gather throughout this survey. Among

of these comments include: (1) *I love how the game was created since it has a lot of information, and it was given in infographic types which makes students excited and easier to understand the topics. I would like to suggest putting the correct answer or information if the player choose the wrong answer so that they can learn and know the correct answer directly and learn from it,* (2) *The objective of the game is very clear, and it makes me easier to understand about tax. Other than that, by playing the game, it helps me to memorize better about the taxation topic,* (3) *This game is very fun, and the animation is very impressive. I personally think that I've learned so much regarding tax just from playing the game.* All these comments were important for us to improve the game in the future, especially in terms of design and content.

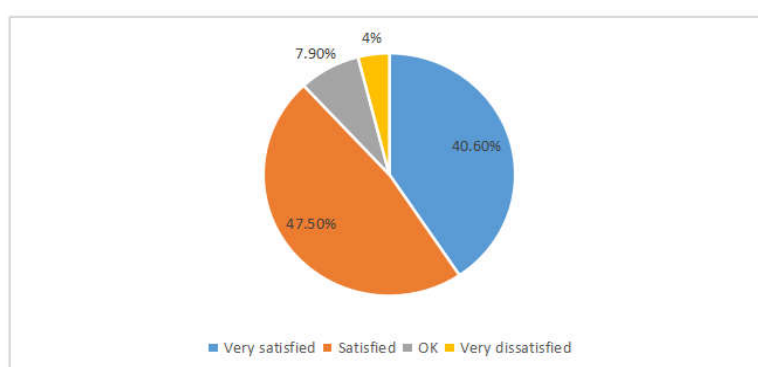


Figure 2.: Level of Satisfaction Towards Tax Game

CONCLUSION

This innovation project successfully demonstrates that tax education can be transformed into an engaging, interactive, and effective learning experience using multi-format gamification. By integrating game-based learning strategies, AI elements, and sensory-rich features, the platform addresses common learning barriers in tax education. The positive learning outcomes and enthusiastic feedback from students affirm the project’s impact and potential for broader application across educational institutions.

Integrating gamification into tax courses may address the challenges faced by students in studying tax, including the complexity of the subject matter and the lack of engagement. By offering an interactive and immersive learning experience, this multi-format tax game enhances understanding, promotes practical application, increases engagement and interest, encourages critical thinking, and facilitates knowledge retention. This innovative approach has the potential to revolutionize tax education, making it more accessible, enjoyable, and effective for students.

ACKNOWLEDGEMENTS

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ESCAPE ROOM: ISLAMIC BANKING CHALLENGE

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ABSTRACT

This paper outlines Escape Room: Islamic Banking Challenge, an interactive and student-centered teaching activity designed to enhance engagement and understanding of Islamic banking education across all levels of students. The activity places students in a simulated crisis, where they act as Shariah advisors working to unlock a bank's system by completing a series of tasks related to Murabahah financing, types of Islamic contracts, relevant Qur'anic and Hadith sources, and Shariah compliance issues. The escape room activity is based on Kolb's Experiential Learning Theory (1984), which emphasizes learning through experience, reflection, conceptualization, and experimentation. As such, this game offers students an opportunity to learn by solving real-world problems rather than passively receiving information from the lecturer. It also allows them to apply theoretical concepts within a contextually relevant scenario. Through this approach, students can connect theory to practice, collaborate with peers, and develop critical thinking skills. The activity is suitable for both traditional physical classroom settings and online platforms, making it adaptable to current teaching methods such as blended learning and Online Distance Learning (ODL). The inclusion of puzzles, numerical tasks, and ethical dilemmas makes the learning process more enjoyable, practical, and experience-based for students.

Keywords: *Islamic banking, experiential learning, Kolb's learning theory, Shariah compliance and gamification*

RESEARCH BACKGROUND

In many classrooms, Islamic banking is still taught using traditional lectures. While this approach delivers the content, it often leaves students feeling passive and disconnected. New concepts learned by them can seem too hard for them to comprehend. As a result, students may struggle to link theory to practice (Sungkawaningrum et al., 2025). Hence, there's growing interest in more hands-on learning approaches like experiential learning. Kolb's Experiential Learning Theory (1984) highlights that learning is most effective through a cycle of experience, reflection, conceptualization and experimentation. Many educators find this method useful because it helps students remember better,

think deeper, and stay motivated (McCarthy & McCarthy, 2006). In addition, gamification in learning has gained its popularity right now. For instance, Dugnol-Menéndez et al. (2021) showed that students in occupational therapy became more motivated and performed better after using escape-room-style tasks. Likewise, Gordillo & López-Fernández (2024) found similar results among software engineering students who learned through virtual escape rooms. One study used Islamic games to teach children about Shariah-compliant banking and the impact of this game was encouraging where students gained a better grasp of the core principles (Sungkawaningrum et al., 2025). Another example by Masood et al. (2024) focused on halal training found that learners not only engaged more but also retained what they learned better. Even so, there's still a missing link. Many tools still fail to connect classroom theory with real-life practice in a deep and meaningful way especially in Islamic banking education. That's where The Escape Room: Islamic Banking Challenge comes in. This initiative blends Kolb's experiential learning cycle with a Shariah-compliant based on game format. The main question is to ask whether this approach is able to improve motivation, teamwork, and real understanding better than the usual lecture method.

PROBLEM STATEMENT

Islamic banking education at the undergraduate level relies heavily on lectures. This approach limits student engagement and real-world application (Masood et al., 2024). Islamic concepts and other Shariah-compliant contracts require not only understanding but also contextual application and ethical reasoning for a better comprehension. Studies have shown that passive learning environments fail to foster critical thinking or long-term retention especially when dealing with subjects that involve complex financial principles and ethical considerations (Dugnol-Menéndez et al., 2021). As a result, many students may graduate without the ability to effectively analyze or apply Islamic banking concepts in professional settings. There is also a growing demand for learning models that align with digital transformation in education. The shift toward blended and online learning especially after the pandemic ends has exposed gaps in interactive content and meaningful student engagement in Islamic finance courses (Sungkawaningrum et al., 2025).

In Islamic education, gamification is not something new anymore but there is limited research on its structured application especially using experiential learning theory in Islamic banking instruction. This study addresses these gaps by introducing and evaluating a gamified escape-room-style learning activity based on Kolb's Experiential Learning Theory. The aim is to determine whether this innovative approach can improve student engagement, understanding, and application of Islamic banking principles in a more interactive and practical learning environment.

THEORETICAL FRAMEWORK

The theoretical framework for this study is based on Kolb's Experiential Learning Theory (1984), which proposes that effective learning is a cyclical process involving four stages:

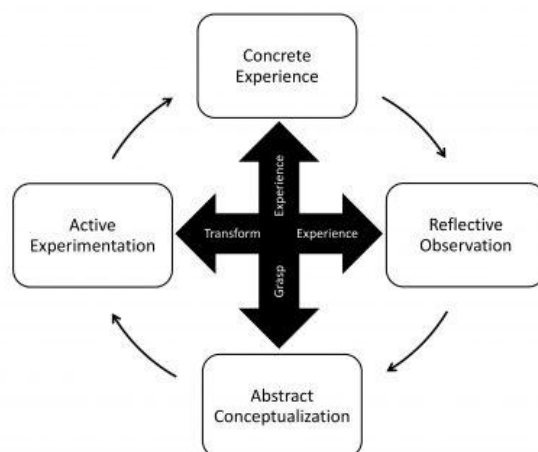


Figure 1.: The Experiential Learning Cycle (Kolb & Kolb, 2017)

1. Concrete Experience – Learning by doing (students participate in an escape room simulation).
2. Reflective Observation – Thinking about what was done (students reflect during and after each task).
3. Abstract Conceptualization – Learning from experience (students link tasks to Islamic banking theories).
4. Active Experimentation – Trying out what was learned (students apply theories to new challenges in the game).

METHODOLOGY

This study uses a research approach that combines both qualitative and quantitative methods. The study examines how the escape room helps students learn Islamic Banking. This approach is chosen because it allows the researcher to collect both numbers and detailed opinions to give a full picture of what is happening during the learning process (Creswell & Plano Clark, 2017). The participants in this study will be undergraduate students who are taking a course in Islamic banking or Islamic finance. The researcher will use purposive sampling, which means selecting students who already have basic knowledge of Islamic finance. This ensure data is relevant (Etikan et al., 2016).

Several tools will be used to collect data. The main tool is the escape room game itself, which is designed to include puzzles and challenges based on real Islamic finance topics. These include contracts like *Murabahah*, *Ijarah*, Islamic financial principles, and Shariah compliance. To measure learning progress, students will take a test before the activity and another test after completing the game. During the game, the researcher will use an observation checklist to see how students work together, think critically, and stay engaged. After the game, students will fill in a questionnaire and take part in group interviews to share their experiences. The study will happen in several stages. First, students will complete the pre-test to check their starting level of knowledge. Then they will play the escape room

game in class or online. After that, they will take the post-test to see how much they have learned. They will also fill in a feedback form and join a group discussion to talk about what they liked or found difficult in the activity. For the analysis, test scores will be compared using simple statistics to find out if there is improvement in students' understanding. The researcher will use a method called paired sample t-test to compare the results before and after the game (Field, 2013). Responses from interviews and open-ended questions will be analyzed using thematic analysis. This helps the researcher find common ideas and themes in what students say (Braun & Clarke, 2006).

EXPECTED FINDINGS AND IMPLICATIONS

Although this study does not include actual results yet, the researcher expects some useful outcomes based on past studies and learning theories. Using Kolb's Experiential Learning Theory, the escape room game is expected to make students more active and interested in learning. When students are involved in solving real problems in a fun way, they tend to understand the subject better and remember it for longer (Dugnol-Menéndez et al., 2021). It is expected that students will gain a better understanding of Islamic finance concepts and how to follow Shariah rules. These ideas can be difficult to learn in normal lectures but become easier when taught through experience and teamwork (Masood et al., 2024). The game will also encourage students to think more deeply and work better in teams since they have to solve problems together within a time limit. Students are also expected to remember what they learned more clearly because they will be actively involved in the learning process. Studies show that students who learn by doing tend to recall information more easily and for a longer time (McCarthy & McCarthy, 2006). In other areas like engineering and medical studies, escape room activities have been shown to increase student motivation and improve learning outcomes (Gordillo & López-Fernández, 2024). This study may also bring benefits to educators and course designers. First, it offers a new way to teach that focuses on the student, not just on lectures. Second, it helps teachers improve their lessons, especially in courses that involve real-life problem solving. Third, it works well in both face-to-face and online classrooms, which is helpful after the pandemic (Sungkawaningrum et al, 2025). The game can also be used as a tool to check what students have learned. Teachers can observe how students apply their knowledge and make decisions during the activity. This helps teachers understand their students' strengths and weaknesses. Finally, the model can be used in other areas of Islamic finance, such as *zakat*, *takaful*, or *waqf* studies.

NOVELTY OF THE STUDY

This study offers something new in the field of Islamic banking education. It introduces a game-based learning model that is designed especially for Islamic finance students. Although escape rooms have been used in other fields like science or management, they are rarely used in Islamic finance. This study not only introduces the idea but also connects it with Kolb's learning theory. This makes the method both creative and grounded in educational research. What makes this study special is how it uses Kolb's four learning stages in a subject like Islamic finance. Usually, Kolb's model is used in engineering or healthcare. This study shows that the model can also help students learn about Islamic principles, ethics,

and contracts. The escape room activity can be used in both classroom and online settings and therefore making it flexible for different teaching needs.

In addition, this is another new idea on how this game can be used for both learning and testing. Students are not just playing a game but are also being evaluated on how well they understand and apply the concepts. Teachers can give quick feedback during the game and help students improve right away. The game also includes situations where students have to think about ethics such as identifying interest-based contracts or judging if a contract follows Shariah. This helps students practice Islamic values in real-life decisions. In short, this study brings a new model for teaching Islamic banking that is fun, useful, and based on theory. It helps students learn better, think critically, and apply Islamic principles in practice. It can be adapted to other Islamic topics and making it valuable to the lecturers.

CONCLUSION AND RECOMMENDATION

Currently, Islamic finance is still taught mostly through lectures. This traditional method helps deliver theoretical foundations, but it does not always engage students or enable them to apply complex contracts in real-life situations (Masood et al., 2024). For subjects that require ethical judgement and critical thinking, passive methods often fall short. In comparison, gamified approaches such as group problem-solving and scenario-based activities have been shown to deepen understanding and improve motivation (Dugmol-Menéndez et al., 2021). The escape room model brings these benefits together. Students are challenged with realistic scenarios, reflect on the outcomes, relate them to Islamic banking concepts, and apply the lessons to new situations. In the process, they also strengthen soft skills which align closely with the objectives of *maqasid al-shariah*. Importantly, this approach is flexible and can be applied in both physical and online settings. In addition, the escape room can also function as a form of assessment. Unlike exams that test memory, it allows lecturers to see how students think, decide, and apply Shariah principles in practice. It could also be extended to other areas such as zakat, takaful, and Islamic capital markets. For this innovation to work well, however, educators need training in gamified learning design along with support and collaboration across institutions. In conclusion, escape rooms are more than entertainment because they connect theory and practice. With the right support, it can become a valuable addition to Islamic finance education.

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EXPLORING THE PEDAGOGICAL IMPACT OF “DUMMIES IN COMMUNICATION” ON 21st CENTURY LEARNERS

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ABSTRACT

“Dummies in Communication” is an innovative teaching and learning resource designed to simplify the understanding of communication skills, particularly for educators and learners in 21st-century classrooms. The book highlights creative strategies to enhance communication competence through interactive and learner-friendly content. The book comprises six engaging chapters: “Chapter 1: Hello! and Goodbye!” introduces basic greetings and parting expressions to set the tone for polite and effective communication; “Chapter 2: Turn-Taking Skills” focuses on how to initiate, maintain and end conversations smoothly; “Chapter 3: Negotiation Skills” teaches strategies to reach mutual understanding in everyday discussions; “Chapter 4: Interjections” explores the use of expressive words that convey emotion and add flavour to speech; “Chapter 5: Expressing Feelings” helps learners articulate emotions clearly and appropriately; and “Chapter 6: Colloquialisms” introduces informal language commonly used in daily conversation for more natural and relatable interactions. A key innovation in this book is the integration of QR codes that allow readers to scan and instantly access real-life recorded conversations. This feature bridges theory and practice, enabling readers to listen, observe and reflect on authentic communication scenarios. By incorporating technology, the book encourages flexible, multimodal learning that supports diverse learning styles. Combining clear explanations, engaging visuals and hands-on activities, Dummies in Communication empowers educators to adopt more interactive, student-centred communication techniques. This timely resource exemplifies how digital tools can transform educational experiences through innovation.

Keywords: *“Dummies in communication”, pedagogical impact, 21st century learners*

INTRODUCTION

Effective communication is a cornerstone of 21st-century education, essential for academic success, personal development and workplace readiness. Effective communication is essential for fostering student engagement and motivation, as it influences attitudes towards learning. It encompasses both verbal and non-verbal techniques, which are vital for building relationships and ensuring understanding (Addimando, 2024). However, teaching communication skills in classrooms often lacks innovation, interaction and real-life relevance. In response to this challenge, “Dummies in Communication” was developed as a creative and practical teaching resource. Designed for both educators and learners, the book integrates user-friendly language, interactive content and digital tools to enhance communication competence.

The book comprises of six chapters: Chapter 1: Hello! and Goodbye!, Chapter 2: Turn-Taking Skills, Chapter 3: Negotiation Skills, Chapter 4: Interjections, Chapter 5: Expressing Feelings and Chapter 6: Colloquialisms. A standout feature is the integration of QR codes linking to authentic recorded conversations, merging theory with practice and supporting diverse learning styles (Ibrahim et al., 2024).

While the book presents innovative strategies, there is limited empirical evidence on how it impacts teaching and learning communication (Fahroni, 2024). Traditional methods still dominate many classrooms, potentially limiting the effectiveness of such innovations. Further exploration of their practical application is essential for maximising their benefits in educational settings. This study explores experiences of educators and learners using “Dummies in Communication”, aiming to understand how the resource influences pedagogical practices and communication outcomes in tertiary education settings.

METHODS

Research Design

This study employed a qualitative research design, specifically semi-structured interviews, to gain in-depth insights into participants’ experiences with “Dummies in Communication”. The qualitative approach is suitable for exploring perceptions, attitudes and real-life applications in educational contexts (Creswell, 2012).

Participants

Purposive sampling was used to select 5 participants: 1 English lecturer (i.e., LEC1) from one Institute of Teacher Education and 4 TESL pre-service teachers (i.e., PST1, PST2, PST3 and PST4) who had used the resource in class. Selection criteria included prior use of “Dummies in Communication” for at least 1 week and willingness to participate in recorded interviews. The interviews were recorded and transcribed verbatim by the researchers.

Data Collection

Data were collected through semi-structured interviews conducted via Google Meet. Each interview lasted between 30 minutes. Guiding questions explored participants' views on the content structure, engagement level, integration of QR codes and overall effectiveness of "Dummies in Communication" in teaching and learning communication.

Data Analysis

Thematic analysis was used to analyse interview transcripts. Following Braun and Clarke (2023)'s six-phase approach, data were familiarised, coded and organised into emerging themes. Themes were validated through member-checking with selected participants and peer examination with one research colleague.

FINDINGS AND DISCUSSION

Analysis of the interview data yielded four major themes: 1. Engaging Structure and Accessibility, 2. Integration of Technology Enhances Learning, 3. Practical Application and Real-Life Relevance and 4. Empowering Educators and Supporting Student Autonomy. The themes were discussed in details as follows:

Engaging Structure and Accessibility

Both lecturer and pre-service teachers praised the user-friendly format of the book. The lecturer reported that the sequential chapter flow made it easy to design lessons that gradually built communication skills. "I like how Chapter 1 starts with greetings. It's simple, but it sets a positive tone for the rest of the lessons," shared LEC1. Pre-service teachers appreciated the use of clear language and visuals that made the learning process less intimidating. "It doesn't feel like a textbook. It's more like a guide with fun materials," said PST2. This aligns with 21st century principles of learner-centred education, where accessibility and engagement are crucial for motivation and retention. The rise of online education (i.e., e-book of "Dummies in Communication") has made learning more accessible, allowing students from various backgrounds to participate and engage in ways that suit their individual needs (Baron & McNeal, 2019).

Integration of Technology Enhances Learning

A key innovation in "Dummies in Communication" was the use of QR codes and it was consistently identified as a highlight. Pre-service teachers noted that scanning codes to access real-life conversations allowed them to observe authentic language use in context. "The QR codes make a big difference. I become more aware of how expressions are used naturally," explained PST1. Other pre-service teachers echoed similar sentiments. PST4 shared how listening to recorded conversations helped with pronunciation and tone recognition: "I didn't just read what to say. I could hear how to say it, and that helped a lot." According to Sakulprasertsri (2020), this multimodal feature supported auditory learners and demonstrated how digital resources can enrich traditional language instruction by making it dynamic and reflective of real-life communication.

Practical Application and Real-Life Relevance

Another common theme was the practicality of content. The lecturer found the negotiation, interjection and turn-taking chapters particularly useful for classroom role-plays and simulations. “I used the turn-taking chapter to run mock dialogues. It encouraged pre-service teachers to speak up, wait their turn and not interrupt. It was a good behavioural learning moment,” noted LEC1. Pre-service teachers appreciated the focus on emotions and informal language, which they found relatable and immediately usable in their daily interactions. “The colloquialisms helped me talk like how my friends actually talk,” remarked PST3. This reflects the increasing need for communication instruction to extend beyond formal speech to include emotional literacy, social appropriateness and authentic voice (Jones et al., 2014).

Empowering Educators and Supporting Student Autonomy

The lecturer found “Dummies in Communication” empowering in shifting from lecturer-led to learner-centred approaches. Several noted how the activities in the book encouraged pair work, self-reflection and peer feedback. “I used the expressing feelings chapter to get pre-service teachers to journal, then discuss in pairs. It created a safe space for emotional expression,” reported LEC1. All pre-service teachers (i.e., PST1, PST2, PST3 and PST4), on the other hand, said they felt more confident and independent using the book: “I could do the activities on my own or with friends. Even without the lecturer, I knew what to do.” This theme illustrates how the book supports autonomy, a key component of 21st-century learning frameworks and aligns with constructivist principles where learners actively build knowledge through interaction (Vygotsky, 1978).

These emerging themes of engaging structure, integration of technology, practical relevance and learner empowerment are summarised in a thematic map that follows (see Figure 1), providing a visual overview of how “Dummies in Communication” supports 21st century communication skills education.

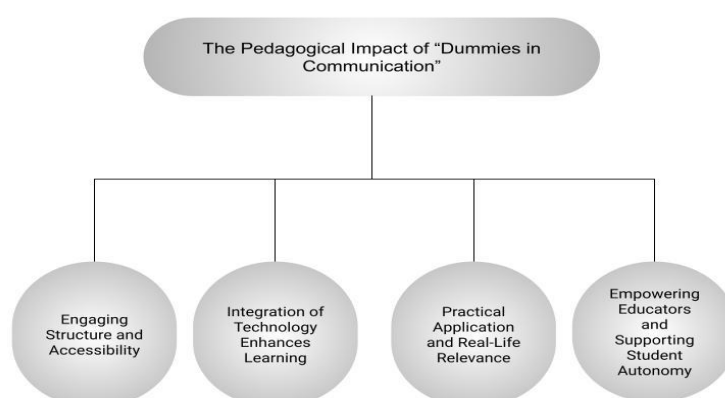


Figure 1.: Emerging Themes of The Pedagogical Impact of “Dummies in Communication”

CONCLUSION

This qualitative study investigated the pedagogical impact of “Dummies in Communication” as a resource for enhancing communication skills in educational settings. Findings suggest that the book effectively bridges theoretical and practical aspects of communication through its accessible content, innovative QR code integration and emphasis on real-life language use. The lecturer found it adaptable for classroom teaching, while pre-service teachers experienced increased motivation, confidence and engagement. The study highlights the value of digital, multimodal resources in fostering communication competence among 21st century learners. It also emphasises the importance of creativity and technology in redesigning traditional language education to suit diverse learner needs. Future research could include a larger sample across different regions or employ a mixed-method design to further validate the findings. Ultimately, “Dummies in Communication” represents a significant step towards more inclusive, interactive and effective language teaching.

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EVALUATING THE EFFECTIVENESS OF TELEGRAM CHATBOTS IN ENHANCING VOCABULARY ACQUISITION AMONG ESL AND EFL LEARNERS

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ABSTRACT

This research examines the use of LexiBot, a chatbot hosted on Telegram, in supporting vocabulary learning for English as a Second Language (ESL) students at Universiti Teknologi MARA (UiTM) in Malaysia and English as a Foreign Language (EFL) students at Universitas Dinamika (UD) in Indonesia. Adopting a cross-sectional mixed-methods approach, the project enlisted 49 learners who incorporated LexiBot into their regular language exercises. Survey results yielded encouraging quantitative data, showing that 95% of the UiTM cohort and 91% of the UD group found the chatbot user-friendly. Regarding its overall effectiveness, UD students indicated that LexiBot was helpful 81.5% of the time, whereas UiTM respondents noted that it was very helpful 59.1% of the time. In-person interviews offered qualitative insights that revealed contrasting patterns of engagement: UiTM learners interacted with LexiBot independently, while their UD counterparts tended to rely on teacher-guided use. Although participants valued the contextual assistance LexiBot provided, many called for more interactive elements and detailed explanations. These results highlight how sociocultural and pedagogical environments shape interactions with AI tools. The study concluded that chatbots like LexiBot can effectively foster vocabulary growth if their design is flexible and centred on the learner, accommodating varying degrees of learner autonomy and differing instructional contexts. These findings suggest that course developers should incorporate responsive design, game-like elements, and timely feedback tools into their platforms to maintain learners' attention and encourage their return. Studies that follow users over an extended period are also needed, along with investigations that test the approach across different language skills and in varied classroom or online environments.

Keywords: Vocabulary acquisition, Telegram chatbot, Learner engagement, ESL learning

INTRODUCTION

The rapid progression of artificial intelligence has profoundly changed the world of educational technology, with language-learning chatbots now occupying a central position. These AI-enabled tools provide learners with the immediacy of real-time conversation, allowing for quick corrections and replies that traditional classrooms often struggle to deliver. Vocabulary acquisition, particularly in the English as a Second Language (ESL) and English as a Foreign Language (EFL) context, remains a foundation of fluency yet often suffers from limited practice time and a dependence on rote memorization imposed by many syllabuses (Salim et al., 2024; Adnan et al., 2024). Workbook exercises and drill sheets rarely connect with students' everyday lives, causing shallow retention and gradual disengagement.

Chatbots offer an inventive solution to these long-standing problems by embedding language practice within authentic dialogue rather than confining it to a worksheet (Yusuf et al., 2024). Learners are free to investigate meanings, grammatical subtleties, and idiomatic phrases in situ, receiving instant clarification or extra examples that keep the discussion moving. This study assesses *LexiBot*, a chatbot available on the Telegram platform, with a specific focus on ESL students at Universiti Teknologi MARA in Malaysia and EFL students at Universitas Dinamika in Indonesia.

The survey seeks to assess learners' views on three interrelated aspects of *LexiBot*: how easy they find it to use, how well it helps them understand language in context, and how much sustained interest and engagement it manages to generate over time. Feedback gathered in this way will inform decisions about how best to weave AI-driven tools into language instruction, regardless of whether classes are held face-to-face, entirely online, or in blended formats.

METHODS

This study used a cross-sectional mixed-methods approach that combined quantitative and qualitative techniques to build a more comprehensive understanding of how students interact with a vocabulary-practice chatbot. The survey component generated the standardised data necessary for making group comparisons, while the subsequent semi-structured interviews explored themes such as learner autonomy, engagement and comfort with technology, issues to which numerical data provide at best a partial answer. A total of forty-nine students participated: twenty-two from Universiti Teknologi MARA (UiTM) in Malaysia and twenty-seven from Universitas Dinamika (UD) in Indonesia. Each participant had been required to employ *LexiBot*, a Telegram-based chatbot, as part of their regular language coursework. Although the sample size is relatively small, it is adequate for exploratory research that prioritises qualitative depth (Dawadi et al., 2021). Before the interviews, every learner completed a structured questionnaire measuring perceived usability and engagement, along with any vocabulary improvement they associated with *LexiBot*, rating each item on a five-point Likert scale.

RESULTS AND DISCUSSION

This section presents the findings from the study, highlighting key differences in usability and effectiveness of *LexiBot* among ESL learners at UiTM and EFL learners at UD. The results are summarised in the table below:

Demographic profile of respondents

There were 49 respondents. UiTM (22) and UD (27). The majority (73.5%) were first-year students, while only 8.16 per cent were in their third year. Meanwhile, 18.36% were second-year students. AI-based tool usage involved 53.06% who had previous experience utilising it. On the other hand, 46.94% had no prior experience.

Usability of *LexiBot*

The usability of *LexiBot* among ESL learners served to answer the first research question.

Table 1.: Usability of *LexiBot*

Item (Ease of use)	Number	Percentage
UiTM (Easy or Very Easy)	21	95
UD (Easy or Very Easy)	25	91

Table 1 indicates the usability of *LexiBot*. Majority (95%) of UiTM students, and 91% of UD students felt it was easy or very easy to use *LexiBot*. Although it is user-friendly, there were technical difficulties, where 18% of UiTM respondents and 22% UD respondents pointed out connectivity problems.

Table 2.: Effectiveness of *LexiBot*

Item (Ease of use)	Number	Percentage
UiTM (Helpful)	9	40
UiTM (Very Helpful)	13	59.1
UD (Helpful)	22	81.5
UD (Very Helpful)	5	18.5

Table 2 reveals the effectiveness of *LexiBot*. Most of the UD respondents (81.5%) perceived *LexiBot* as helpful, while only 18.5% perceived it as very helpful. On the other hand, 40% of UiTM respondents perceived this as helpful, while 59.1% perceived this as very helpful.

Engagement with *LexiBot*

Interview-based findings on engagement with *LexiBot* served to answer the third research question on the level of engagement of ESL and EFL learners when utilising *LexiBot*. Five UiTM and UD students were interviewed in terms of frequency of use, motivation and the degree to which *LexiBot* determined their vocabulary learning habits. The majority of the UiTM respondents utilised *LexiBot* independently and incorporated this into their study routine. Respondent 1 stated, “*LexiBot* helps me review words at my own pace, but I still need additional resources to fully understand new words.” Additionally, students noted that *LexiBot* serves as a tool for teaching contextual clues that provide relevant types and examples that reinforce vocabulary comprehension”. Respondent 2 mentioned “*LexiBot* provides useful information, somehow it lacked interactive elements that could have made learning more engaging”. UD students integrated *LexiBot* as an optional source in class. This chatbot was applied with guidelines, thus teacher supervision was required when it was used. Respondent 3 (a UD student) indicated, “*LexiBot* was useful for practicing vocabulary but mostly used it when I was doing classwork”. This meant that this chatbot could be used by UD learners as a main requirement *LexiBot* in class rather than as a personal choice. On the other hand, respondents from both groups highlighted problems they encountered with *LexiBot*. UiTM’s Respondent 4 describes this as “is useful, but sometimes it does not tell me why an answer is wrong”. This resonates with UD’s Respondent 5, who indicated that the chatbot turned boring after a while, reducing their motivation level to utilise it.

Discussion

These findings indicate the validity of the effectiveness of lexical acquisition in ESL and EFL settings via chatbots. However, the findings revealed subtleties that call for further analysis. Although both UiTM and UD students’ high usability ratings indicated that *LexiBot* fundamentally fulfilled the criteria for usability. However, the conversation needs to be more than about undisputable achievements for deeper educational considerations. In the AI literature about autonomy and dependency on context, there were distinct differences between participation levels and learning autonomy, by which ESL learners reacted to independently, while EFL learners were asked to utilise the chatbot (Annamalai et al., 2023; Lo et al., 2024).

Such disparity calls for the need for AI to be educational to rethink AI’s framework of adaptability that incorporates sociocultural dimensions. Although *LexiBot* chatbot style is adaptable, their pedagogical preparation must address contrasts in language autonomy and immersion. Such a gap of ESL learners’ self-directed learning and EFL learners’ teacher-supported approach echoes Jeon’s (2021) findings that AI devices need to promote both inquiry and structurally driven learning. The efficiency of *LexiBot* still needs to be evaluated in the learners’ sociocultural and instructional environments. The following versions should involve characteristics that are adjustable to the interaction level, feedback details, and alignment-based needs guidelines offered to learners that agree with the transition towards personalised AI in education (Belda-Medina & Kokošková, 2023)

Moreover, chatbot technologies could be applied reasonably to other educational contexts provided there is adequate curricular and instructional support despite the study analysing two institutional contexts. The results show that chatbot use is not solely defined by information provision, but by

content incorporation with operational instruction frameworks and digitalisation preparedness level possessed by learning institutions. For example, some respondents reported that students living in areas with internet infrastructure that are poorly developed may not be able to be involved in interact with chatbot functionalities.

In discerning the merits of the impact of chatbots in teaching and learning, change is not seen in teaching instruction but rather in teaching enrichment. For instance, through instant response, emotional involvement, and learning modelling. Even so, to achieve the desired result, it is necessary to teach rigorously, and guide based on empirical evidence. The implementation of *LexiBot* demonstrates the promise of such technologies, but with a gracious indication on the importance of purposeful design, continuous evaluation, and policy support to uncover innovation in education across various ecosystems.

CONCLUSION

This study set out to explore how effective *LexiBot*; a Telegram-based chatbot really is when it comes to helping learners pick up new vocabulary. It focused on two different learner groups: ESL students from Universiti Teknologi MARA (UiTM), Malaysia, and EFL students from Universitas Dinamika (UD), Indonesia. Interestingly, both groups found *LexiBot* easy to use. Many reported that navigating the chatbot was smooth and straightforward. Beyond just ease of use, learners generally agreed that *LexiBot* helped them pick up new vocabulary, especially through contextual cues provided in the conversation. That said, there were some differences worth noting. While both ESL and EFL learners found the chatbot helpful, students from UD (EFL group) rated it as slightly more beneficial overall. This difference might be tied to how the chatbot was used in each setting. ESL learners seemed to thrive more when using *LexiBot* independently, whereas EFL learners appeared to benefit from using it in a more guided, classroom-based setup. This highlights an important point: chatbot design shouldn't be one-size-fits-all. Instead, it should be flexible enough to cater to different learning contexts and levels of learner autonomy.

These findings support what others have also suggested that for chatbots in education to work very well, they need to be responsive and adaptable. As Chaves and Gerosa (2021) note, the most effective chatbots are those that adjust to users' language abilities, comfort with self-directed learning, and even their usage patterns. ESL learners, for instance, often respond better to open-ended questions that allow for exploration and conversation. On the other hand, EFL learners might prefer more structured, step-by-step tasks that align with a formal syllabus. To keep learners engaged—especially in self-paced settings—it helps when chatbots incorporate a bit of gamification. Features like digital badges, countdown timers, or even short stories that require learner input can go a long way in boosting motivation. Add to that clear feedback for both correct and incorrect answers, and suddenly, each interaction becomes a meaningful learning opportunity. Pair that with context-based exercises, and students don't just learn—they reflect and remember.

Of course, to truly make the most of chatbot tools like *LexiBot*, educators need to be strategic about how they integrate them. These bots can serve multiple purposes: quick reviews before class, follow-

ups after lessons, or even as ongoing support for large lectures and asynchronous courses. But they shouldn't replace human instruction—they should enhance it. Looking ahead, there's still plenty of ground to cover. Future research should go beyond just vocabulary. There's real potential in exploring how chatbots can support other areas, like improving spoken fluency, writing accuracy, and grammar knowledge. Also, including more diverse participant groups—across countries, learning environments, and cultural backgrounds—could help us uncover more universal design principles for chatbot-based learning.

It might also be worth investing in long-term studies. Tracking learners' interaction with chatbots over several months, or even a year, could tell us a lot about how these tools influence motivation, retention, and overall language development. Early signs are encouraging. Learners seem to stay engaged and are more likely to practice on their own when supported by intelligent, responsive bots. But as with most things in education, context matters. Cultural norms, classroom practices, and educational systems all shape how learners interact with technology.

Lastly, future studies should consider including wider demographic groups, tracking retention over time, and testing more advanced chatbot functions. These steps could paint a fuller picture of the real impact digital tools like LexiBot can have on language education. In all, this study contributes to the growing conversation around the role of AI-driven tools in ESL and EFL education. It also offers practical ideas for designing more learner-centred chatbots—ones that adapt, respond, and most importantly, support learners in meaningful ways.

ACKNOWLEDGEMENTS

The authors would like to express their sincere appreciation to the students of Universiti Teknologi MARA (UiTM), Malaysia, and Universitas Dinamika (UD), Indonesia, for their active participation in this study. Special thanks are also extended to the instructors from both institutions for their guidance and support throughout the research process. Their cooperation in facilitating the integration of *LexiBot* into classroom activities greatly contributed to the success of this study.

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EVERYONE CAN DRINK

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ABSTRACT

Water is known to be the most important substance on Earth. Without water, we cannot continue to live on Earth. One in eight people worldwide lack access to safe and clean drinking water. Many people have no choice but to drink water they know is contaminated with potentially life-threatening bacteria. The World Health Organization (WHO, 2015) reported that about 159 million people globally fetch untreated surface water from lakes, ponds, rivers and streams. Surface water sources in Africa are sometimes highly polluted. As far as water quality is concerned, water which is consumed or to be consumed by the human must be treated to achieve the desired water quality level according to Bain et al. (2014). “Everyone Can Drink” is a newly invented prototype which benefits all people especially Africans because it can help to filter the water to produce clean and safe water for drinking. This invention contains the Solar panel, water pump, oxidizing agent, filtration tank and UV light. The Solar panel absorbs the light energy from the Sun and converts it to electricity. While UV light is lethal to bacteria and viruses because of its high frequency that scrambles and damages their nuclear material, so that we can drink the water safely. The best feature of “Everyone Can Drink” is that it is portable. We can bring it anytime and anywhere. In the future, we want to make it known to the whole world.

Keywords: *Everyone Can Drink, newly invented prototype, Solar panel, UV light, portable*

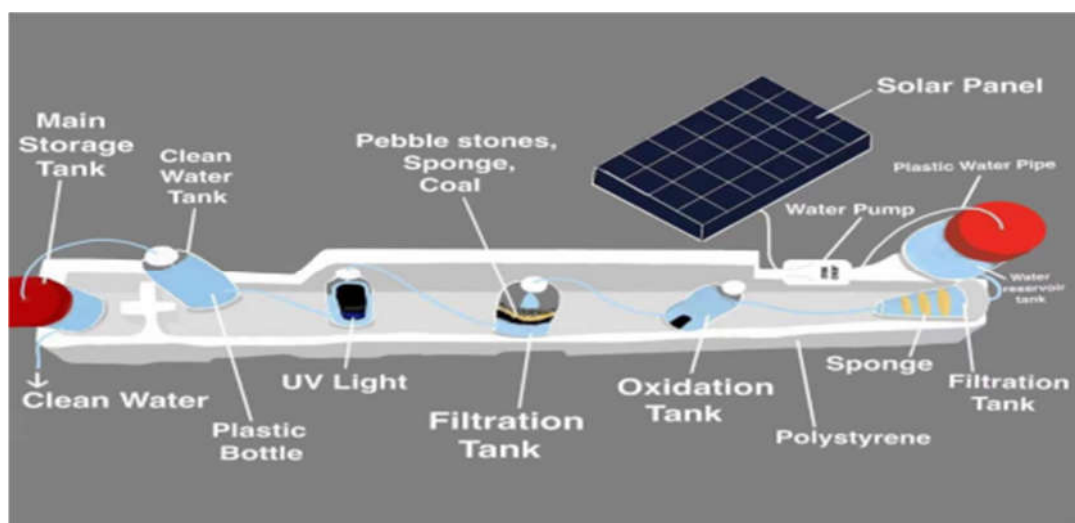
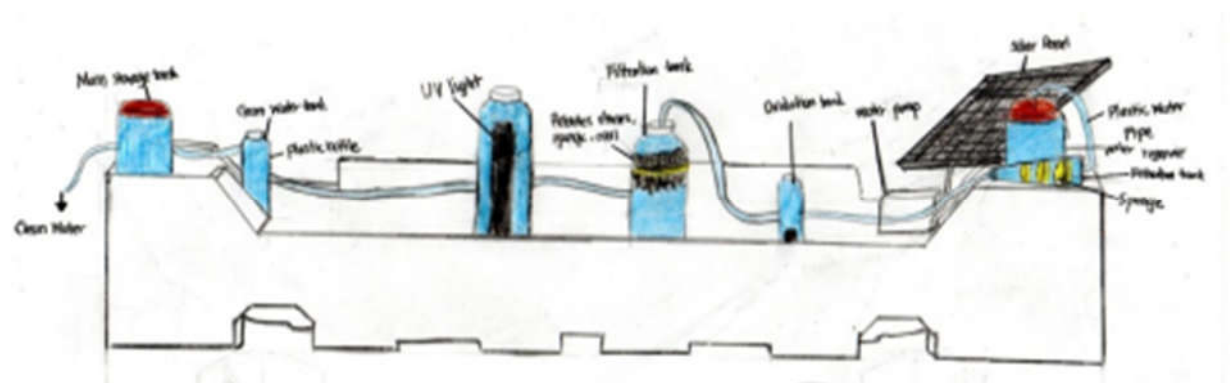
INTRODUCTION

“Everyone Can Drink” is a newly invented prototype which benefits all people especially Africans because it can help to filter the water and produce clean and safe water for drinking. This invention contains UV light which can kill the microorganisms and bacteria in the water. This invention also contains solar panels to generate electricity in order to operate the water pump. After the filtration process by our “Everyone Can Drink”, the water is safe to use. “Everyone Can Drink” is

environmentally friendly and it will not cause pollution. This invention can save energy because it uses renewable energy from sunlight. It will help the people in Africa to obtain clean water easily so that they can avoid waterborne diseases which will cause death.

METHODS

This new prototype contains the Solar panel, water pump, oxidizing agent, filtration tank and UV light. Firstly, the Solar panel absorbs the light energy from the Sun and converts it to electricity. It helps the water pump to pump the water in the water reservoir tank to every part of the water filter tank to carry out the process. The oxidizing agent in the oxidation tank helps to get rid of unpleasant smell and taste of the water. After that, water flows to the filtration tank containing coals, pebble stones and filter sponge which can remove the large suspended particles. According to Bolton and Cotton (2008), the filtered water flows to UV light partitions which helps to kill the bacteria and microorganisms in the water. The clean water with no bacteria and microorganisms is stored in the storage tank and prepared to be used. The portable design of “Everyone Can Drink” is friendly to be used by everyone and everywhere.



RESULTS AND DISCUSSION

Conventional water filter	“Everyone Can Drink”
It needs to connect to a plug in order to generate electricity to operate the filter system.	A solar panel is used to absorb the sunlight in order to generate electricity.
Does not consist of oxidizing agents which cannot get rid of unpleasant smell and taste.	Consists of oxidizing agents which can get rid of the unpleasant smell and taste.
Does not consist of UV light which the water filter cannot kill the microorganisms effectively.	Consist of UV light which can kill the microorganisms and bacteria in the water.
The conventional water filter system is bulky and difficult to bring along.	The portable design of “Everyone Can Drink” is easy to bring along and use everywhere.

Why we use UV light:

According to Berezow (2020), a microbiologist who has written on the topic, “*UV light is lethal to bacteria and viruses because of its high frequency that scrambles and damages their nuclear material*”, although 100% destruction of microorganisms cannot be guaranteed, it is possible to achieve 99.9% reduction in certain applications and with proper maintenance, in order for a UV unit to successfully disinfect water.

Why we use Solar panel:

Solar power is a great sustainable, green energy choice. Eastern Sahara/ Northeastern Africa is often considered and referred to as the "Sun continent" or the continent where the Sun's influence is the greatest. According to the World Sunshine Map (2019), those countries receive many more hours of bright sunshine during the course of the year than any other continent of the Earth.

CONCLUSION

“Everyone Can Drink” is a newly invented prototype which benefits all the people as it can help to filter the water effectively and produce clean water. Everyone deserves to enjoy the privilege of having clean water for their daily activity.

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I would like to express my sincere gratitude to my principal Mr. Nguang Seng for his patient guidance, constructive comments, and continuous professional support throughout this innovative product. I

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EXPERIENCES OF STUDENT NURSES UTILIZING QR CODES IN MEDICAL-SURGICAL NURSING CLASS RECITATION TO ENHANCE ENGAGEMENT

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ABSTRACT

Integration of technology into education has transformed older ways of teaching, and QR code technology seems to be emerging as a tool for increasing student participation. Included in CMO 15 2017 is NCM 112, one of the core subjects that student nurses are most horrified of because it has the highest weight in the BSN curriculum. While existing literature on use of QR code in education, few studies about the use of QR Code in recitation, specifically in Nursing Education. This qualitative study examines the lived experiences of student nurses in a medical-surgical nursing class who used QR codes to record recitation points. Phenomenological qualitative study with semi-structured interviews. Participants were chosen through purposive sampling. Data collected through semi-structured interviews in a face-to-face setup. This study included 25 BS nursing students with the following inclusion criteria: student nurses passed Nursing Care Management 112, voluntarily agreed to participate and share experiences, provided informed consent and must have used QR code technology as a learning tool for at least one semester. The interviews were recorded, transcribed, and analyzed for thematic content using Colaizzi's method. Findings revealed three produced three major themes: Boosted class participation, Friendly competition, and Technology Challenges. Participants reported increased motivation and high interactive engagement with strengthened collaboration among peers. QR code technology holds pointed potential to boost student participation and collaborative learning in the practice of medical-surgical nursing. Challenges like technological issues and digital adaptability became points of concern. However, careful orientation, implementation, and teacher-student support with the use of technology are necessary to fulfil its benefits.

Keywords: QR Code, Student Nurses, Engagement, Technology

INTRODUCTION

The Japanese company Denso-Wave, based in Kariya, Aichi, Japan, introduced quick response codes in 1994. These two-dimensional barcodes were originally designed for tracking storage. Now, integrating Quick Response (QR) codes into nursing education is a new approach that shows great promise. It can improve student engagement, satisfaction, and learning outcomes. Recent studies show that QR codes are useful tools for providing just-in-time access to educational resources. This access supports clinical skills development and helps nursing students feel more prepared for exams (Scott et al., 2025; El-Sayad, Fareed, & Masry, 2023; Bradshaw, Rawle, & Muller, 2024). For instance, Scott et al. (2025) studied dynamic QR codes paired with data analytics. They found that using QR codes to access timely multimodal content led to better engagement and knowledge retention. Likewise, El-Sayad et al. (2023) noted significant improvements in clinical competency and positive student feedback after QR code training. Additionally, both students and educators view QR code technology favorably. They see it as a way to modernise nursing curricula and meet the changing needs of learners in a more digital world (Scott et al., 2025). Given that mobile technologies are increasingly popular among nursing students today, using QR codes during medical-surgical nursing classes can create interactive learning experiences. It encourages active participation and strengthens critical clinical judgment skills necessary for professional practice. This study examines student nurses' experiences with QR codes during medical-surgical nursing classes and aims to understand how this technology boosts their engagement and learning.

METHODS

This study used structured self-reports and detailed, standardised open-ended interviews along with non-verbal observations noted in field notes. Participants received full information about the study's purpose, procedures, benefits, risks, and their rights, including the choice to participate voluntarily and withdraw at any time. We kept confidentiality strictly, recording interviews and transcribing them word for word. The researcher conducted all interviews, checked the transcriptions for accuracy, and created a neutral, trusting setting to encourage honest and comfortable sharing, following ethical qualitative practices (Lopez et al., 2010; Gall & Borg, 2003; Polit & Beck, 2004).

To ensure the study's reliability, we applied Lincoln and Guba's (1985) criteria of credibility, transferability, dependability, and confirmability. We supported credibility by encouraging participants to express themselves freely and recording interviews in full. Transferability was achieved through purposeful sampling of nurses from various clinical settings, which provided rich, descriptive data for comparison. Dependability involved using suitable research designs, including standardised interviews and field observations. We maintained confirmability by being objective, presenting participants' voices authentically, and reducing researcher bias. We also gave participants a token of appreciation for their contributions.

This study followed ethical standards to protect participants' rights and welfare. Participants were informed about the study's purpose, procedures, potential benefits, risks, and their right to participate

voluntarily, including the option to withdraw at any time, ensuring respect for their autonomy. We maintained strict confidentiality, securely recording and transcribing all responses. The researcher created a neutral, supportive environment to encourage open, honest sharing while avoiding coercion or discomfort, in line with principles of beneficence and non-maleficence. We received ethical approval from the relevant Pangasinan State University Ethics Review Board. This framework ensured that the study upheld justice, reliability, and integrity throughout the research process.

RESULTS AND DISCUSSION

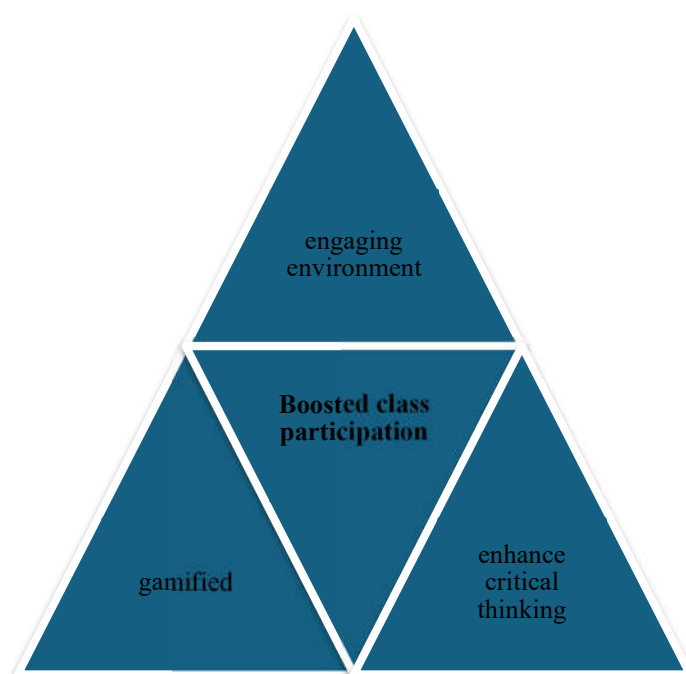


Figure 1.: Boosted Class Participation

Main Theme: Boosted Class Participation

a) Engaging Environment

QR codes have been used effectively in educational settings to create interactive and engaging learning environments. They allow easy mobile access to quizzes, case studies, and resources. This change turns passive lectures into active sessions. This is especially beneficial in large nursing classes, where it can be hard to get individual engagement. Kinyon et al. (2023) found that technology-driven activities, like mobile-based response systems and QR code tasks, improve student participation and focus during class. Research shows that interactive technologies boost learner engagement by making sessions more immersive and encouraging real-time involvement. For example, Chang, Wu, Chang, Tseng, and Wang

(2021) found that using technology to enhance active learning increases attention and motivation in healthcare education.

b) Gamified Learning

Timed quizzes delivered through QR codes effectively include gamification elements. Research shows this approach boosts learner motivation and engagement in clinical education. Wong et al. (2023) found that gamified learning strategies, such as timed challenges, scoring, and competition, enhance nursing students' clinical judgment and decision-making skills. Gamification relies on psychological incentives like rewards, competition, and tracking progress. These factors improve learning outcomes in clinical reasoning and retention (Sardi, Idri, and Fernández-Alemán, 2017).

c) Critical Thinking

QR-linked case studies give learners a chance to work with realistic scenarios. This helps develop critical and independent analytical skills that are important for clinical reasoning. The practice supports the goals of the Next Generation NCLEX (NGN), which focuses on clinical judgment and decision-making through realistic cases. A study from Damanhour University in 2020 showed that using QR code technology with case-based learning allowed students to access informative, multimedia patient cases. This approach improved their critical thinking skills in line with NGN competencies.

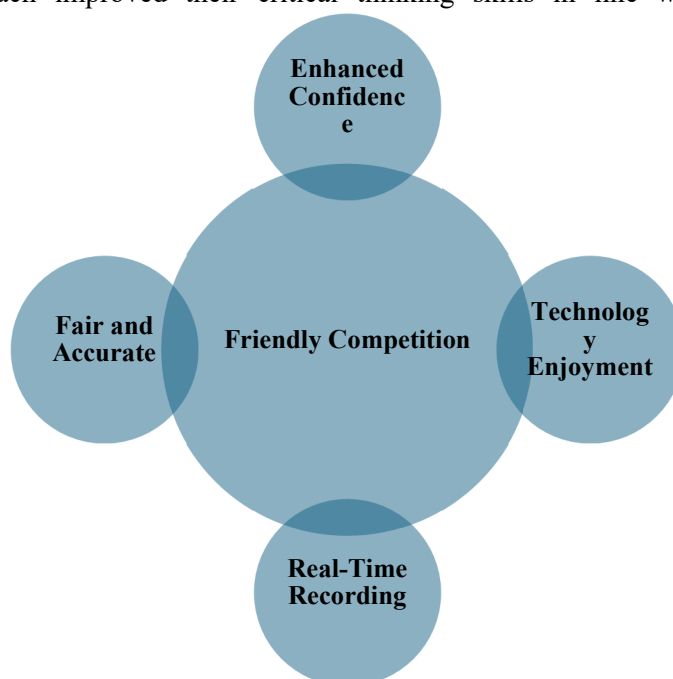


Figure 2.: Friendly Competition

Main Theme: Friendly Competition

a. Real-Time Recording

Leaderboards provide immediate feedback. This boosts motivation and engagement by promoting social learning and self-regulation. This ties closely to social cognitive theory, which highlights the importance of social context and feedback in improving learners' motivation and goal-setting (Zurmehly, 2017). Research in nursing education shows that timely feedback, along with competitive ranking, improves self-reflection and persistence (Bandura, 1986; Zurmehly, 2017).

b. Fair and Accurate

Automated QR code assessments ensure more objective and standardised grading. They significantly reduce bias linked to manual grading (Smith and Jones, 2022). Studies in nursing simulations show that QR scanning methods offer safer and fairer evaluations of medication administration, resembling real clinical practice (Brown et al., 2022).

c. Technology Enjoyment

The use of mobile devices in healthcare education greatly increases user satisfaction and engagement. Reviews have found that smartphones and apps improve accessibility, learner motivation, and knowledge retention (Nguyen et al., 2023). Students consistently report that mobile integration makes coursework more enjoyable and convenient. This approach enhances overall learning experiences (Anderson and Lee, 2023).

4. Enhanced Confidence

Immediate feedback helps students evaluate their performance accurately. This builds the confidence necessary for clinical decision-making (Clark et al., 2022). Research shows that real-time feedback during simulations supports better self-assessment skills and professional judgment (Davis et al., 2022; Clark et al., 2022).

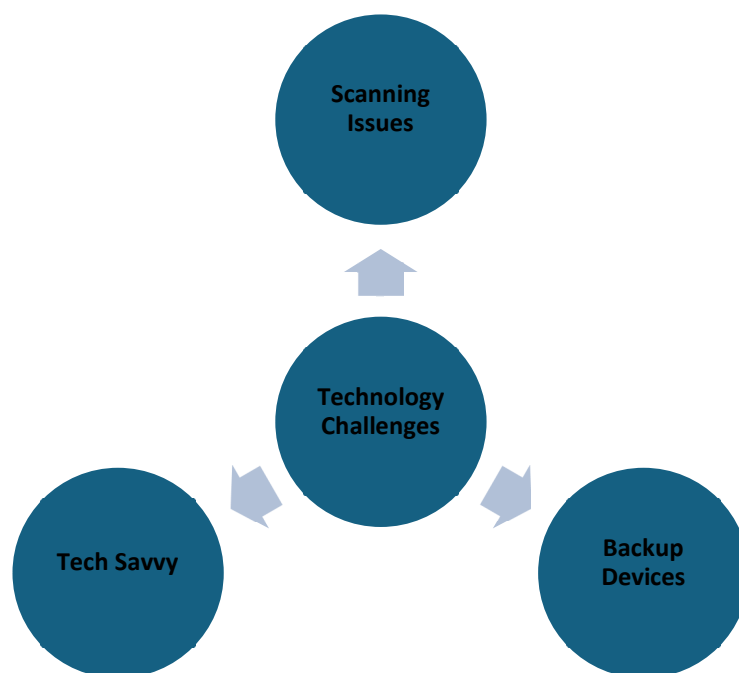


Figure 3.: Technology Challenges

Main Theme: Technology Challenges

a. Scanning Issues

Poor QR code readability disrupted workflow in educational settings. Various pilot studies have noted such challenges while investigating QR implementation in healthcare education. For instance, Zurmehly and Adams (2017) found that severely wrinkled or small QR codes reduced scanner connectivity. This issue impaired access to learning materials. Additionally, the need for fast and reliable internet access significantly limits many clinical areas, as reported by several authors (Scott et al., 2025; Lin et al., 2019). These technological limitations can interrupt instructional flow, leading to frustration and reduced student participation.

b. Backup Devices

To address this issue, pairing students without devices with those who own smartphones has been a practical strategy in clinical education. However, consistent support for backup devices or alternative access is still necessary to ensure equal opportunities for all learners. Equity gaps have emerged for students who lack smartphones, a challenge clearly identified in large-classroom studies (Zurmehly and Adams, 2017).

c. Tech Savvy

Without structured help in using QR code technologies and related mobile apps, some learners may face barriers that limit their ability to benefit fully from technology-enhanced learning environments.

Significant differences in digital literacy among students highlight the ongoing need for pedagogical and technical support from educational institutions (Wong et al., 2023; Scott et al., 2025).

CONCLUSION

The findings match global research on using QR codes in nursing education. The theme of increased participation shows that QR codes can engage millennial learners through self-paced, technology-driven activities. Gamification elements like timed quizzes relate to better clinical judgment by simulating high-stakes exam conditions. Using QR codes for friendly competition supports social cognitive principles. Peer modelling and real-time feedback boost motivation. However, educators need to balance competition with inclusivity. This helps avoid discouraging students who are less skilled with technology. Studies highlight ongoing equity challenges in this area. Technology barriers reveal gaps in digital access and literacy. Scanning problems and device inequality reflect issues found in large-classroom pilot projects. Offering training sessions and loaner devices could help, especially for non-traditional learners. Incorporate QR codes into important topics to enhance engagement benefits. Workshops on troubleshooting and gamification techniques can encourage better adoption. Schools should ensure device accessibility to maintain inclusivity.

Limitations and Future Research

In summary, QR codes successfully update medical-surgical nursing education by promoting engagement and confidence. However, success relies on tackling technical and equity issues through focused support.

ACKNOWLEDGEMENTS

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EXPLOREARABIC

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ABSTRACT

ExploreArabic is an innovative Arabic language learning tool designed for secondary school students, integrating interactive PowerPoint presentations with ClassPoint to enhance vocabulary acquisition. Built around themes from the KSSR Arabic syllabus, the module leverages gamification strategies to provide a fun, engaging, and pedagogically sound learning experience. The project aims to support 21st-century learning principles by combining language mastery with digital interactivity, creating an active learning environment aligned with students' technological preferences.

PROBLEM STATEMENT

Traditional Arabic language teaching methods often fail to capture student interest, particularly when delivered through static or one-way mediums. There is a clear need for interactive, student-centered tools that align with digital learning environments and national curriculum goals. Additionally, existing materials may not fully utilize gamification to motivate learners or provide real-time feedback to reinforce learning.

OBJECTIVES

1. To design a ClassPoint-powered PowerPoint module that facilitates Arabic vocabulary learning aligned with the KSSR curriculum.
2. To gamify the learning process using interactive elements that increase student engagement and participation.
3. To support teacher-led and student-centered learning in a hybrid or physical classroom setting.

METHODOLOGY

The innovation employs a development-based approach with iterative feedback cycles from language teachers and trial sessions with students. The module is designed using Microsoft PowerPoint with integrated ClassPoint tools, including quizzes, gamified missions, and visual storytelling. Key features include:

- Interactive storyline and character-based journey.
- ClassPoint quizzes embedded within learning missions.
- Vocabulary-focused challenges with visual prompts and audio support.

TARGET AUDIENCE

- Primary school students studying Arabic under the KSSR curriculum.
- Arabic language teachers in Malaysian primary schools.
- Educational technologists and curriculum developers.

INNOVATION AND CONTRIBUTION

ExploreArabic introduces a creative, story-based learning module that transforms a static PowerPoint into a gamified digital learning experience. By utilizing ClassPoint, it bridges the gap between traditional instruction and interactive learning. Its integration with 21st-century skills (communication, critical thinking, and collaboration) aligns with national education reform. Furthermore, the innovation offers:

- A ready-to-use digital resource for Arabic teachers.
- Contextual vocabulary exposure with formative assessment tools.
- A replicable model for other language subjects.
-

CONCLUSION

This project demonstrates that simple tools like PowerPoint, when creatively integrated with interactive platforms such as ClassPoint, can yield high-impact educational experiences. ExplorArabic stands as a practical and scalable solution for improving Arabic vocabulary instruction while promoting student motivation and teacher empowerment.

ACKNOWLEDGEMENTS

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EZCukai

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ABSTRACT

An inventive digital learning tool called EZCukai was created to improve university students' taxation course learning experiences. Students find it difficult to understand complicated tax rules and processes since traditional tax education techniques are frequently too theoretical, out-of-date, and lack real-world applicability. In order to overcome these obstacles, EZCukai provides a user-friendly, interactive website with bilingual material (in both English and Bahasa Malaysia), real-time updates on Malaysian tax laws, and interactive learning resources including self-assessment tests and e-filing simulations. The app also incorporates engaging tutorials and flexible, self-paced learning modules that allow students to explore tax concepts in a more accessible and practical manner. By bridging the gap between theory and real-world application, EZCukai not only improves academic performance but also equips students with relevant skills for future professional roles in the field of taxation.

Keywords: digital learning, user-friendly, interactive website, real-time updates, interactive learning

DESCRIPTION OF THE INNOVATION

App for Taxation Subject namely EZCukai is an innovative digital learning tool designed to overcome typical issues encountered by university students taking taxation courses. Many students fail to understand complex tax rules and processes since traditional teaching techniques are theoretical, there is limited access to actual examples, and the learning materials are out of date. According to Palil and Mustapha (2011), the better the knowledge of taxation, the greater is the level of tax compliance. This EZCukai is intended to make tax education more entertaining and successful by utilizing interactive tutorials, self-assessment quizzes, real-time updates on Malaysian tax regulations, and practical simulations such as e-filing exercises. It promotes bilingual learning (Bahasa Malaysia and English), fosters self-paced study, and assists students in applying theoretical knowledge to real-world circumstances, thereby increasing their academic performance and preparation for professional tax responsibilities.

INNOVATIVE FEATURES AND CHARACTERISTICS

Progress Tracking

EZCukai allows students to monitor their learning journey through progress bars, quiz results, and module completion status, helping them stay on track with their taxation studies. According to Kurniawan (2020), there are several ways used by teachers to evaluate students who have followed the course of tax, among others, by giving assignments, and exams in the form of quizzes, exams Middle Semester and Final Exam Semester.

Multimedia Integration

The app features videos, infographics, voice notes, and interactive diagrams to make complex tax concepts easier to understand and more engaging for visual and auditory learners.

Flexibility and Accessibility

EZCukai can be accessed anytime and anywhere via mobile or desktop, and supports both Bahasa Malaysia and English to ensure inclusive learning for all university students.

Real-time Feedback

Students receive instant feedback after completing quizzes and simulations, allowing them to identify mistakes and improve their understanding immediately.

Interactive Learning

Through gamified tasks, drag-and-drop exercises, tax return simulations, and scenario-based questions, EZCukai transforms passive studying into an active, engaging experience.

IMPACT OR CONTRIBUTION

Enhances Tax Literacy Among Students

The interactive approach adapted for each module of the app allows students to comprehend complex tax concepts with ease. Comprehension and understanding among students create further interest, facilitating learning and improving retention of the principles covered in each module. The app can simplify complex tax concepts through interactive modules, increasing understanding and retention.

Encourages Active and Self-Paced Learning

Accessibility to learning material is simplified, supporting flexible learning for its users. The self-assessment monitoring mechanism made available through built-in quizzes, flashcards, and gamified tasks motivates and facilitates progressive and self-paced learning. This is because attracting students through gamified elements, allows educators to bridge this gap, transforming abstract financial theories into hands-on learning experiences that enhance their cognitive retention of investment strategies (Kurniasari 2021).

Real-Time Updates on Tax Regulations

The online nature of this application facilitates real-time updates on matters such as tax laws, budget, and compliance rules, ensuring users are kept abreast with the latest developments relevant to the topic in each module.

COMMERCIALIZATION VALUES OR FUTURE POTENTIAL

This app may move into commercialization to tap into the potential market comprising students at tertiary education institutions and perhaps those who wish to venture into tax-related business or handle tax-related issues as part of their job specifications.

Partnership with Government Agencies and Tax Authorities

The app can be made available or licensed to LHDN (IRBM) or the Ministry of Finance for tax awareness campaigns for the public. It can be mobilized as an educational tool for students, especially those in tertiary institutions. In addition, it could be used in training or outreach programs by tax authorities to promote tax literacy and compliance for small businesses, start-ups, or new taxpayers.

A Gamified learning approach, interactive content delivery, and simplified guidance via digital tools help foster understanding of complex tax-related matters such as the availability and application of tax incentives. These characteristics may indirectly encourage voluntary tax compliance by business entities, entrepreneurs, and individuals, especially new taxpayers.

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FINLOGIC.@STATEMENTS

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ABSTRACT

FINLOGIC.@STATEMENTS is a web-based digital learning platform developed to enhance the comprehension of financial reporting concepts such as double-entry bookkeeping, the Statement of Financial Position, the Statement of Profit or Loss, and the Statement of Cash Flow. Initially released as a mobile app, the tool evolved into a comprehensive, browser-based system after receiving high demand from academic institutions and learners. It provides an interactive, simulation-driven, and gamified learning experience that aims to bridge the gap between theoretical accounting knowledge and practical application. By incorporating interactive tools such as real-time transaction simulation and dynamic statement generation, FINLOGIC.@STATEMENTS helps learners and professionals visualize financial data flows, enabling them to grasp accounting principles more intuitively. The platform aligns with modern educational standards and pedagogies and is well-positioned for institutional integration. Furthermore, its scalability and adaptability present significant commercialization opportunities across education, corporate training, and public-sector financial literacy initiatives.

Keywords: Digital learning, Web-based platform, Accounting education, Gamification, Simulation, Financial literacy

INTRODUCTION

FINLOGIC.@STATEMENTS was created in response to the learning barriers many learners face when approaching traditional accounting subjects. Concepts such as the double-entry system and the preparation of core financial statements are often perceived as complicated and difficult due to the numerical complexity and lack of real-time feedback in conventional teaching methods.

Initially launched as a mobile app, FINLOGIC.@STATEMENTS allowed users to simulate accounting transactions and immediately see the impact on ledgers and financial statements. With positive user feedback and growing institutional interest, the app transitioned into a full web-based platform. The new version enhances accessibility, cross-platform functionality, and interactivity, making it highly suitable for hybrid classrooms, self-learners, and remote education models. This innovation aligns with the shift in educational technology that prioritizes learner autonomy, interactivity, and visual learning, thereby supporting better engagement and understanding in financial education (Almuntsr et al., 2024).

FINLOGIC.@STATEMENTS distinguishes itself through a suite of innovative features that enhance accounting education by making it more practical, interactive, and learner-centered. Built with a deep understanding of the challenges learners often face when learning financial concepts, the platform incorporates modern pedagogical strategies that foster engagement, comprehension, and retention.

One of its standout features is the **Interactive Double-Entry Simulator**. This tool allows learners to input transactions, such as sales, purchases, or expenses, and immediately observe how these entries affect the accounting books through corresponding debit and credit changes. This interactive environment enables users to visualize the accounting equation in real time, offering a dynamic and intuitive approach to mastering one of the core foundations of accounting.

Complementing this is the **Dynamic Financial Statement Builder**, which automatically updates key financial reports as users enter transactions. The platform generates the Statement of Financial Position, the Statement of Profit or Loss, and the Statement of Cash Flow in real time, allowing learners to instantly see how each transaction influences the overall financial health of a business. This feature bridges the gap between transaction-level entries and their outcomes on financial statements, fostering a deeper understanding of how daily business activities shape financial reporting.

Another key innovation is the **Real-Time Feedback and Hints** system. Acting like a virtual tutor, this feature provides prompt, intelligent responses when users make errors. By guiding learners to correct mistakes and reinforcing accurate concepts, it promotes a supportive learning environment that builds confidence and reinforces proper accounting practices. Such feedback is essential in helping learners develop not just procedural skills, but also the critical thinking necessary for accurate financial analysis.

In addition, **Gamified Learning Modules** have been thoughtfully integrated into the platform. Elements such as progress bars, badges, challenges, and reward points are used to increase motivation and sustain engagement. These gamification strategies have been shown to significantly improve learning outcomes in accounting education by making the experience more enjoyable and less intimidating. Recent academic research supports this approach, highlighting that gamification and

interactive tools enhance learners' conceptual understanding and help reduce anxiety commonly associated with accounting courses (Gmińska et al., 2025; Zainol, 2022; Abu Bakar, 2022).

Collectively, these features make FINLOGIC.@STATEMENTS a forward-thinking solution that aligns with the latest educational research and technological trends. By combining interactivity, real-time feedback, and gamification, the platform provides a comprehensive and engaging learning experience that meets the evolving needs of accounting students and educators alike.

METHODS

The methodology for FINLOGIC.@STATEMENTS involves a simulation-based, gamified learning approach that integrates real-time transaction entry with dynamic financial statement generation to foster active, experiential learning. By leveraging interactive digital tools, learners engage in scenario-driven exercises that mimic real-world financial reporting processes, reinforcing their understanding of double-entry bookkeeping and the preparation of key financial statements. The methodology emphasizes constructivist and experiential pedagogies, encouraging learners to build knowledge through hands-on practice, immediate feedback, and iterative problem-solving. Additionally, the adaptive system can be tailored for diverse learning contexts, from academic coursework to corporate training, ensuring both scalability and alignment with modern educational standards.

RESULT AND DISCUSSION

The impact of FINLOGIC.@STATEMENTS is both educational and societal. In classrooms, lecturers have observed increased student engagement and improved comprehension of abstract topics like trial balances and statement interpretation. Learners can now focus on the logic behind transactions rather than memorizing journal entry rules without context.

Beyond formal education, the platform also supports financial literacy and empowerment, particularly for self-learners, entrepreneurs, and small business owners who may lack access to traditional training. This is in line with Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education) and SDG 12 (Responsible Consumption and Production), by equipping users with essential financial skills to make informed decisions.

Incorporating technology into financial education can democratize learning and reduce educational inequalities, particularly when platforms are affordable and accessible, qualities that FINLOGIC.@STATEMENTS actively promotes (Almuntsr et al., 2024).

CONCLUSION

FINLOGIC.@STATEMENTS is developed with a robust business model that emphasizes its strong potential for commercialization across multiple sectors. Designed as a digital learning platform that simplifies the understanding of financial reporting, it caters to the growing demand for accessible, engaging, and practical financial education. Its application spans a wide range of audiences, positioning it as a valuable tool with high market relevance and impact.

One of the most promising markets for FINLOGIC.@STATEMENTS is the education sector. Schools, colleges and universities can seamlessly integrate the platform into their accounting curricula. As financial literacy becomes increasingly essential in today's economy, this tool can serve not only as a primary learning resource but also as a supplementary material in hybrid or fully online courses. Furthermore, it can be bundled with textbooks or embedded into learning management systems (LMS), offering a more interactive and engaging alternative to traditional text-based methods of teaching.

Beyond formal education, FINLOGIC.@STATEMENTS holds significant value in corporate training and professional development. Accounting firms, business associations and corporate training providers can utilize the platform to onboard new employees, educate clients or offer upskilling opportunities to their staff. With its clear and visual approach to accounting principles, the platform is ideal for demystifying complex topics, making it suitable for both professionals and non-accountants seeking to enhance their financial literacy.

The platform also presents a unique opportunity for use by government bodies and non-governmental organizations (NGOs). It can be effectively employed in national financial literacy campaigns, community outreach programs, and initiatives aimed at youth, women entrepreneurs, and underserved populations. Its accessibility and clarity make it a powerful tool for increasing financial inclusion and empowering communities through education.

Looking ahead, FINLOGIC.@STATEMENTS has significant room for future growth and enhancement. Planned developments include multilingual support to cater to non-English speakers, the creation of industry-specific financial training modules to address niche sectors and the establishment of certification pathways for micro-credentials to increase its value for professional development. Additionally, integration with widely used accounting software such as Xero or QuickBooks is envisioned, which would allow learners to transition seamlessly from theory to real-world application.

Overall, FINLOGIC.@STATEMENTS is marked by its adaptability, scalability, and alignment with modern educational practices. These strengths position it as a practical learning solution but also as well as a potential global benchmark in digital financial education. Its commercialization potential is vast, spanning educational institutions, corporate environments, and public-sector initiatives, making it a forward-looking investment in the future of financial literacy.

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FONARAB: FORMULA PENGAJARAN NOMBOR DAN AYAT BAHASA ARAB

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ABSTRAK

Kaedah pengajaran dan pembelajaran (P&P) berasaskan formula telah lama diterapkan dalam pelbagai subjek. Kaedah formula dilihat sesuai untuk diterapkan dalam P&P bahasa Arab. Khususnya bagi topik jenis ayat iaitu ayat kata kerja dan ayat kata nama, serta nombor dan bilangan, penerapan kaedah P&P yang berasaskan formula amat sesuai diterapkan. Hal ini kerana topik-topik ini memerlukan kaedah yang lebih kreatif untuk memudahkan pemahaman pelajar dengan cara yang lebih berkesan. Oleh kerana gaya pembelajaran setiap pelajar adalah berbeza-beza, maka kaedah P&P berasaskan formula dapat membantu pelajar yang cenderung ke arah gaya pembelajaran secara visual. Topik ayat kata kerja dan ayat kata nama serta nombor dan bilangan terkandung di dalam silibus subjek TAC501 Bahasa Arab Permulaan (Tahap III). Subjek ini ditawarkan kepada pelajar ijazah sarjana muda di fakulti-fakulti tertentu sebagai subjek bahasa ketiga di kampus-kampus Universiti Teknologi MARA. Oleh yang demikian, kajian ini dijalankan bagi mengenal pasti keberkesanan pengajaran topik jenis ayat iaitu ayat kata kerja dan ayat kata nama serta nombor dan bilangan bahasa Arab berasaskan formula. Kaedah tinjauan digunakan dalam kajian ini. Borang soal selidik menggunakan google form merupakan instrumen kajian ini bagi mengumpul data kajian. Data dianalisis secara deskriptif berdasarkan peratusan. Hasil maklum balas daripada pelajar menunjukkan bahawa pengajaran berasaskan formula bagi topik ayat kata kerja dan ayat kata nama serta nombor dan bilangan bahasa Arab adalah berkesan untuk diaplikasi.

Kata kunci: Formula, Pengajaran, Pembelajaran, Bahasa Arab

PENGENALAN

Kaedah pengajaran dan pembelajaran (P&P) telah berkembang dari pengajaran berpusatkan guru kepada pengajaran berpusatkan murid. Justeru kajian Saipol Barin et al., (2019) telah mencadangkan bahawa, pendekatan yang sedia ada perlu diolah semula di samping memperkenalkan pendekatan baharu yang lebih efektif bagi menghasilkan pengajaran kemahiran bahasa yang berkesan seperti penggunaan formula.

Kaedah P&P berasaskan formula telah digunakan dalam pelbagai subjek yang melibatkan topik-topik pembelajaran yang bersifat teknikal dan berstruktur seperti subjek Matematik (lihat Mann dan Enderson, 2017; Altıntaş dan Iğün, 2017; Leong, Y. H., Cheng, L. P., Toh, W. Y. K., Kaur, B., & Toh, T. L., 2020) dan Sains (lihat Stott, 2021; Zhao, F., & Schuchardt, A., 2021). Subjek bahasa juga melibatkan topik-topik yang bersifat teknikal dan berstruktur.

Topik dalam bahasa Arab seperti jenis ayat serta nombor memerlukan pendekatan yang sistematik dan mudah difahami. Bagi memudahkan proses P&P topik-topik ini, formula dilihat berupaya membantu menjelaskan struktur bahasa secara visual (pemetaan) dan tersusun.

Kaedah pembelajaran berasaskan formula ini dilihat dapat membantu gaya pembelajaran pelajar secara visual kerana ia menyokong pemahaman pelajar melalui visual atau corak yang jelas. Individu yang cenderung dengan gaya pembelajaran visual adalah mereka yang gemar dengan huruf, visual, gambar rajah dan objek maujud (Faridah Mahadi et al., 2022). Gaya pembelajaran visual akan lebih berkesan dengan bantuan teks dan gambar.

Pendekatan berasaskan formula ini menjadi lebih signifikan apabila diterapkan dalam pengajaran topik-topik yang mencabar dan berstruktur, terutamanya dalam kursus TAC501 (Bahasa Arab Permulaan tahap III) yang merupakan tahap akhir dalam pembelajaran bahasa Arab di peringkat universiti. Kursus ini ditawarkan kepada pelajar Ijazah Sarjana Muda sebagai salah satu subjek bahasa ketiga di Universiti Teknologi MARA dan tergolong dalam kategori kursus wajib universiti. Justeru, penguasaan terhadap topik-topik ini amat penting bagi memastikan pelajar dapat menamatkan kursus dengan cemerlang dan memenuhi keperluan pengijazahan. Sehubungan itu, kajian ini dijalankan untuk meneroka potensi pendekatan pengajaran berasaskan formula dalam membantu pelajar menguasai topik jenis ayat serta nombor dan bilangan dalam bahasa Arab dengan lebih sistematik. Kajian ini juga diharapkan dapat menyumbang kepada penambahbaikan strategi pengajaran bahasa Arab di peringkat universiti selaras dengan keperluan pembelajaran abad ke-21.

METODOLOGI

Kaedah tinjauan digunakan dalam kajian ini. Borang soal selidik menggunakan *google form* merupakan instrumen kajian ini bagi mengumpul data kajian. Data dianalisis secara deskriptif berdasarkan peratusan. Bilangan responden yang menjawab borang soal selidik adalah seramai 48 orang pelajar.

Berikut merupakan representasi dua formula yang digunakan dalam sesi pengajaran, iaitu (i) formula nombor dan bilangan dan (ii) formula jenis ayat. Formula-formula ini dapat digambarkan dalam gambar yang berikut:

RIBU	RATUS	PULUH	BELAS	SA
ألف	مائة	عشرة	أحد عشر	واحد
ألفان	مائتان	عشرون	اثنا عشر	اثنان
				ثلاثة
				أربعة
	مائة + ع X	ون + ع X		خمس
آلاف +			عشر +	سنة
	مائة + ع X	ون + ع X		سبعة
				ثمانية
				تسعة

Gambar 1.: Formula nombor dan bilangan

Gambar 1 di atas menunjukkan pemetaan formula bagi nombor dan bilangan bahasa Arab untuk nilai tempat sa, puluh, ratus dan ribu. Pengaplikasian formula ini memerlukan pelajar untuk mengingat dan menghafal nilai tempat sa terlebih dahulu. Tanpa hafalan nilai tempat sa, formula ini tidak dapat diaplikasi oleh pelajar.

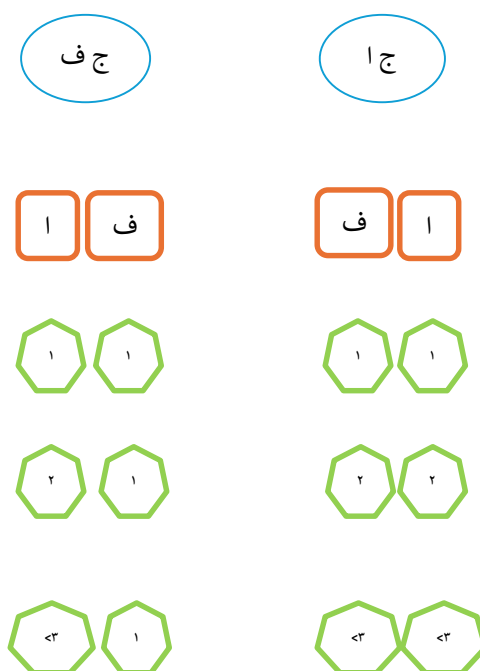
Pada kiraan belas, hanya sebelas dan dua belas sahaja perlu kepada hafalan, manakala bagi kiraan tiga belas hingga sembilan belas, pelajar hanya perlu mengingati kiraan tiga hingga sembilan pada nilai tempat sa dan ia perlu diikuti dengan perkataan ‘asyar (عشر +). Justeru, menghasilkan kiraan nombor belas.

Namun begitu, bagi nilai tempat puluh hanya perkataan sepuluh dan dua puluh perlu dihafal oleh pelajar. Adapun, untuk kiraan tiga puluh hingga sembilan puluh pula, pelajar hanya perlu mengaplikasi formula iaitu melalui pengguguran tā’ marbūṭatt (ة X) bagi nombor tiga hingga tujuh serta sembilan pada nilai tempat sa dan diikuti dengan penambahan (ون +) di akhir kata. Namun begitu, bagi nombor lapan ia perlu kepada pengguguran huruf yā’ dan tā’ (ية X), kemudian barulah diikuti oleh penambahan (ون +).

Seterusnya, pada nilai tempat ratus hanya perkataan seratus dan dua ratus sahaja yang memerlukan kepada hafalan, untuk tiga ratus hingga sembilan ratus pengguguran huruf adalah sama seperti yang dilaksanakan pada nilai tempat puluh, namun ia memerlukan penambahan perkataan mī’att (مائة +) bagi menunjukkan kiraan ratus.

Akhir sekali, kiraan seribu dan dua ribu memerlukan hafalan pada nilai tempat ribu. Namun, bagi menghasilkan kiraan tiga ribu hingga sepuluh ribu, aplikasi formula melalui ingatan nombor tiga hingga sepuluh pada nilai tempat sa diperlukan, dan ditambah dengan perkataan آلاف bagi menunjukkan kepada nilai tempat ribu.

Bagi memastikan formula ini berkesan untuk diaplikasi, pengajaran topik ini perlu diajar secara sekaligus, tanpa membahagikan pengajaran mengikut minggu atau topik bagi setiap nilai tempat sa, puluh, ratus dan ribu. Formula ini lebih baik diajar pada topik yang pertama, manakala pada topik seterusnya hanyalah berfokuskan pada latihan. Hal ini bagi memberi ruang kepada pelajar untuk menggunakan formula yang sama berkali-kali, di samping sebagai sebahagian latih tubi bagi membantu pelajar mengingat.



Gambar 2.: Formula jenis ayat

Gambar 2 di atas menunjukkan pemetaan formula bagi jenis ayat kata kerjaan dan ayat kata namaan. ج merupakan singkatan frasa bagi الجملة الاسمية (ayat kata namaan). Ayat kata namaan dimulakan dengan kata nama (الاسم) yang diwakili oleh ا, manakala ف merujuk kepada kata kerja (الفعل). Kewujudan kata kerja dalam ayat kata namaan adalah pilihan. Namun begitu, jika ayat kata namaan mengandungi kata kerja, struktur kata kerjanya dapat dijelaskan seperti yang diperlihatkan dalam formula di atas. Pemetaan nombor pada ayat kata namaan menjelaskan bahawa struktur kata kerja akan mengikut bilangan kata nama yang mendahului ayat tersebut secara selari. Jika kata nama menunjukkan kepada bilangan tunggal, maka kata kerja yang mengikutinya juga menggunakan struktur kata kerja merujuk kepada kata ganti nama diri tunggal. Namun, jika kata nama yang terdapat di awal ayat merujuk kepada bilangan dua, maka kata kerja yang mengikutinya akan menggunakan struktur kata kerja merujuk kepada kata ganti nama diri dua. Begitu juga yang berlaku terhadap bilangan kata nama tiga orang atau lebih, kata kerja yang mengikuti kata nama tersebut perlulah menggunakan kata kerja bagi kata ganti nama diri jamak.

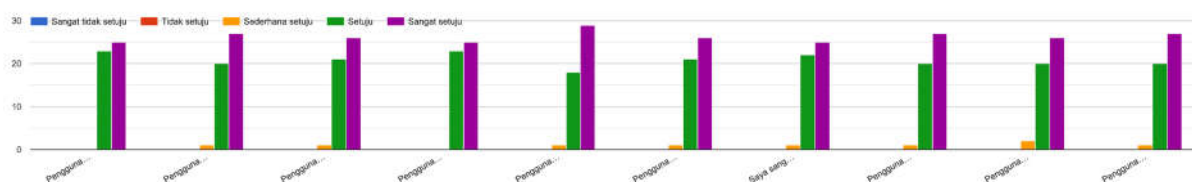
Adapun, ج ف merupakan singkatan frasa untuk الجملة الفعلية (ayat kata kerjaan). Struktur ayat kata kerjaan perlulah didahului oleh kata kerja dan diikuti oleh kata nama atau tanpa kata nama. Pemetaan nombor dalam ayat kata kerjaan adalah berbeza dengan ayat kata namaan. Formula di atas merepresentasikan bahawa kata kerja bagi ayat kata kerjaan akan kekal menggunakan bentuk kata kerja bagi kata ganti nama diri tunggal, walaupun bilangan kata nama merujuk kepada bilangan tunggal, dua dan jamak (tiga orang atau lebih).

Formula ini juga perlu diajarkan secara serentak bagi memperlihatkan kepada pelajar perbezaan di antara jenis ayat kata kerjaan dan ayat kata namaan. Hal ini dapat membantu pelajar lebih memahami dan memudahkan proses mengingat.

DAPATAN DAN PERBINCANGAN

Hasil maklum balas dari pelajar TAC501 yang telah mengaplikasi formula nombor dan bilangan serta jenis ayat semasa satu semester pembelajaran menunjukkan dapatan yang positif. Berikut perbincangan hasil data yang diperolehi.

Keberkesanan aplikasi formula terhadap pelajar:



Rajah 1.: Graf Peratusan Keberkesanan Aplikasi Formula Menurut Pelajar

Rajah di atas menunjukkan bahawa skala likert yang digunakan adalah 5 mata iaitu sangat tidak setuju, tidak setuju, sederhana setuju, setuju dan sangat setuju. Berdasarkan rajah 1 di atas, pelajar hanya memberikan jawapan sangat setuju, setuju dan sederhana setuju sahaja. Tiada seorang pelajar pun yang memilih jawapan tidak setuju dan sangat tidak setuju. Perincian peratusan bagi maklum balas pelajar terhadap keberkesanan aplikasi formula dapat diperlihatkan dalam jadual berikut:

Jadual 1.: Maklum balas pelajar terhadap keberkesanan aplikasi formula

NO	SOALAN MAKLUM BALAS	Sederhana setuju	Setuju	Sangat setuju
1	Penggunaan formula memudahkan saya memahami topik yang dipelajari.	-	47.9%	52.1%
2	Penggunaan formula membantu saya mengingat topik yang dipelajari.	2.1%	41.6%	56.3%
3	Penggunaan formula meringkaskan pemahaman topik yang kompleks.	2.1%	43.7%	54.2%
4	Penggunaan formula sangat membantu pelajar.	-	47.9%	52.1%
5	Penggunaan formula patut diaplikasi dalam pembelajaran bahasa.	2.1%	37.5%	60.4%

NO	SOALAN MAKLUM BALAS	Sederhana setuju	Setuju	Sangat setuju
6	Penggunaan formula menjimatkan masa ulangkaji pelajar.	2.1%	43.7%	54.2%
7	Saya sangat suka pembelajaran menggunakan formula.	2.1%	45.8%	52.1%
8	Penggunaan formula membuatkan saya lebih bersemangat mempelajari bahasa Arab.	2.1%	41.6%	56.3%
9	Penggunaan formula membolehkan saya menerangkan topik yang dipelajari kepada rakan yang lain.	4.2%	41.6%	54.2%
10	Penggunaan formula membuatkan proses pembelajaran menjadi ringkas dan padat.	2.1%	41.6%	56.3%

Berdasarkan jumlah peratusan yang direpresentasikan dalam Jadual 1 di atas jelas menunjukkan keberkesanan aplikasi formula nombor dan bilangan serta jenis ayat terhadap pelajar. Hal ini dapat dikukuhkan lagi melalui komen dan cadangan penambahbaikan yang dikemukakan oleh pelajar. Komen dan cadangan tersebut dapat diperlihatkan dalam gambar berikut:

Komen dan cadangan penambahbaikan. = - Memudahkan cara . Tiada sebab semua okey bagi saya tidak perlu penambahbaikan kerana ianya sudah cukup sempurna tiada tiada Baikkkk tiada, bagi saya ia sangat membantu	Komen dan cadangan penambahbaikan. tiada ustazah semuanya lengkap dan sempurna tiada tiada Tiada semuanya terbaik - Banyakkan lagi formula
Komen dan cadangan penambahbaikan. pendapat saya dengan penggunaan formula ini sememangnya sangat membantu dalam pembelajaran bahasa arab iniii	Komen dan cadangan penambahbaikan. memudahkan para pelajar untuk mendapat A tiada

Gambar 3.: Komen dan cadangan penambahbaikan

Gambar 3 di atas menunjukkan senarai komen dan cadangan penambahbaikan oleh para pelajar hasil penggunaan formula nombor dan bilangan serta jenis ayat dalam sesi pengajaran subjek TAC501. Komen yang diberikan menunjukkan maklum balas yang positif dari pelajar seperti pelaksanaan formula memudahkan cara, sangat membantu, di samping memudahkan pelajar mendapat gred A bagi subjek ini. Terdapat juga cadangan untuk memperbanyakkan lagi penggunaan formula dalam sesi pengajaran subjek ini. Oleh yang demikian, maklum balas tersebut menjelaskan bahawa aplikasi formula nombor dan bilangan serta jenis ayat berkesan digunakan dalam sesi pengajaran subjek TAC501.

PEMBAHARUAN

Formula ini dibangunkan khusus untuk topik nombor dan bilangan, serta jenis ayat dengan menampilkan formulasi baharu yang bersifat asli dan inovatif. Formula ini direka khas untuk memudahkan pemahaman pelajar bagi topik yang terlibat. Ia belum diperkenalkan secara formal, menjadikannya satu pembaharuan yang signifikan dan sesuai dengan keperluan pengajaran semasa.

PENGGOMERSIALAN

Formula ini mampu dikomersialkan jika visual formula tersebut dipindahkan kepada bentuk aplikasi teknologi terkini.

KESIMPULAN

Secara keseluruhannya, dapatan kajian ini menunjukkan kesesuaian dan keberkesanan pendekatan berasaskan formula dalam pengajaran bahasa Arab, khususnya bagi topik yang bersifat teknikal dan berstruktur. Maka, pendekatan ini wajar diteruskan dan diperluaskan aplikasinya dalam konteks pembelajaran bahasa di peringkat institusi pengajian tinggi.

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FUNETIX: AN INTERACTIVE PHONETICS LEARNING GUIDE

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ABSTRACT

Phonetics is an essential subject in many academic programmes across local universities, yet students often face significant challenges in learning its complex sound symbols, particularly the International Phonetic Alphabet (IPA). Like learning any new language or writing system, mastering phonetics requires consistent practice, memory reinforcement, and effective revision tools—resources that are frequently lacking in traditional instruction. To bridge this gap, FUNETIX was developed as a digital application designed to support phonetics learning through interactive exercises and multimedia content. Inspired by established language learning applications, FUNETIX aims to enhance student engagement and retention by offering repetitive quiz-based activities that vary in content but reinforce the same phonetic principles. This method, grounded in cognitive learning theories such as active recall and spaced repetition, enables learners to gradually internalize phonetic symbols, improving both their accuracy and speed in transcription tasks. The application also includes optional supplementary materials available for purchase, providing users with extended learning opportunities. By integrating technology with linguistics education, FUNETIX serves as a practical and innovative solution for students seeking to strengthen their foundational skills in phonetics. This paper outlines the pedagogical rationale, design features, and educational potential of the FUNETIX application as a modern tool for phonetic instruction.

Keywords: *Linguistics, Language Learning Application, International Phonetic Alphabet (IPA)*

INTRODUCTION

Phonetics, the study of speech sounds, is a crucial aspect of language learning. Mastering its symbols is fundamental for students across various levels of education; from undergraduate linguistics students to doctoral candidates. These symbols are also used widely in every other country, although their representation may vary across languages. FUNETIX aims to not only assist students who are particularly enrolled in English for Professional Communication (LG120) at Universiti Teknologi MARA (UiTM) Cawangan Melaka Kampus Alor Gajah. However, its potential may even go beyond and across the sea by aiding linguistics students all over the globe. This project focuses on the phonetic symbols of English. A study conducted by Salas-Morera, L., Arauzo-Azofra, A., and García-Hernández,

L. (2012) students rated between 4.06 and 4.20 out of 5 in regards of quizzes in keeping up with subject content. This further proves that learning in the form of quizzes may help the students' cognitive ability in recognising the symbols through repeated practice. Despite there being plenty of language learning applications readily available online, there are not many that are aimed at phonetic symbol learning. FUNETIX also provides additional notes that will be helpful for the users' studies on Instagram and sells PDFs of an exercise book. FUNETIX aims to increase linguistics students' ability in identifying IPA symbols, allowing improvements in phonetic transcription skills from a spoken word. This will also result in enhancement of English pronunciation accuracy as a result of better understanding of the proper oral placement of a sound. Moreover, due to the interactive element of the application and exercise book, students will feel more motivated to learn as their overall experience when learning phonetics becomes more enjoyable. This application focuses its market on semester 1 students who are furthering their studies in the Diploma in English for Professional Communication (LG120), specifically those who study the Pronunciation (ALS102) subject in Universiti Teknologi MARA (UiTM). Not only can the application be used by LG120 students, but its marketability can be expanded amongst Linguistics students across the globe.

METHODS

This project, FUNETIX was born from multiple trials and errors on many different platforms. After much thinking, Genially was chosen for website making, and AppsGeyser will turn the website into the final version, which is an application. The exercise book on the other hand was made on Canva and converted into a PDF. FUNETIX focuses its performance in terms of interactivity and the utilisation of audio-visual aids. Learning phonetics without the help of audio-visual aids is a challenging procedure as the subject itself revolves around sounds and the way they are made. A study by Zerroug, E. (2019) mentioned that audio aids are helpful for EFL learners' motivation to attain a foreign language and refine their speaking skills. Learning from audio may guide the learning of spoken language to a native level. In the same study, it was found that visual aids may contribute greatly to the students' understanding and retention of information. This project is generally inexpensive and budget-friendly. Although that is the case, equipment, like gadgets and other necessities such as electricity and Internet connection are most certainly needed as the progress of this project is heavily online.

RESULTS AND DISCUSSION

The results of this project were gained through primary research questions conducted on semester 1, Diploma in English for Professional Communication (LG120) students through Google Form.

Which of the following challenges relate to you when learning phonetics?

 Copy chart

20 responses

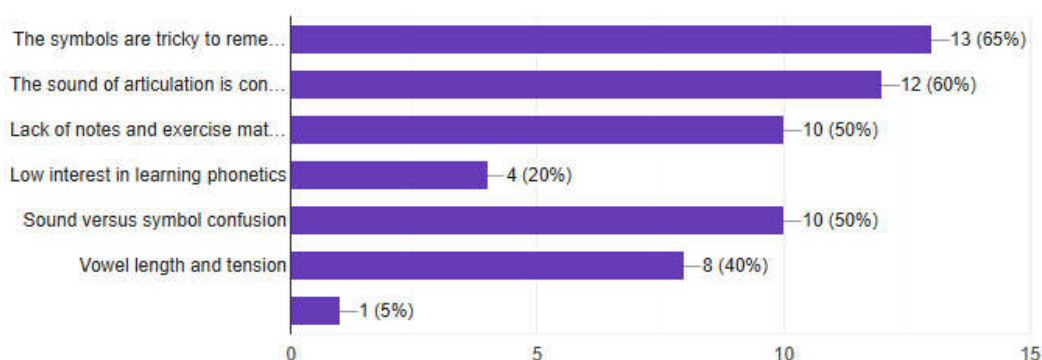


Figure 1.: Challenges in Learning Phonetics

The figure above shows that more than half of the first-semester students of LG120 face difficulties such as recalling tricky symbols, confusing the sound of articulation, a lack of notes and exercise materials, and sound versus symbol confusion. This shows the importance of exercises and learning sources in learning phonetics. In the survey, all 20 students agreed that interactive quizzes are helpful for their studies, showing FUNETIX’s application and exercise potential in aiding the students with their learning.

Have you come across any interactive website or materials on phonetics?

20 responses

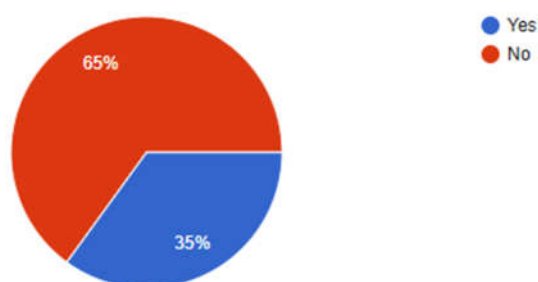


Figure 2.: The Availability of Interactive Website or Materials on Phonetics

As seen in Figure 2, 65% of the students could not find any interactive website or materials related to phonetics. This explains that despite interactivity being useful, content on phonetics is still limited. Based on the short pre-trial link of the application sent in the survey form, 100% of the responders find the website which was turned into an application helpful for their phonetics studies.

CONCLUSION

This project has received a generous amount of feedback due to its useful nature in helping studies on phonetics. Utilising interactivities on notes and exercises not only will make it interesting, but also effective, helping the project stand out in its own ways in comparison to other platforms. The addition of an exercise book also functions well as an extra hand for the memorization journey. With this project, study materials for these students will grow. This project is believed to have the potential to grow better in terms of interactivity. However, due to the limitations of budgets and sources, some initiatives had to be removed. Despite that, the project still received quite a massive amount of positive feedback.

ACKNOWLEDGEMENT

Throughout the journey of finishing this project, we have received a tremendous amount of support from everyone, be it family, friends, or the lecturer. This project will not be able to see the light of day without the emotional and intellectual support given to us. To conclude, this project would not have existed without the aid of everyone who has brought me to this stage of life. We thank you all.

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FROM TEACHERS TO GLOBAL EDUCATORS: THE MALAYSIAN GCED MANUAL

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ABSTRACT

Global Citizenship Education (GCED) is gaining global recognition as a transformative approach in teacher training, particularly aligned with Sustainable Development Goal (SDG) 4.7, which aims to ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including through education for global citizenship. However, Malaysian teacher training institutions often lack structured and contextualized tools for embedding GCED in instructional practice. This project introduces an innovative product, a manual titled “Pendidikan Kewarganegaraan Global untuk Institusi Pendidikan”, developed by USM’s Global Citizenship Education Cooperation Centre-Malaysia GCC-Malaysia@USM team. The manual integrates UNESCO’s core values of diversity, solidarity, and shared sense of humanity into teacher education, supported by a modular training framework. The manual features a wide range of practical content, emphasizing the integration of three key domains of GCED: cognitive (Head), socio-emotional (Heart), and behavioral (Hand). It includes basic information on understanding GCED, classroom activities, reflective exercises, and planning templates. These are tailored to help teachers bring abstract global issues such as diversity, sustainability, peace, human rights, and global interdependence into relatable classroom experiences. All these were implemented through structured sessions across several teacher training institutes in Malaysia. Findings demonstrate an increase in reflective practice, global awareness, and classroom integration of GCED concepts among participating teachers. This project strongly contributes to the realization of SDG 4.7 in the Malaysian context and has high scalability potential, positioning Malaysia as a regional leader in operationalising GCED through teacher education in an effort to build educators’ capacity in fostering globally aware and socially responsible students.

Keywords: *global citizenship, teacher training, sustainable development, education innovation, Malaysia*

INTRODUCTION

In the 21st century, education must respond to increasingly complex global realities such as migration, climate change, inequality, and cultural pluralism. The need to nurture globally competent learners has increased efforts to embed Global Citizenship Education (GCED) in national education systems. Teachers are no longer simply knowledge deliverers as they are expected to be global role models capable of nurturing students to become informed, responsible global citizens. The 2030 Agenda for Sustainable Development, particularly SDG Target 4.7, emphasizes the need for all learners to acquire knowledge and skills essential for promoting sustainable development, human rights, gender equality and global citizenship (UNESCO, 2015a). Global Citizenship Education (GCED) is not a new concept in Malaysian education because its values resonate with the national philosophy of education and are aligned with the aspirations laid out in the Malaysian Education Blueprint 2013 – 2025, which promotes values-driven education and identifies student aspirations (Ministry of Education, 2013). While the Malaysian Education Blueprint 2013–2025 reflects this direction, GCED has yet to be fully translated into training modules for teachers. Moreover, the UNESCO-APCEIU Final Report (2021) found that both pre-service and in-service teachers in Malaysia possess moderate to high awareness of GCED concepts but lack pedagogical confidence and training. Additionally, the absence of standardised GCED modules highlights this readiness gap. Studies suggest that well-designed GCED training materials and reflective pedagogical practices can significantly enhance teacher preparedness (APCEIU, 2020; UNESCO, 2018). Without the manual, Malaysian teachers face challenges, often left without culturally relevant, practical resources in interpreting and implementing GCED in real classroom settings. Therefore, by recognising this gap, a manual was developed to provide guidance rooted in local values and pedagogy for Malaysian teachers.

THE INNOVATION: THE MALAYSIAN GCED MANUAL

This innovation responds to the gap through the implementation of an instructional manual entitled “Pendidikan Kewarganegaraan Global untuk Institusi Pendidikan”, published by Universiti Sains Malaysia (USM) in July 2024, spearheaded by the Global Citizenship Education Cooperation Centre (GCC) at Universiti Sains Malaysia. The manual provides a comprehensive and structured framework for embedding Global Citizenship elements (GCE) into teacher training programs across Malaysia, guided by the United Nations Educational, Scientific and Cultural Organization’s (UNESCO) three core domains which are cognitive (head), socio-emotional (heart), and behavioural (hand), with three key principles that are respect for diversity, solidarity, and shared humanity (APCEIU, 2020; UNESCO, 2018). It is designed in the Malay language to promote accessibility and cultural resonance, particularly in Malaysian context.

This manual comprises eight comprehensive chapters designed to guide the integration of Global Citizenship Education (GCED) into teacher training, which includes a conceptual framework, curriculum integration, classroom activities, assessment tools, and teacher reflection components. Further insights of the manual consist of **Chapter 1**, which introduces GCED, its definition, importance, and the concepts of interconnectedness and diversity. **Chapter 2** outlines the core domains that are

cognitive, socio-emotional, and behavioural, as well as its guiding principles such as respect, solidarity, and shared humanity. **Chapter 3** explores the key elements and presents a conceptual framework for implementing GCED. **Chapter 4** focuses on translating GCED concepts into transformative learning activities, providing guidelines for activity selection and delivery. **Chapter 5** connects GCED to the national curriculum, highlighting its current status in Malaysia and its historical context. **Chapter 6** offers practical steps to develop an action plan for implementing GCED at the institutional level. **Chapter 7** emphasizes self-reflection and self-assessment as tools for improving GCED practices. Finally, **Chapter 8** concludes the manual, summarizing key insights and providing references for further reading and application.

The manual was piloted through face-to-face training at 12 schools and teacher education institutes nationwide. Teachers engaged in experiential activities such as role-playing, collaborative lesson planning, and reflective journaling. Feedback loops were integrated to revise and adapt content to participants' needs. This innovation is a transformative approach in teacher training, particularly aligned with Sustainable Development Goal (SDG) 4.7, which aims to ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including through education for global citizenship.

METHODOLOGY

This project adopted a structured approach to integrate Global Citizenship Education (GCED) into teacher training programs using the *Pendidikan Kewarganegaraan Global untuk Institusi Pendidikan* manual. The manual development involved four stages, which are seen below:

Needs Analysis - The process begins with professional development workshops for teacher educators across Malaysia, focusing on the manual's core domains, which are cognitive (head), socio-emotional (heart), and behavioural (hand), as well as its key values of diversity, solidarity, and shared humanity (UNESCO, 2015b). Then, GCC-USM Associates identified teachers' lack of GCED awareness and resources via questionnaires.

Content Development - Training modules were piloted in selected teacher education institutions. The materials were created based on UNESCO's GCED framework, Malaysian curriculum standards and teachers' input. Interactive learning activities such as case studies, role-plays, and reflective journaling were utilised to build critical thinking, empathy, and collaborative skills among teachers. This approach aligns with Kolb's Experiential Learning Cycle (Kolb, 2015).

Implementation - Trainings were conducted across Malaysia, from January to June 2024 with more than 360 educators from schools and tertiary institutions.

Evaluation and Feedback - Participants' responses were collected to assess relevance, usability and its impact. In addition to that, the teachers reported the projects that have been done in their respective fields, like Geography, History, and English classes. The project includes continuous monitoring to ensure alignment with Sustainable Development Goal (SDG) 4.7 and the Malaysian Education Blueprint, ultimately aiming to cultivate educators capable of nurturing responsible global citizens. In July 2025, a symposium was held for teachers to showcase their work post-training.

RESULTS AND DISCUSSION

The **GCC-USM GCED manual** provides a much-needed innovation. The implementation of the *Pendidikan Kewarganegaraan Global untuk Institusi Pendidikan* manual across selected teacher training institutes in Malaysia through its 12 series in 2024, has yielded promising outcomes. Teachers and educators who underwent the training reported a significant increase in their understanding and application of GCED concepts, particularly in integrating global issues such as diversity, sustainability, and human rights into classroom activities. In 2024 alone, more than 360 educators had gone through the training conducted using the manual.

The training modules successfully fostered the development of the three core GCED domains of cognitive (head), socio-emotional (heart), and behavioural (hand). Participants demonstrated improved capabilities in designing lesson plans and learning activities that reflect GCED principles. Many educators also reported increased confidence in facilitating discussions on complex global topics, highlighting a shift in both pedagogical mindset and practice. The manual's structured modules and its Malay language format also contributed to user-friendliness and practical application.

Moreover, the GCED symposium, which was held on the 9th of July 2025 with 500 teachers attended from schools across Penang, provided a platform for teachers and educators to showcase their field-based projects, encouraging knowledge exchange and collaborative reflection in a classroom setting. The variety of classroom strategies and action plans presented during the symposium reflected diverse local adaptations of GCED, indicating the manual's flexibility and relevance across educational contexts.

The results suggest that a structured, contextually grounded approach to GCED, when supported with clear guidelines, practical tools, and reflective practices, can effectively transform teacher training, thus confirming prior regional findings by UNESCO (2018). The scalability of the project further positions Malaysia as a potential leader in operationalising GCED in Southeast Asia. Continued institutional support and policy alignment are essential to sustain these gains and expand the program's reach nationwide, in alignment with SDG 4.7 and the Malaysian Education Blueprint.

CONCLUSION

The **GCC-USM GCE manual**, *Pendidikan Kewarganegaraan Global untuk Institusi Pendidikan* provides a much-needed innovation to bridge global educational goals and local classroom realities. It represents a significant step toward integrating GCED in Malaysia's teacher education and addresses gaps by offering a practical, scalable, and contextually relevant training solution that aligns with both global frameworks and local needs.

The project has shown positive reception among Malaysian educators, many of whom expressed increased confidence and clarity in integrating global perspectives into lesson planning. Participants also reported improved self-awareness as educators in a global context. The findings indicate that GCE training, when embedded with culturally relevant materials and structured support, can contribute

meaningfully to teacher professional development. This innovation has a strong potential for national scale-up and international collaboration in the Southeast Asian region. Investing in teacher capacity building through this manual will not only improve classroom outcomes, but also contribute to cultivating socially responsible, globally minded Malaysian youth through teachers.

ACKNOWLEDGEMENTS

This study was conducted post-training to Malaysian educators, in schools and tertiary institutions. We would like to thank Global Citizenship Education Cooperation Centre Malaysia @ USM under the funding of Asia-Pacific Centre of Education for International Understanding (APCEIU), in the construction of this manual and the training sessions conducted for teachers in Malaysia.

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GAMIFIED LEARNING TOOL WITH INTEGRATED FORMATIVE ACTIVITIES FOR BASIC ELECTRICITY AT DIPLOMA LEVEL

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ABSTRACT

Students at the diploma level often face challenges in retaining and applying fundamental concepts of electricity. This is largely attributable to the persistence of passive pedagogical approaches and conventional assessments that provide minimal interactivity and lack prompt feedback. Such approaches are no longer effective in meeting the learning needs of 21st century students, who thrive in digital, engaging, and self-paced environments. As a result, this disconnect contributes to reduced motivation, shallow understanding, and weak knowledge retention, particularly in technical subjects like electricity. In response to this issue, this innovation introduces a game-based learning tool developed using an online platform, specifically designed to enhance learning of basic Electricity. The tool integrates formative assessment activities, including Multiple Choice Questions (MCQ), True/False, and Fill-in-the-Blank, to support knowledge-level outcomes. By offering interactive gameplay, real-time feedback and visual engagement, the tool aims to improve conceptual clarity, promote active learning, and sustain student motivation. This innovation supports flexible and independent learning while aligning with current trends in technology-enhanced education, offering a dynamic and student-centered alternative to conventional teaching methods in technical education.

Keywords: Game-based learning, Formative assessment, Basic electricity, Knowledge retention, Diploma-level education

INTRODUCTION

Understanding the principles of electricity is essential in technical and engineering education, particularly at the diploma level. However, many students continue to face difficulties in grasping and applying these concepts in meaningful ways. Traditional lecture-driven instruction, which limits student engagement and critical thinking, remains a significant barrier to effective learning in this area. These conventional approaches often fail to provide opportunities for interaction, hands-on practice, and timely feedback, which are essential for promoting deeper conceptual understanding and sustained motivation. Smiderle et al. (2020) found that gamified learning environments can positively influence students' engagement, motivation, and learning outcomes, supporting the need for more interactive, student-centered approaches in technical education. Gamification in education, as highlighted by Fitria (2022), enhances learning by increasing motivation and engagement. By incorporating elements such as immediate feedback, challenge, and learner autonomy, game-based approaches provide a more interactive and student centered experience suited for digital-native learners. These methods promote active learning while enabling students to monitor their own progress through instant feedback. The shift toward Industry 4.0 and digital education post pandemic has heightened the demand for innovative, student-centered learning solutions. Technical education, in particular, must evolve to equip learners with both conceptual mastery and independent learning skills supported by technology-enhanced tools. To bridge the gap between traditional methods and modern learning needs, this study introduces Circuit Quest. It is a gamified, game-based learning tool developed to enhance conceptual understanding of basic electricity. By embedding formative assessment elements within engaging gameplay, the innovation aims to boost knowledge retention, support self-directed learning, and offer a dynamic alternative to conventional instruction.

METHODS

Circuit Quest is a gamified, web-based educational tool designed to enhance diploma students' understanding of basic electricity. Developed using interactive content platforms such as Genially, the tool requires no installation and can be accessed via a QR code on any device such as a laptop, tablet, or smartphone. This makes it highly accessible and flexible for diverse learning environments. Upon launching the game, students choose their preferred game mode, either solo or team player (up to four players). They then select one of four avatars: Captain Volt, Lightning Dash, Battro, or Blade Spark, to begin their mission. After that, players roll a virtual dice to move across a gamified Electric Grid, landing on tiles that trigger different types of learning zones. Each tile represents a specific formative assessment zone:

1. **Current Clash:** Focused on electric current concepts.
2. **Voltage Vault:** Related to voltage sources and power measurement.
3. **Ohm Zone:** Application of Ohm's Law.

4. Circuit Checkpoint: Differentiation and classification of series and parallel circuits.

At each zone, players must complete a challenge, which may be in the form of multiple-choice questions (MCQ), true/false prompts, or fill-in-the-blank tasks. All questions are aligned to learning outcomes at the knowledge level. Players receive instant feedback after each response, allowing them to either move forward for correct answers or step back if incorrect. Visuals, animations, sound effects, and reward elements are embedded to sustain engagement and motivation. A similar approach was adopted by Nuraminah et al. (2024), who incorporated MCQ-based quizzes within interactive learning media for electrical installation classes, demonstrating improved student understanding and engagement through multimedia integration.

This gameplay approach integrates formative assessment and gamification, which have been shown to significantly enhance student learning, engagement, and behavioral outcomes when implemented in educational contexts, as supported by Smiderle et al. (2020). The overall gameplay structure is illustrated in Figure 1, which outlines the learner’s journey from launch to mission completion.

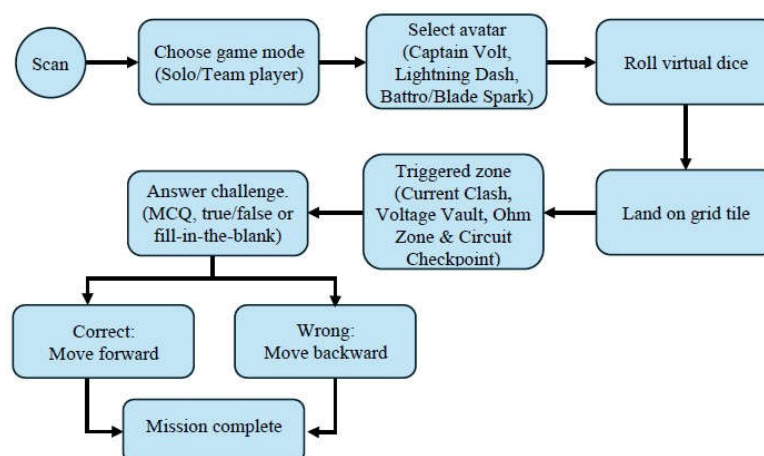


Figure 1.: Gameplay Flow of Circuit Quest

RESULTS AND DISCUSSION

Student Engagement and Feedback

Pilot classroom implementation of Circuit Quest yielded promising responses from diploma-level students. Many learners reported increased interest and clearer understanding of electrical concepts such as voltage, current, and circuit types, which they previously found difficult. The game's interactive zones, avatar-based design, and real-time feedback were consistently described as engaging and motivating. Table 1 shows representative feedback from students, reflecting how the game’s features helped facilitate meaningful learning experiences.

Table 1.: Representative Student Feedback from Initial Pilot Session

Student	Feedback
1	It's really fun and engaging! I didn't get bored at all.
2	I love the visuals—they make it easier to understand.
3	Now I understand the topic, not just memorize it.
4	I'm focused. Finally understood current vs voltage

The game's multiplayer mode fostered collaboration and peer learning, echoing the principles of collaborative engagement presented by Adipat et al. (2021), who identified that social and narrative elements in game-based learning enhance motivation and group interaction. Some students also mentioned that the competitive nature of the multiplayer mode made learning feel more like a game than a classroom activity, reducing anxiety and increasing participation. Informal observations during gameplay sessions revealed high levels of concentration, peer-to-peer explanation of concepts, and voluntary replay attempts, indicating strong engagement and cognitive involvement.

Learning Benefits and Accessibility

The real-time feedback embedded in each challenge allowed students to reflect on their understanding immediately, supporting formative learning. The self-paced and replayable structure promoted independent learning and allowed learners to revisit difficult concepts, which contributed to better retention as supported by Huang & Soman (2013). One of the notable strengths of the game is its high accessibility, allowing students to engage with the platform effortlessly across multiple devices, without the barrier of installation or user authentication. This ease of use made it suitable for in-class use, group study sessions, and individual revision, aligning with Bedenlier et al. (2020), who emphasized the role of accessible, well-designed educational technologies in enhancing engagement and learner autonomy in higher education.

Several students accessed the game outside of class hours, using their smartphones during self-study time. This behavior reflects the tool's appeal and supports its role in encouraging continuous, self-directed learning beyond structured lessons. These findings are in line with Ramdani et al. (2021), who reported that the use of digital teaching materials, particularly those developed using problem-based learning, can significantly enhance students' conceptual understanding and motivation in learning basic electricity within vocational education settings. Although the pilot involved a small number of students, the feedback indicates that Circuit Quest holds strong potential to bridge the gap between passive instruction and active, learner-centered exploration.

CONCLUSION

Circuit Quest presents an effective alternative to conventional methods for teaching basic electricity at the diploma level. By integrating formative assessments within an interactive, gamified environment, it tackles common issues such as low motivation and weak conceptual understanding. Preliminary classroom feedback suggests the game is engaging, easy to use, and supports clearer understanding of core concepts. Its self-paced format and cross-device accessibility cater well to modern learners. Although tested on a small scale, the tool shows strong potential for wider adoption. Future enhancements could include expanded content and tracking features.

In the future, Circuit Quest could be expanded to cover higher-level topics such as AC circuits, instrumentation, or digital systems. The tool also holds promise for integration with analytics features to track learner progress, enabling instructors to personalize support and interventions. Its modular structure opens up possibilities for adaptation across other STEM fields, promoting scalable and sustainable innovation in technical education.

ACKNOWLEDGEMENTS

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GAMIFIKASI DALAM PSIKOLOGI KAUNSELING: KEMBARA KERJAYA

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ABSTRAK

Kajian ini bertajuk Kembara Kerjaya yang bertujuan untuk mengenal pasti bagaimana hubungan individu dan penyesuaian diri di dalam sesebuah organisasi berdasarkan sifat, jenis personaliti, dan pendekatan mereka terhadap isu-isu umum yang timbul dalam persekitaran kerja. Melalui perbincangan terbuka dan pandangan terhadap situasi secara tidak langsung, kajian ini cuba menggambarkan corak tingkah laku serta kecenderungan seseorang tanpa menimbulkan rasa tersinggung atau penghakiman. Walaupun kajian ini masih berada pada peringkat awal dan belum melibatkan pengumpulan data secara formal, hasil yang diharapkan adalah pemahaman yang lebih mendalam terhadap gaya kerja individu dalam organisasi. Kesimpulannya, pendekatan ini berpotensi membantu ahli organisasi memahami antara satu sama lain dengan lebih berkesan, sekali gus memperkukuh hubungan dan produktiviti dalam pasukan.

Kata kunci: organisasi, personaliti, tingkah laku, komunikasi interpersonal dan intrapersonal, dinamik pasukan.

PENGENALAN

Gamifikasi dalam psikologi dan kaunseling merupakan salah satu pendekatan inovatif yang boleh diaplikasikan di dalam sesi kaunseling bagi meningkatkan motivasi, penglibatan, dan komitmen klien terhadap proses kaunseling itu sendiri (Kapp, K. M., 2012 ; Deterding, Dixon, Khaled, & Nacke, 2011). Pendekatan ini menggunakan elemen permainan seperti ganjaran, pencapaian, cabaran, serta maklum balas segera untuk membantu klien memahami diri mereka dengan lebih baik, seterusnya memupuk perubahan tingkah laku yang positif secara lebih menyeronokkan dan interaktif (Werbach & Hunter, 2012).

Selain itu, kemahiran komunikasi dalam sesebuah organisasi memainkan peranan yang sangat penting kerana ia menjadi asas kepada pembentukan hubungan kerja yang harmoni, suasana kerja yang kondusif, dan keberkesanan dalam pencapaian matlamat organisasi (Keyton, 2017). Keupayaan setiap individu untuk berkomunikasi secara sopan, profesional, dan berkesan adalah amat mustahak bagi mengelakkan sebarang salah faham, isu dalaman, atau konflik yang boleh menjejaskan produktiviti serta keharmonian tempat kerja. Oleh itu, organisasi yang menekankan pembangunan kemahiran komunikasi dalam kalangan ahlinya bukan sahaja dapat memperkukuhkan budaya kerja positif, malah turut meningkatkan tahap kepuasan kerja dan kesejahteraan psikologi para pekerja.

KAEDAH

Kajian ini dijalankan bermula dengan sesi kelompok yang melibatkan beberapa orang staf bagi mengenal pasti cabaran dan kekangan yang dihadapi semasa sesi perbincangan. Hasil daripada sesi tersebut, didapati bahawa para peserta kurang berkongsi idea, kurang memberikan pandangan serta pendapat, yang sekali gus menjejaskan keberkesanan perbincangan. Berdasarkan pemerhatian ini, tercetuslah idea untuk membangunkan satu bentuk inovasi yang dapat menggalakkan penglibatan lebih aktif daripada staf.

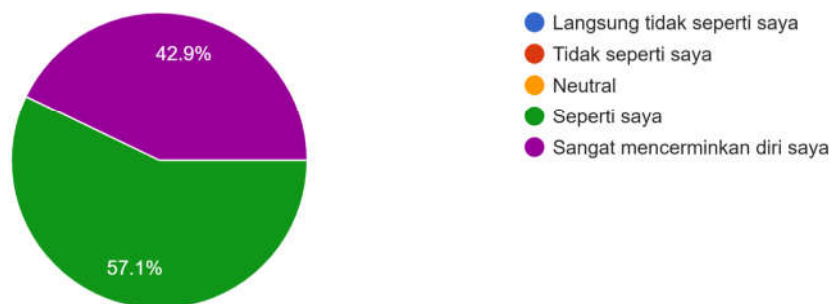
Inovasi ini dipilih kerana reka bentuknya yang mudah difahami dan senang digunakan oleh semua golongan staf, tanpa mengira latar belakang atau kemahiran teknologi. Selain itu, inovasi ini juga bersifat fleksibel kerana boleh dimainkan di mana-mana sahaja sama ada di pejabat, bilik mesyuarat mahupun semasa sesi latihan. Ia turut sesuai dijadikan sebagai bahan interaktif semasa pameran di reruai pameran atau dalam pelbagai aktiviti berkaitan pengajaran dan pembelajaran.

Kaedah pelaksanaan inovasi ini melibatkan pemerhatian semasa penggunaan, pengumpulan maklum balas daripada peserta, serta analisis kualitatif terhadap perubahan tahap penglibatan staf. Pendekatan ini membolehkan penilaian dibuat secara lebih menyeluruh terhadap keberkesanan inovasi dalam merangsang idea, meningkatkan keyakinan diri untuk berkongsi pendapat, serta mewujudkan suasana perbincangan yang lebih aktif dan produktif.

HASIL DAN PERBINCANGAN

Saya lebih faham gaya komunikasi saya selepas aktiviti ini.

7 responses

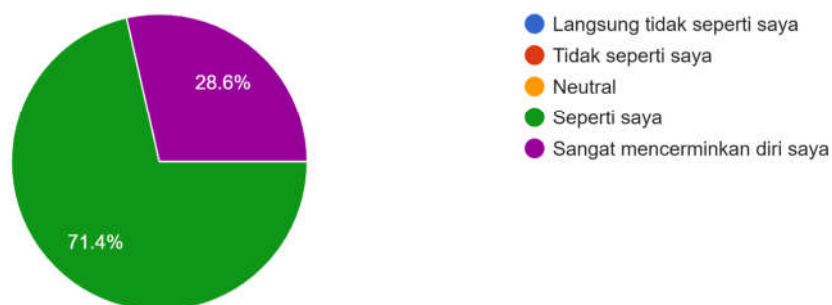


Rajah 1.: Peratusan responden yang memahami gaya komunikasi diri selepas aktiviti dijalankan.

Berdasarkan Rajah 1, didapati bahawa semua responden bersetuju aktiviti ini membantu mereka memahami gaya komunikasi diri, dengan 57.1% memilih "Seperti saya" dan 42.9% memilih "Sangat mencerminkan diri saya". Tiada responden yang memberi maklum balas negatif atau neutral, membuktikan keberkesanan aktiviti dalam meningkatkan kesedaran komunikasi dalam kalangan peserta.

Aktiviti ini membantu saya melihat peranan saya dalam pasukan.

7 responses



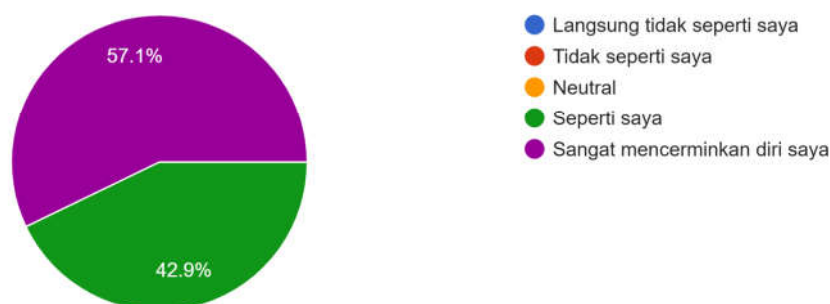
Rajah 2.: Peratusan responden yang bersetuju aktiviti membantu mereka melihat peranan dalam pasukan.

Berdasar Rajah 2, sebanyak 71.4% responden memilih “Seperti saya” dan 28.6% memilih “Sangat mencerminkan diri saya” bagi pernyataan bahawa aktiviti ini membantu mereka melihat peranan dalam pasukan. Tiada responden yang memberi maklum balas negatif atau neutral. Ini membuktikan bahawa

aktiviti yang dilaksanakan berjaya meningkatkan kesedaran peserta terhadap peranan mereka dalam sesebuah pasukan.

Saya dapat mengenal perspektif orang lain dengan lebih baik.

7 responses



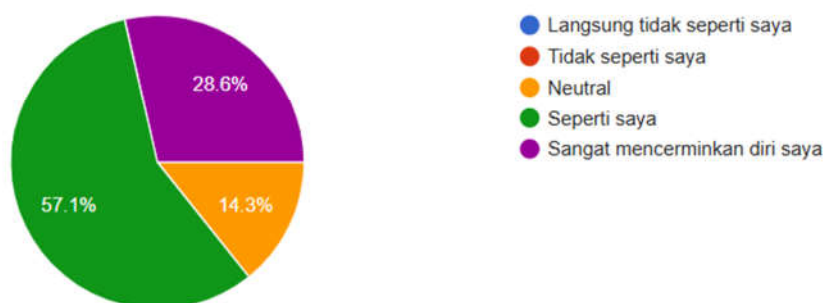
Rajah 3.: Peratusan responden yang bersetuju dapat mengenal perspektif orang lain dengan lebih baik selepas aktiviti dijalankan.

Berdasarkan Rajah 3, sebanyak 57.1% responden menyatakan bahawa mereka sangat dapat mengenal perspektif orang lain dengan lebih baik, manakala 42.9% lagi bersetuju dengan pernyataan tersebut. Tiada responden yang memberi maklum balas negatif. Ini menunjukkan bahawa aktiviti yang dijalankan berjaya meningkatkan keupayaan peserta untuk memahami pandangan dan pendapat orang lain dalam kumpulan.

Saya seronok menyertai aktiviti ini.

7 responses

 Copy chart



Rajah 4.: Peratusan responden yang bersetuju keseronokan menyertai aktiviti selepas dijalankan.

Berdasarkan Rajah 4, daripada keseluruhan 7 orang responden, majoriti peserta menyatakan rasa seronok menyertai aktiviti ini. Sebanyak 57.1% responden memilih “Seperti saya”, manakala 28.6% lagi memilih “Sangat mencerminkan diri saya”, yang menunjukkan tahap kepuasan dan keseronokan

yang tinggi. Hanya 14.3% peserta yang bersikap neutral dan tiada responden yang memilih kategori “Tidak seperti saya” atau “Langsung tidak seperti saya”.

Secara keseluruhan, semua dapatan menunjukkan tiada maklum balas negatif, dan lebih 70% responden memberikan reaksi positif yang konsisten. Hal ini membuktikan keberkesanan inovasi dalam meningkatkan kesedaran komunikasi, peranan pasukan, perspektif orang lain, serta keseronokan dalam pembelajaran.

PENUTUP

Aktiviti inovasi ini berjaya mewujudkan suasana pembelajaran yang santai dan menyeronokkan tanpa memaksa peserta untuk bercerita atau memberi pendapat. Melalui pendekatan berasaskan permainan, peserta terdorong untuk berkongsi idea secara semula jadi, sekali gus meningkatkan keyakinan diri dan penglibatan aktif. Selain membantu mengurangkan rasa segan, aktiviti ini juga mengukuhkan kerjasama dan interaksi positif dalam kalangan staf, membuktikan bahawa elemen keseronokan mampu menjadi strategi yang berkesan dalam pengajaran dan pembelajaran.

PENGHARGAAN

Setinggi-tinggi penghargaan dan terima kasih diucapkan kepada pihak penganjur kerana memberi peluang kepada kami untuk membentangkan inovasi ini, serta kepada semua ahli pasukan yang telah bekerjasama dengan penuh komitmen dan dedikasi sepanjang proses pembangunan. Penghargaan khas turut diberikan kepada staf IPG yang sudi meluangkan masa, memberikan maklum balas serta menjadi responden dan peserta dalam aktiviti ini. Inovasi ini juga disokong oleh beberapa pakar melalui proses kesahan kepakaran, yang membantu memastikan kualiti dan kesesuaian inovasi dalam konteks sebenar. Segala sumbangan idea, pandangan dan sokongan daripada semua pihak amat dihargai dan menjadi faktor penting dalam kejayaan kajian ini.

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GAMIFIKASI E-SUKAN 3S-TVM: MENINGKATKAN PENGUASAAN NILAI MASA WANG PELAJAR LEMAH

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ABSTRAK

Penguasaan konsep nilai masa wang (TVM) masih menjadi cabaran utama dalam kalangan pelajar matrikulasi disebabkan sifatnya yang abstrak dan memerlukan kemahiran penyelesaian masalah kewangan yang berstruktur. Kaedah pengajaran tradisional sering gagal membina pemahaman mendalam dan menggalakkan aplikasi formula secara tepat, terutamanya dalam soalan bukan rutin. Bagi menangani isu ini, inovasi Gamifikasi E-Sukan 3S-TVM telah dibangunkan iaitu satu pendekatan pembelajaran berasaskan permainan yang mempermudah penguasaan TVM melalui tiga langkah utama: (1) kenalpasti kehendak soalan, (2) pilih formula yang betul, dan (3) selesaikan dengan jawapan serta unit yang tepat. Pendekatan ini dibina berasaskan Taksonomi Bloom dan direka bentuk melalui antara muka permainan maya berbentuk mendaki bukit yang interaktif. Pembangunan inovasi menggunakan model ADDIE (Analisis, Reka Bentuk, Pembangunan, Pelaksanaan dan Penilaian), dengan kandungan bertumpu kepada topik utama TVM seperti nilai kini, nilai masa hadapan, anuiti dan perpetuiti. Inovasi ini diuji dalam bilik darjah sebenar melibatkan 14 pelajar menerusi empat fasa: perancangan, pembangunan kandungan, ujian rintis dan pelaksanaan penuh. Hasil kajian menunjukkan impak positif dimana 90% pelajar mencatat peningkatan markah ujian, 85% melaporkan tahap keterlibatan yang lebih tinggi, dan 70% menunjukkan peningkatan dalam pengekalan konsep. Inovasi ini menyokong pembelajaran abad ke-21 dengan memperkuat literasi kewangan, pemikiran kritis dan kecekapan digital. Gamifikasi E-Sukan 3S-TVM ialah penyelesaian praktikal, berskala dan menyeronokkan untuk meningkatkan pendidikan kewangan dalam kalangan pelajar. Ia selari dengan Matlamat Pembangunan Mampan (SDG 4: Pendidikan Berkualiti) dan berpotensi untuk diperluas kepada subjek lain serta pelbagai peringkat pendidikan di Malaysia.

Kata Kunci: Pembelajaran berasaskan permainan, nilai masa wang, pendidikan kewangan, keterlibatan pelajar

PENGENALAN

Dalam era pendidikan abad ke-21, penggunaan teknologi dalam bilik darjah menjadi pemangkin utama kepada pembelajaran yang lebih efektif, menyeronokkan, dan berimpak tinggi. Sistem pendidikan masa kini perlu menggalakkan inovasi yang mampu melahirkan pelajar yang celik digital, berfikiran kritis, kreatif serta berupaya untuk berkolaborasi secara aktif. Salah satu pendekatan yang selari dengan keperluan ini ialah gamifikasi, iaitu penggunaan elemen permainan dalam proses pengajaran dan pembelajaran untuk meningkatkan motivasi serta penglibatan pelajar secara menyeluruh.

Sehubungan itu, inovasi Gamifikasi E-Sukan 3S-TVM diperkenalkan sebagai satu kaedah pembelajaran alternatif yang bertujuan untuk membantu pelajar menguasai topik Nilai Masa Wang (TVM) yang bersifat abstrak dan mencabar. Dalam mata pelajaran Pengurusan Perniagaan semester satu, topik ini menuntut pemahaman konsep yang mendalam serta kemahiran menyelesaikan masalah kewangan secara berstruktur. Berdasarkan pengalaman pengajaran dalam kelas A1T4b yang terdiri daripada 14 orang pelajar, analisis keputusan peperiksaan SPM serta dapatan entrance-exit survey (EES) mendapati bahawa majoriti pelajar lemah dalam menjawab soalan berbentuk pengiraan, terutamanya soalan yang melibatkan struktur kewangan. Pendekatan pengajaran tradisional yang terlalu menekankan penghafalan rumus didapati tidak berkesan dalam membantu pelajar menterjemahkan pengetahuan kepada aplikasi sebenar.

Bagi menangani isu ini, satu inovasi berasaskan permainan maya interaktif berbentuk pendakian bukit telah dibangunkan. Inovasi ini dinamakan Gamifikasi E-Sukan 3S-TVM kerana menggabungkan elemen permainan digital dengan struktur penyelesaian tiga langkah utama, iaitu: (1) kenalpasti kehendak soalan, (2) pilih formula yang betul, dan (3) selesaikan dengan jawapan serta unit yang tepat. Reka bentuk pendakian bukit dipilih kerana ia melambangkan cabaran progresif yang perlu dilalui pelajar dalam memahami konsep TVM secara bertahap. Inovasi ini dibina berasaskan Taksonomi Bloom dan direka bentuk menggunakan Model ADDIE, yang merangkumi lima fasa iaitu analisis, reka bentuk, pembangunan, pelaksanaan dan penilaian.

Objektif utama inovasi ini adalah untuk meningkatkan penguasaan konsep TVM dalam kalangan pelajar berprestasi rendah, memperkukuh kemahiran penyelesaian masalah kewangan secara berstruktur, serta menyokong pendekatan pembelajaran berasaskan teknologi yang lebih interaktif dan menyeronokkan. Selain itu, inovasi ini juga dilihat sebagai satu penyelesaian praktikal yang seiring dengan keperluan pendidikan masa kini serta menyokong Matlamat Pembangunan Mampan (SDG 4: Pendidikan Berkualiti).

METODOLOGI

Gamifikasi E-Sukan 3S-TVM dibangunkan menggunakan perisian Scratch. Pemilihan perisian ini berdasarkan kemudahan penggunaan, fleksibiliti visual, dan kesesuaian dengan capaian pelajar. Dokumentasi pembangunan juga direkodkan bagi memudahkan replikasi atau penambahbaikan oleh pendidik lain.

Inovasi Gamifikasi E-Sukan 3S-TVM dibangunkan berasaskan Model Reka Bentuk Pembelajaran ADDIE yang merangkumi lima fasa utama: Analisis, Reka Bentuk, Pembangunan, Pelaksanaan dan Penilaian.

Dalam fasa analisis, keperluan pembelajaran dikenalpasti melalui semakan silibus, penilaian rekod akademik pelajar dan maklum balas daripada entrance-exit survey (EES). Hasil analisis menunjukkan bahawa pelajar menghadapi kesukaran dalam menguasai konsep dan pengiraan topik Nilai Masa Wang (TVM), terutamanya apabila berdepan dengan soalan berbentuk struktur kewangan.

Dalam fasa reka bentuk dan pembangunan, satu antara muka permainan maya interaktif berbentuk hill climb dibangunkan menggunakan perisian interaktif. Permainan ini dibina dengan elemen gamifikasi seperti pemarkahan automatik, ganjaran visual dan tahap kesukaran berperingkat. Elemen permainan direka bentuk untuk meningkatkan motivasi pelajar secara progresif mengikut tahap kefahaman. Inovasi ini disepadukan dengan model 3S-TVM yang membimbing pelajar melalui tiga langkah utama: (1) mengenal pasti kehendak soalan, (2) memilih formula yang betul, dan (3) menyelesaikan soalan dengan jawapan serta unit yang tepat. Kandungan permainan memberi tumpuan kepada subtopik seperti nilai kini, nilai masa hadapan, anuiti dan perpetuiti. Satu ujicuba prototaip turut dijalankan secara dalaman bagi menilai kefungsi permainan, reka bentuk mesra pengguna dan kesesuaian kandungan terhadap tahap penguasaan pelajar.

Pelaksanaan inovasi dibahagikan kepada tiga fasa yang jelas:

Fasa Sebelum (Pra-Intervensi): Pelajar menjalani ujian diagnostik bagi mengenal pasti tahap penguasaan awal terhadap topik TVM. Pemerhatian terhadap kelemahan umum turut direkodkan sebagai asas reka bentuk intervensi.

Fasa Semasa (Pelaksanaan Inovasi): Pelajar diperkenalkan kepada permainan 3S-TVM dan melaksanakan aktiviti penyelesaian masalah dalam suasana pembelajaran berasaskan gamifikasi. Aktiviti dijalankan secara individu dan kolaboratif dalam sesi tutoran selama tiga minggu. Penglibatan serta maklum balas pelajar dipantau secara langsung oleh fasilitator.

Fasa Selepas (Pasca-Intervensi): Pelajar menjalani ujian sumatif untuk menilai pencapaian selepas intervensi. Selain itu, refleksi pelajar dan soal selidik keberkesanan inovasi turut dikumpulkan bagi menilai impak keseluruhan penggunaan inovasi.

Jadual 1.: Kaedah Analisis Data

Persoalan Kajian	Instrumen / Sumber Data	Kaedah Analisis
1. Apakah tahap penguasaan pelajar terhadap topik TVM sebelum dan selepas penggunaan inovasi 3S-TVM?	Diukur melalui ujian diagnostik dan ujian sumatif	Perbandingan skor dan peratus peningkatan
2. Apakah tahap keterlibatan pelajar semasa penggunaan inovasi gamifikasi 3S-TVM?	Soal selidik keterlibatan pelajar dan pemerhatian tingkah laku	Diskriptif
3. Adakah pelajar menunjukkan peningkatan dalam pengekalan konsep	Aktiviti pengukuhan pasca pelaksanaan	Analisis peratus pencapaian & maklum

Persoalan Kajian	Instrumen / Sumber Data	Kaedah Analisis
selepas intervensi?		balas pelajar
4. Apakah persepsi pelajar terhadap inovasi dari aspek keseronokan, kefahaman dan kesesuaian?	Temu bual	Analisis tematik

DAPATAN DAN PERBINCANGAN

Persoalan 1: Apakah tahap penguasaan pelajar terhadap topik Nilai Masa Wang sebelum dan selepas penggunaan inovasi 3S-TVM?

Bagi menilai perubahan tahap penguasaan pelajar, skor ujian pra dan pasca pelaksanaan dianalisis. Jadual berikut menunjukkan perbandingan skor purata bagi 14 orang pelajar:

Jadual 2.: Purata Skor Pelajar

Jenis Ujian	Purata Skor (%)
Ujian Pra (Diagnostik)	42%
Ujian Pasca (Sumatif)	74%
Peratus Peningkatan	+32%

Peningkatan purata sebanyak 32% menunjukkan perubahan yang positif dan bermakna, khususnya dalam kalangan pelajar yang sebelum ini lemah dalam penguasaan konsep dan pengiraan TVM. Dapatan ini menunjukkan bahawa E-Sukan 3S-TVM berjaya meningkatkan kefahaman pelajar. Walau bagaimanapun, tahap peningkatan ini masih belum mencapai tahap luar biasa. Ia menandakan keberkesanan awal yang wajar dikembangkan dan ditambah baik untuk hasil yang lebih konsisten dan berimpak tinggi di masa akan datang.

Kajian oleh Alsawaier (2020) menyokong dapatan ini, menyatakan bahawa elemen gamifikasi memberi kesan langsung terhadap peningkatan prestasi akademik kerana ia mendorong motivasi dalaman, minat, dan tumpuan pelajar dalam topik yang mencabar. Dalam konteks pendidikan kewangan, gamifikasi membantu pelajar membina hubungan bermakna antara teori dan aplikasi praktikal. Tambahan pula, Ismail & Rahman (2021) mendapati bahawa pelajar yang terlibat dalam pembelajaran gamifikasi menunjukkan keupayaan lebih tinggi dalam memilih strategi penyelesaian yang sesuai, terutamanya dalam topik berasaskan pengiraan.

Pendekatan model 3S-TVM telah berjaya memberi panduan berstruktur kepada pelajar, menggantikan kebergantungan kepada hafalan semata-mata. Ini selari dengan saranan Barzilai & Blau (2021) bahawa strategi pembelajaran eksplisit berbentuk langkah-langkah yang boleh dikuasai secara progresif mampu meningkatkan keyakinan dan pemindahan ilmu dalam kalangan pelajar lemah.

Persoalan 2: Apakah tahap keterlibatan pelajar semasa penggunaan inovasi gamifikasi 3S-TVM?

Tahap keterlibatan pelajar dinilai melalui pemerhatian semasa aktiviti gamifikasi dan soal selidik skala Likert. Dapatan soal selidik (14 responden) diringkaskan seperti berikut:

Jadual 3.: Keterlibatan Pelajar

Pernyataan	Setuju/Sangat Setuju (%)
Saya lebih fokus semasa aktiviti gamifikasi berbanding kuliah biasa	85%
Saya berasa seronok dan termotivasi semasa menjawab soalan dalam permainan	92%
Saya lebih mudah memahami langkah penyelesaian menggunakan pendekatan 3S	88%

Dapatan menunjukkan bahawa lebih 85% pelajar menyatakan keterlibatan yang tinggi sepanjang pelaksanaan inovasi. Majoriti pelajar berasa lebih fokus, lebih berminat untuk belajar, dan lebih mudah memahami kandungan apabila elemen permainan diperkenalkan. Hal ini selari dengan dapatan Darin (2020) yang menekankan bahawa gamifikasi dapat meningkatkan penglibatan pelajar secara intrinsik kerana ia memenuhi keperluan psikologi asas seperti cabaran, pencapaian, dan ganjaran. Pendekatan ini menjadikan pelajar lebih aktif dan responsif dalam pembelajaran.

Selain itu, interaktiviti dan visualisasi dalam permainan maya memudahkan pelajar membina model mental yang lebih kukuh terhadap prosedur penyelesaian masalah. Keterlibatan tinggi ini merupakan prasyarat penting dalam membina motivasi dalaman, yang seterusnya menyumbang kepada peningkatan penguasaan kognitif. Oleh itu, tahap keterlibatan pelajar yang tinggi sepanjang pelaksanaan inovasi merupakan petunjuk awal kepada keberkesanan pedagogi berasaskan gamifikasi.

Persoalan 3: Adakah pelajar menunjukkan peningkatan dalam pengekal konsep selepas intervensi?

Untuk menilai pengekal konsep, soalan pengukuhan diberi satu minggu selepas ujian pasca. Hasil analisis menunjukkan peratusan pelajar yang masih dapat menjawab dengan betul:

Jadual 4.: Peningkatan Pengekal Konsep

Jenis Soalan	Peratus Pelajar Jawab Betul
Nilai Kini	79%
Nilai Masa Hadapan	71%
Anuiti	65%
Perpetuiti	64%
Purata Keseluruhan	70%

Dapatan menunjukkan bahawa secara purata, 70% pelajar masih dapat mengekalkan kefahaman dan aplikasi konsep yang telah dipelajari melalui pendekatan gamifikasi. Subtopik *nilai kini* mencatatkan kadar pengekalan tertinggi manakala *perpetuiti* paling rendah, menunjukkan bahawa struktur dan konteks permainan memberi kesan terhadap daya ingatan pelajar terhadap jenis soalan yang lebih kompleks.

Penemuan ini adalah selari dengan kajian Alqahtani & Mohammad (2020) yang mendapati bahawa pendekatan pembelajaran berasaskan permainan menyumbang kepada pengekalan maklumat yang lebih tinggi dalam kalangan pelajar, disebabkan oleh aktiviti interaktif dan pelibatan berasaskan pengalaman. Mereka menjelaskan bahawa apabila pelajar terlibat secara aktif melalui persekitaran pembelajaran yang menyeronokkan, proses pengkodan maklumat menjadi lebih kukuh, seterusnya meningkatkan ingatan jangka panjang terhadap konsep yang dipelajari.

Di samping itu, urutan langkah dalam model 3S-TVM membantu pelajar membina rutin penyelesaian yang berstruktur. Ini menyokong dapatan Taspinar, Schmidt & Schuhbauer (2021) yang menyatakan bahawa strategi penyelesaian berurutan dalam pembelajaran gamifikasi membantu menstabilkan memori prosedural dan mengurangkan kebergantungan terhadap hafalan semata-mata.

Oleh itu, hasil ini menunjukkan bahawa inovasi ini bukan sahaja memberi impak dalam jangka pendek, tetapi juga mempunyai potensi untuk meningkatkan pemahaman berterusan dalam jangka sederhana terutamanya bagi pelajar yang sebelum ini menghadapi kesukaran dalam aplikasi formula dan langkah pengiraan.

Persoalan 4: Apakah persepsi pelajar terhadap inovasi dari aspek keseronokan, kefahaman dan kesesuaian?

Untuk menjawab persoalan ini, satu soal selidik berbentuk campuran (tertutup dan terbuka) telah diedarkan kepada 14 orang pelajar selepas pelaksanaan inovasi. Soalan terbuka dianalisis secara tematik, iaitu mengenal pasti pola jawapan yang berulang dalam maklum balas pelajar. Jadual di bawah merumuskan dapatan utama berdasarkan tema yang dikenal pasti:

Jadual 5.: Analisis Tematik Persepsi Pelajar terhadap Inovasi Gamifikasi 3S-TVM

Tema Utama	Kekerapan Muncul (n=14)	Contoh Petikan Pelajar
Menyeronokkan	12 pelajar	<i>"Saya rasa lebih seronok belajar TVM sebab macam main game."</i>
Meningkatkan Kefahaman	11 pelajar	<i>"Langkah dalam permainan membantu saya faham cara pilih rumus dan jawapan."</i>
Memudahkan Ingatan	9 pelajar	<i>"Saya senang ingat rumus sebab selalu ulang dalam bentuk permainan."</i>
Meningkatkan Motivasi	10 pelajar	<i>"Saya lebih semangat belajar sebab ada ganjaran dan cabaran dalam permainan."</i>
Sesuai untuk Pelajar Lemah	8 pelajar	<i>"Saya sebelum ni tak minat kira-kira, tapi bila guna game ni rasa lebih yakin nak cuba."</i>

Analisis tematik menunjukkan bahawa persepsi pelajar terhadap inovasi Gamifikasi E-Sukan 3S-TVM adalah sangat positif, terutamanya dari aspek keseronokan dan kefahaman konsep. Tema “menyeronokkan” dan “meningkatkan kefahaman” adalah yang paling dominan, dengan 85% pelajar menyatakan inovasi ini menjadikan pembelajaran lebih menarik berbanding kaedah tradisional. Elemen gamifikasi seperti cabaran, skor dan visual interaktif terbukti memainkan peranan penting dalam meningkatkan motivasi dalaman pelajar.

Penemuan ini disokong oleh kajian Hamari, Koivisto & Sarsa (2020) yang mendapati bahawa elemen permainan dalam konteks pembelajaran dapat meningkatkan keterlibatan emosi dan kognitif pelajar, menjadikan mereka lebih terbuka untuk mencuba dan belajar daripada kesilapan. Tambahan pula, menurut Khalil et al. (2021), persepsi positif pelajar terhadap pendekatan gamifikasi mempunyai korelasi langsung dengan peningkatan sikap proaktif dalam menyelesaikan tugas dan latihan berbentuk aplikasi.

Selain itu, beberapa pelajar menyatakan bahawa inovasi ini sangat membantu pelajar lemah kerana susunan langkah penyelesaian yang jelas dan ulangan visual dalam permainan memudahkan mereka mengingat rumus dan kaedah. Ini selari dengan cadangan Plass et al. (2022) yang menekankan kepentingan reka bentuk berasaskan sokongan kognitif (scaffolding) dalam gamifikasi untuk membantu pelajar dengan tahap penguasaan yang rendah.

Secara keseluruhannya, persepsi pelajar terhadap inovasi ini menunjukkan penerimaan yang sangat menggalakkan, dan menjadi indikator penting bahawa pendekatan gamifikasi seperti 3S-TVM sesuai dilaksanakan dalam konteks bilik darjah sebenar, khususnya dalam subjek yang mencabar seperti kewangan.

KESIMPULAN

Inovasi Gamifikasi E-Sukan 3S-TVM telah membuktikan potensinya sebagai pendekatan pembelajaran alternatif yang efektif, khususnya dalam membantu pelajar berprestasi rendah menguasai topik Nilai Masa Wang (TVM) yang bersifat abstrak dan mencabar. Pembangunan inovasi ini melalui model reka bentuk pembelajaran ADDIE membolehkan penyusunan yang sistematik dan berpanduan kepada analisis keperluan pelajar secara menyeluruh. Pendekatan gamifikasi yang digunakan bukan sahaja meningkatkan pencapaian akademik, tetapi turut menyumbang kepada tahap keterlibatan yang tinggi, motivasi intrinsik, dan pengekalan konsep dalam kalangan pelajar.

Dapatan kajian menunjukkan peningkatan skor purata sebanyak 32% selepas intervensi, keterlibatan pelajar melebihi 85%, dan tahap pengekalan konsep sekitar 70% selepas satu minggu. Selain itu, persepsi pelajar terhadap inovasi ini adalah positif, terutamanya dari aspek keseronokan, kefahaman, dan kesesuaian untuk pelajar yang lemah dalam pengiraan. Penemuan ini membuktikan bahawa pendekatan gamifikasi berstruktur seperti model 3S-TVM mampu merapatkan jurang penguasaan dan menyokong pembelajaran yang lebih berpusatkan pelajar.

Inovasi ini turut selari dengan prinsip Pendidikan Abad ke-21 dan menyokong aspirasi Matlamat Pembangunan Mampan (SDG 4: Pendidikan Berkualiti), dengan memberi fokus kepada pemeraksanaan pelajar melalui integrasi teknologi dan pedagogi inovatif. Potensi peluasan inovasi ini adalah luas –

bukan sahaja kepada topik-topik lain dalam mata pelajaran Pengurusan Perniagaan, tetapi juga kepada subjek pengiraan lain seperti Ekonomi, Matematik dan Perakaunan.

Dengan penambahbaikan berterusan dan pelaksanaan berskala secara sistematik, inovasi ini berpotensi untuk dijadikan rujukan dalam pembangunan bahan pengajaran berasaskan gamifikasi yang responsif, relevan dan berimpak tinggi dalam sistem pendidikan Malaysia.

PENGHARGAAN

Dengan penuh rasa hormat dan penghargaan, saya merakamkan setinggi-tinggi terima kasih kepada pihak pengurusan Kolej Matrikulasi Perak atas sokongan yang berterusan dalam menjayakan pelaksanaan inovasi ini. Penghargaan juga ditujukan kepada rakan penyelidik yang telah memberikan kerjasama dan sumbangan idea yang bernas sepanjang tempoh pembangunan inovasi. Tidak dilupakan, para pelajar yang terlibat atas komitmen, kesungguhan dan keterbukaan mereka dalam menjayakan sesi intervensi serta memberikan maklum balas yang membina. Segala sokongan dan penglibatan ini amat dihargai dan menjadi asas kejayaan inovasi Gamifikasi E-Sukan 3S-TVM.

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i-AQADQUEST

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ABSTRACT

The Islamic banking sector is experiencing rapid growth and is projected to reach a market value of USD 7.7 trillion by 2033. This expansion highlights the urgent need for accessible educational tools to improve understanding of complex Shariah-compliant financial contracts. Traditional methods, such as textbooks and lectures, often lack the engagement and practicality needed to equip learners effectively. To address this gap, i-AqadQuest was developed as an interactive, gamified learning platform designed to simplify Islamic banking concepts for students, professionals, and the public. Built on the ZEP Quiz platform, it transforms learning into a game-based experience using attractive visuals, customizable avatars, interactive quizzes, and real-time feedback. Users engage in a virtual environment, answering questions to progress and receiving immediate corrections that strengthen understanding. The platform encourages active participation and enhances retention of knowledge while fostering a deeper comprehension of Islamic banking. Features such as leaderboards help create a motivating, competitive learning environment. Furthermore, i-AqadQuest is device-friendly, free to access, and requires no registration, making it ideal for individual and classroom use. Beyond improving financial literacy, i-AqadQuest offers a flexible, self-paced learning solution for professionals seeking to stay updated with the industry developments. It holds strong commercial potential for educational institutions, training programs, and community outreach. Future developments may include mobile app integration, expanded content, and additional features to further improve accessibility and enrich the user experience.

Keywords: *Islamic banking, Islamic finance, Gamification, Financial literacy, Interactive learning*

INTRODUCTION

The Islamic banking industry is experiencing significant and sustained growth. Based on data from GlobeNewswire, the market expanded from \$7.16 billion in 2023 to \$7.99 billion in 2024. It is further projected to reach \$3.4 trillion by 2027 and \$7.7 trillion by 2033 (GlobeNewswire, 2025). This upward trend reflects a growing need for employment opportunities and educational resources for the public.

As Islamic banking continues to expand on a global scale, there is an increasing need for effective and accessible methods to comprehend its intricate contracts and financial principles. Conventional educational approaches, such as textbooks and lectures, often fall short in engaging both students and professionals. Additionally, public awareness of Shariah-compliant financial products remains limited.

PROBLEM STATEMENTS AND SOLUTION

Islamic banking contracts and concepts are often challenging to comprehend due to the use of technical terminology and their inherent complexity. Traditional learning approaches, such as textbooks and lectures, tend to be less engaging for students and often fail to equip them with the practical skills needed to apply their knowledge in real-world contexts. Industry practitioners also face difficulties in keeping pace with evolving standards and frequently lack access to flexible and user-friendly learning tools. At the same time, members of the public who are interested in Shariah-compliant finance have limited educational resources to deepen their understanding. Shariah-compliant banking refers to financial transactions that adhere to Islamic principles and conform to established commercial practices in Islamic law (Engku Ali, E.R.A., 2013).

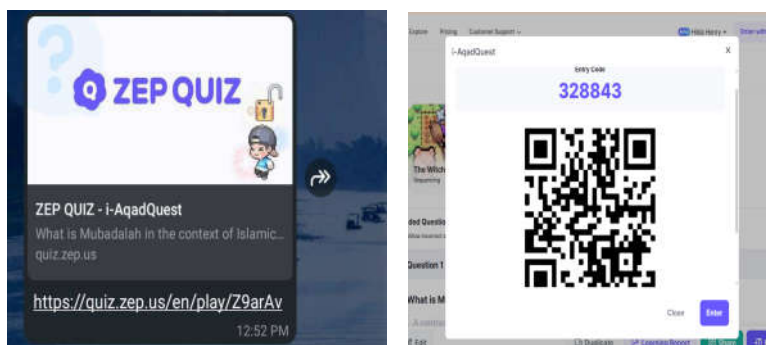
To address these challenges, *i-AqadQuest* was developed as an innovative solution. This interactive, gamified platform aims to simplify the learning of Islamic banking contracts and make the process more engaging and accessible. By combining educational content with game-like elements, *i-AqadQuest* effectively caters to a diverse audience, including students, financial professionals, and the public. The platform provides a dynamic learning experience that not only enhances user engagement but also improves understanding and retention of complex Shariah-compliant financial principles.

METHODS AND MATERIAL

i-AqadQuest is a quiz-based, interactive learning game developed using the ZEP Quiz platform (ZEP, n.d.). It is specifically designed to support users in understanding and mastering Islamic banking contracts and principles through an engaging and enjoyable approach. The ZEP Quiz platform offers a user-friendly experience with free of charge, accessible across various devices, and does not require user registration. ZEP Quiz making *i-AqadQuest* highly suitable for both classroom settings and independent learning. Table 1 below shows the steps for using *i-AqadQuest*:

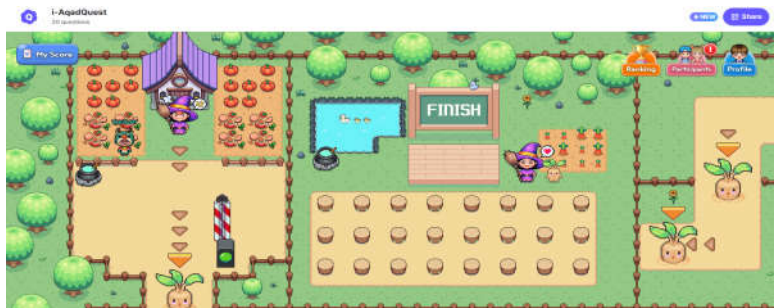
Table 1.: Steps for using *i-AqadQuest*

1.



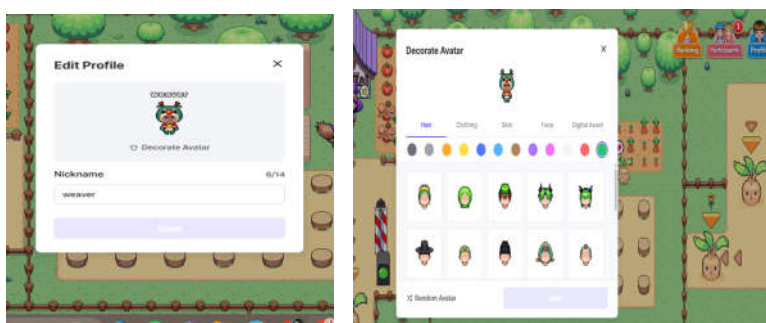
To begin, users can access the game by clicking on the provided link, scanning the QR code, or entering the entry code on the ZEP Quiz platform. Logging into an account is not required to participate in the game.

2.



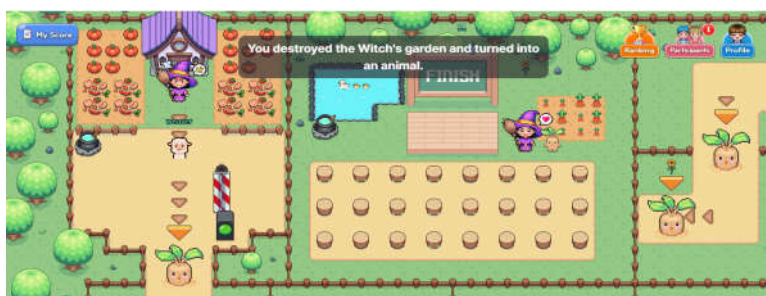
After entering the game, players will see the *i-AqadQuest* map displayed on their screen, which serves as their starting point.

3.



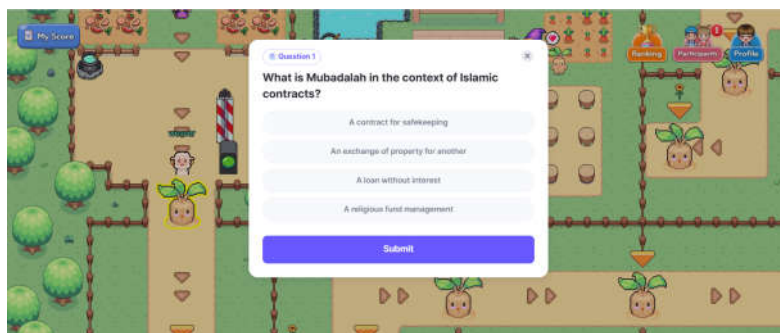
By clicking the “Profile” button, they can customize their avatar and choose a nickname according to their preferences.

4.



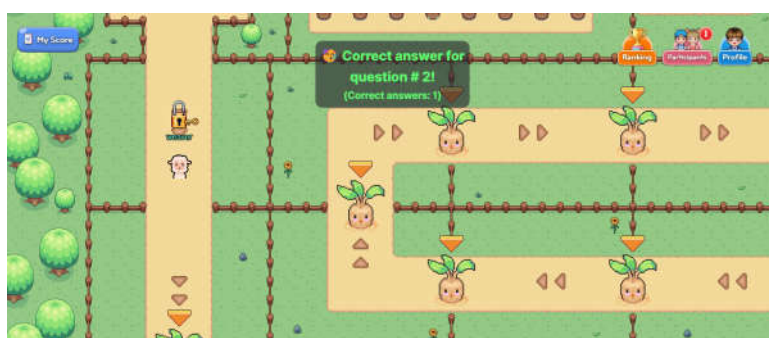
The game begins once players are transformed into animal characters. To return to their original avatar, they must complete 20 questions on Islamic banking contracts by moving through giant carrots.

5.



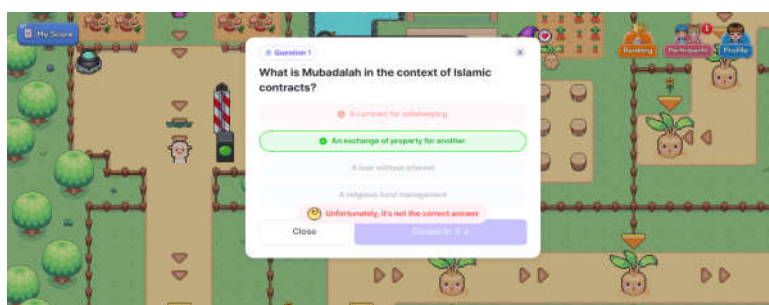
The gameplay involves a series of multiple-choice questions related to the Islamic banking topics, where players select the correct answer to progress. Each question must be answered in order to pass through the giant carrots.

6.



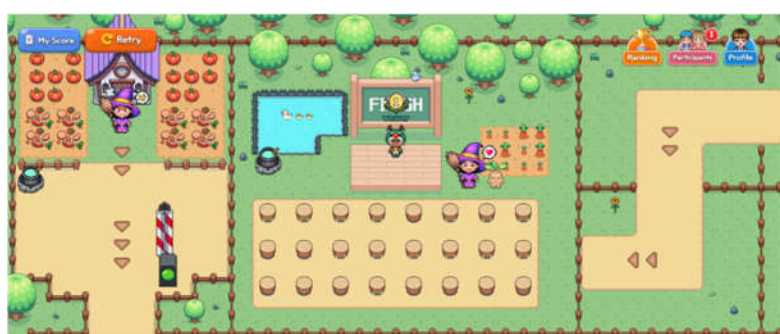
If they choose the correct answer, they can proceed to another question.

7.



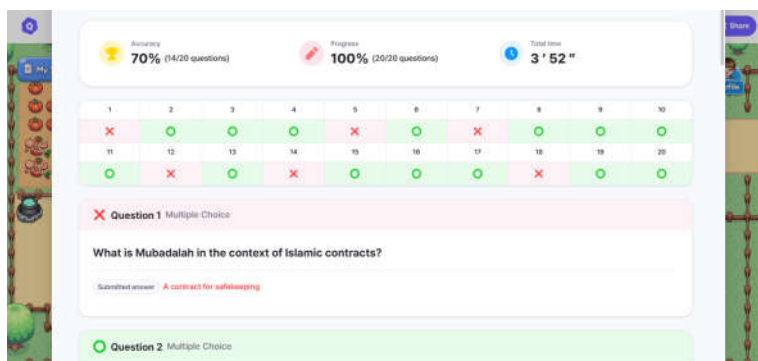
If players select an incorrect answer, they are still allowed to continue to the next question. The correct answer will be displayed for their reference. As they move through the quiz, players must overcome obstacles to reach the finish line.

8.



Upon completing all 20 questions, they will revert to their original avatar, and their final ranking will be displayed.

9.



Players can monitor their overall progress to identify areas that need improvement. The game also includes a leaderboard feature, allowing them to compare their scores with others, which adds a competitive aspect to maintain high levels of engagement.

RESULTS AND DISCUSSION

i-AqadQuest revolutionizes the way Islamic banking contracts and concepts are taught by making learning more engaging and accessible to students, professionals, and the public. For students, it transforms complex topics into interactive, real-life scenarios that enhance understanding, retention, and practical application—all through an enjoyable and fun learning experience. For professionals, it serves as a flexible, self-directed platform that supports continuous learning and helps them stay informed about the latest developments in the field. For the public, *i-AqadQuest* breaks down the complexities of Shariah-compliant finance, promoting greater financial literacy and enabling individuals to make more informed financial decisions. Ultimately, the platform contributes to building a more informed and financially aware society.

i-AqadQuest has strong commercialization potential by positioning itself as an engaging educational tool for students, industry practitioners, and the general public. For students, it offers a simplified and interactive way to learn complex Islamic finance concepts through simulations. Practitioners can benefit from using it as a practical training tool to update and reinforce their knowledge. The public, in turn, gains easier access to information about halal finance and ethical banking practices.

By combining education with entertainment, *i-AqadQuest* becomes an attractive resource for schools, financial institutions, and community organizations, helping to promote broader awareness and understanding of Islamic banking in an enjoyable and practical manner.

This innovation also holds promise for future development as a mobile application, allowing users to conveniently access content and refresh their understanding of Islamic financial contracts anytime, anywhere. Future enhancements will include expanded content and feature upgrades to further enrich the user experience and educational value.

CONCLUSION

In summary, *i-AqadQuest* marks a major advancement in enhancing the way Islamic banking education is delivered making it more engaging, accessible, and impactful. Through the use of gamification and interactive technology, it overcomes the shortcomings of conventional teaching methods by providing a dynamic learning platform suitable for a wide range of users. With its intuitive interface, ease of access, and promising potential for future development, *i-AqadQuest* is well-equipped to play a vital role in advancing Shariah-compliant financial literacy and supporting the ongoing expansion of the Islamic banking industry.

ACKNOWLEDGEMENT

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i-BanCross 2.0 (ISLAMIC BANKING CROSSWORD 2.0)

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ABSTRACT

The origins of Islamic banking trace back to the era of Prophet Muhammad (SAW). In recent years, the industry has expanded significantly in terms of both services and global reach. Today, over 560 Islamic banks and more than 1,900 mutual funds operate according to Shariah principles. A 2022 report by the Islamic Corporation for the Development of the Private Sector (ICD) and Refinitiv indicated that Islamic financial assets grew from \$2.17 trillion in 2015 to nearly \$4 trillion by 2021 and are projected to reach approximately \$5.9 trillion by 2026 (Evan Tarver, 2023). This upward trend not only reflects the industry's strength but also its potential to offer diverse academic and career opportunities. Despite this growth, many individuals especially students face challenges in understanding Islamic financial terms and concepts. In response, i-BanCross 2.0 was developed as an educational innovation aimed at increasing awareness and comprehension of Islamic banking terms and concepts. Utilizing Crossword Labs platform, a digital tool for creating interactive crossword puzzles, i-BanCross 2.0 transforms complex Islamic finance terms and concepts into engaging word-based games. This gamified learning method encourages users to learn through play, making it easier to identify and recall key terms commonly found in Islamic contracts. The platform is particularly helpful for students, practitioners and public, offering an interactive way to bridge knowledge gaps and promote greater literacy in Islamic banking. Furthermore, the application is a user-friendly and free without any charges.

Keywords: Crossword Puzzle, Gamification, Islamic Banking

INTRODUCTION

The origins of the Islamic banking industry trace back to the time of Prophet Muhammad (SAW). Today, the industry is expanding rapidly, offering an increasingly diverse array of financial products and services. Globally, there are over 560 Islamic banks and more than 1,900 mutual funds operating in compliance with Shariah law. Between 2015 and 2021, Islamic financial assets grew from \$2.17 trillion to approximately \$4 trillion, and projections suggest they will reach around \$5.9 trillion by 2026, according to a 2022 report by the Islamic Corporation for the Development of the Private Sector (ICD) and Refinitiv (Tarver, 2023). This growth reflects the industry's continuous expansion and its potential to create various educational and career opportunities. However, understanding Islamic banking contracts remains challenging.

Islamic banking, often referred to as interest-free banking, is a financial system guided by *Shariah* law. It strictly forbids the charging or earning of interest, instead focusing on ethical investments and profit-and-loss sharing arrangements between financiers and clients. Rooted in the teachings of the Quran, Islamic banking strives to ensure fairness and equity in all financial dealings. The following are some of its core principles (Athul, 2023).

PROBLEM STATEMENTS AND SOLUTION

Banking uses a range of technical terms and jargon that can be challenging for beginners to grasp. Words such as *riba*, *gharar*, *maysir*, and *qard hassan* not only need to be memorized but also understood within different contexts. Islamic banks provide a variety of services and financial products, from simple savings accounts to more advanced investment options. Each of these offerings comes with its own specific rules, advantages, and risks, requiring thorough knowledge to fully comprehend. Understanding the fundamentals of Islamic banking can be difficult, especially for individuals who are unfamiliar with *Shariah*-compliant financial principles, as it involves unique concepts, terminology, and contract structures that differ significantly from conventional banking systems.

To address this issue, an innovative solution i-BanCross 2.0 has been introduced. i-BanCross 2.0 is a web-based platform featuring educational games centred on Islamic banking. It emphasizes key terms and concepts related to Islamic contracts, making it easier for users, especially students, to recognize and understand the various contracts and concepts used in Islamic banking. This initiative holds great promise in enhancing the current generation's literacy in *Shariah*-compliant financial practices. i-BanCross 2.0 is an educational game designed in the form of a crossword puzzle to help learners familiarize themselves with key terms and concepts related to Islamic banking. This method uses an engaging and interactive approach to reinforce understanding, especially among students and beginners.

METHODS AND MATERIAL

The innovation is primarily designed to develop the Islamic banking knowledge needed by the students, practitioners and public to meet the demands of business operation. i-BanCross 2.0 is designed to make the often complex and technical terminologies and concepts of Islamic banking easier to understand. By breaking down difficult concepts and presenting them in a more accessible and interactive format, i-BanCross 2.0 helps users especially students and beginners to grasp the meanings and applications of various Islamic banking terms and concepts. This innovative tool transforms traditional learning into a more engaging experience, allowing individuals to explore *Shariah*-compliant banking principles in a simplified and user-friendly manner. Generally, the innovation developed by using Crossword Labs. Crossword Labs is an online tool that allows users to quickly and easily create, solve, print, and share crossword puzzles at no cost. It offers a user-friendly interface that requires no sign-up and is free from advertisements. With options to customize puzzles and distribute them digitally or in print, the platform serves as a practical and flexible resource for teachers, students, and puzzle lovers alike (Crossword Labs, 2011). Table 1 below shows the steps for using i-BanCross 2.0:

Table 1.: Steps for using i-BanCross 2.0

1 	To begin, the user needs to visit the Crossword Labs website and click on the provided link to access and play the crossword puzzle. Here is the link to i-BanCross 2.0: https://crosswordlabs.com/embed/i-BanCross 2.0.
2 	Next, the user must solve the displayed crossword puzzle in order to complete it. The puzzle will appear on the screen, ready to be filled in.
3 Across 2. a contract to assist the poor or needy by offering a loan without any interest. 4. a set of Islamic religious law that governs aspects of day-to-day life for Muslims in addition to religious rituals. 6. a form of forward contract when the price for an asset is paid upfront at the time of the contract for an asset or	The user will be presented with Islamic banking concepts and is required to type the correct answer into the designated box.

Down

5. an order contract to producer or manufacture a specific commodity for the purchaser.

7. products which have their origin from the conventional market and are "Islamised" by modifying it to suit the Syariah requirements.

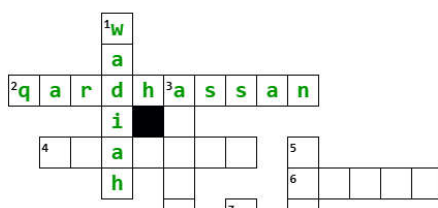
8. a form of contract where two or more persons combine

They have the flexibility to answer any part of the crossword they prefer and can clear or modify their responses if they make a mistake.

4

i-BanCross 2.0

Print Share Edit Answers

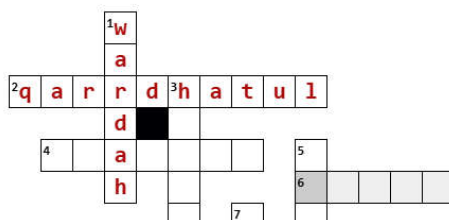


Once the user enters their answer, the system will immediately indicate whether it is correct or incorrect. If the letters turn green, it confirms that the answer is correct.

5

i-BanCross 2.0

Print Share Edit Answers

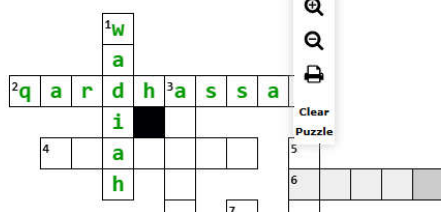


Conversely, if the letters in the boxes turn red, it means the answer is incorrect.

6

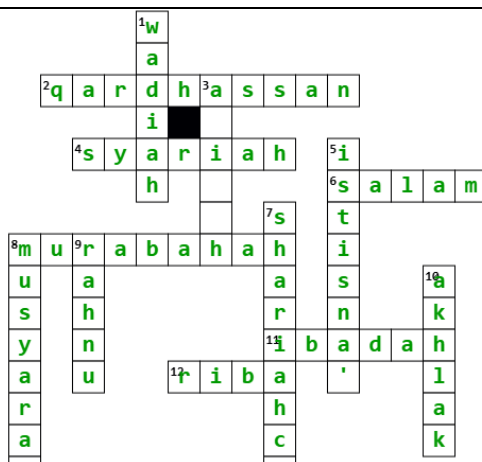
i-BanCross 2.0

Print Share Edit Answers



It also includes functions such as print, share, edit, zoom in, zoom out, and the ability to clear and print answers.

7



If all your answers turn green, it means you answered all the questions correctly.

IMPACTS OF INNOVATION

What makes i-BanCross 2.0 unique is its interactive approach that encourages students to actively engage with Islamic banking terms and concepts, rather than just passively reading or listening. Through solving crossword puzzles, students are required to recall and apply terminologies and concepts in various contexts, which helps improve their understanding and long-term retention. The use of puzzles makes learning more enjoyable and less monotonous by introducing a fun challenge and a sense of achievement, which can enhance student motivation (Torres, et al., 2022). Additionally, the clues provided in the puzzles offer contextual hints, helping learners grasp how these terms are used in real Islamic banking scenarios. Notably, i-BanCross 2.0 is the first crossword-based innovation specifically focused on Islamic banking and finance, making complex concepts easier to understand for learners. Additionally, several new terms have been incorporated into i-BanCross 2.0 to expand its coverage and provide a broader understanding of Islamic banking and finance. This enhancement ensures that users are exposed to a wider variety of concepts, allowing them to deepen their knowledge and stay updated with relevant terminology in the field. i-BanCross 2.0 is an improved version of the original, with several new concepts and terms added.

COMMERCIALIZATIONS OF INNOVATION

One of the key advantages of i-BanCross 2.0 is its ability to engage students in active learning by encouraging them to absorb and apply Islamic banking terms and concepts through interactive crossword puzzles. Unlike traditional learning methods that often rely on passive reading or listening, i-BanCross 2.0 promotes hands-on participation, which helps to reinforce understanding more effectively. By consistently encountering Islamic banking concepts across different puzzle scenarios, students are able to strengthen both their comprehension and long-term memory of essential concepts and vocabulary.

Furthermore, the gamified nature of crossword puzzles introduces an element of challenge and achievement that makes the learning process more enjoyable and stimulating. This sense of accomplishment can significantly boost students' motivation and interest in the subject, reducing the monotony often associated with conventional study methods (Wulan, et al., 2024). In addition, the clues provided in each puzzle often contain contextual hints that reflect real-world applications of Islamic banking principles. These contextual cues not only support students in solving the puzzles but also deepen their practical understanding by demonstrating how the terms are used in actual banking situations. As a result, i-BanCross 2.0 serves as both an engaging educational tool and an effective resource for mastering complex Islamic banking concepts in a more relatable and interactive manner.

This innovation has the potential to be commercialized for individuals pursuing studies in the field of Islamic banking and finance. In addition to students, it is also well-suited for industry practitioners and anyone with an interest in gaining deeper insights into Islamic banking and finance concepts.

CONCLUSION

In conclusion, it is our hope that this product will serve as a valuable tool for the community in expanding their knowledge of Islamic banking and recognizing the significance of understanding the field's specific terminologies and concepts. This is especially beneficial for individuals who are eager to explore and learn about Islamic banking studies. Moreover, the product aims to raise public awareness and assist students in better grasping the concepts related to Islamic finance. Ultimately, it is designed to support those who aspire to deepen their knowledge and enhance their skills in the area of Islamic banking.

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i-Cons 2.0 (ISLAMIC CONTRACTS 2.0)

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ABSTRACT

Islamic banking is increasingly gaining attention due to its compliance with Shariah and Sunnah principles. Governed by the Islamic Financial Services Act 2013, it operates based on ethical and interest-free financial practices. Despite its growth, public awareness and understanding of Islamic banking particularly its concepts and specialized terms remain low. Many people, including students pursuing studies in Islamic finance, often find the subject complex and challenging to grasp. In response to this issue, we have developed an innovative educational tool designed to make learning Islamic banking more accessible and engaging. The innovation developed using wordwall, a free online classroom's activities include quizzes, matching exercises, word games, and more. This innovation focuses on simplifying the definitions and terminology of Islamic banking, with a special emphasis on Islamic contracts. Known as i-Cons 2.0, these contracts are introduced through interactive and entertaining methods that cater to the learning preferences of 21st-century students. By integrating technology and gamification, our product helps users understand fundamental concepts in a more enjoyable and less intimidating way. The aim is to enhance comprehension while also increasing interest and motivation among learners. Ultimately, our goal is to support students and the wider community in gaining a better understanding of Islamic banking and finance. By making complex ideas more relatable through digital tools and engaging content, we hope to bridge the knowledge gap and encourage more individuals to explore the field. This product not only serves educational purposes but also promotes greater financial literacy rooted in Islamic values.

Keywords: Gamification, Islamic Banking, Islamic Contracts

INTRODUCTION

Islamic banking is a financial system that operates in accordance with the principles of *Shariah* (Islamic law), emphasizing ethical and interest-free transactions. Unlike conventional banking, which relies on interest-based lending, Islamic banking prohibits *riba* (interest), *gharar* (excessive uncertainty), and *maysir* (gambling), instead promoting risk-sharing, asset-backed financing, and socially responsible investments (Iqbal & Mirakhor, 2011). The foundation of Islamic banking is rooted in the teachings of the Qur'an and the practices of the Prophet Muhammad (SAW), making it a faith-based yet globally relevant alternative to conventional banking systems.

Over the years, Islamic banking has grown substantially, not only in Muslim-majority countries but also globally, with over 560 Islamic financial institutions operating in more than 80 countries (Wilson, 2009). The industry's assets were estimated to have reached nearly USD 4 trillion by 2021 and are projected to grow to USD 5.9 trillion by 2026 (Islamic Corporation for the Development of the Private Sector & Refinitiv, 2022). This remarkable growth reflects a rising demand for *Shariah*-compliant financial solutions and a growing awareness of ethical finance among consumers and investors alike.

PROBLEM STATEMENTS AND SOLUTION

Islamic banking extensively uses Arabic terms such as *Murabahah*, *Mudarabah*, *Ijarah*, and *Wakalah*, each representing specific financial contracts rooted in *Shariah* law. Moreover, these terms carry deeper legal and ethical implications that go beyond literal translation. Understanding them requires knowledge of *Shariah* principles, such as the prohibition of *riba* (interest), the requirement of transparency, and the need for fairness in all transactions. For instance, in a *Mudarabah* contract, profits are shared based on a pre-agreed ratio, and losses are borne solely by the capital provider unless negligence occurs. Such contextual rules must be adhered to for the contract to remain valid under Islamic law. Therefore, learners must not only memorize these terms but also comprehend the principles and legal frameworks that govern them, which can be challenging without proper guidance or resources.

To overcome this challenge, an innovative solution called i-Cons 2.0 has been developed. This web-based platform incorporates educational games focused on Islamic banking, with a particular emphasis on the definitions and concepts of Islamic banking contracts. It aims to help users especially students for them easily identify and understand the key contracts commonly used in Islamic banking. i-Cons 2.0 is designed as a match-up game, offering an interactive and engaging way for learners to become familiar with important terms. This approach not only makes learning more enjoyable but also strengthens understanding, particularly for beginners and those new to *Shariah*-compliant financial practices.

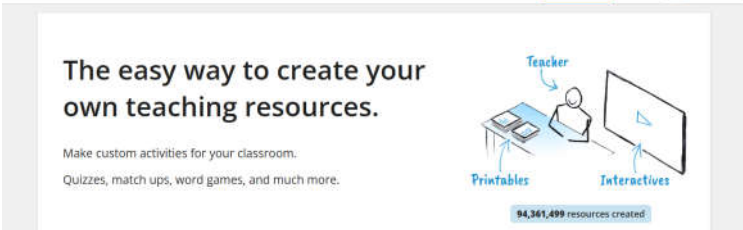
The objectives of this project are to develop an engaging, web-based learning platform that utilizes educational games to enhance users' understanding of Islamic banking and to assist in easily identifying and comprehending the key contracts and concepts commonly used in Islamic banking through an interactive match-up game format. It also aims to offer an innovative and enjoyable learning experience, particularly for beginners who are new to *Shariah*-compliant financial practices. Additionally, the

platform seeks to improve learners’ retention and familiarity with Islamic banking terminology by incorporating gamified educational methods.

METHODS AND MATERIAL

This innovation is a web-based educational game aimed at introducing modern Islamic banking and finance terms, particularly to tertiary-level students. It provides essential knowledge on Islamic financial contracts in an interactive format suitable for both practitioners and the public. Created using Wordwall, the game utilizes a platform that enables user-generated learning activities while also supporting skill development for its creators. Wordwall is an online platform that allows educators and users to create interactive and printable learning activities. It's widely used in classrooms and online learning environments to make lessons more engaging and fun (Wordwall, 2016). Table 1 below shows the steps for using i-Cons 2.0:

Table 1.: Steps for using i-Cons 2.0

1	 The easy way to create your own teaching resources. Make custom activities for your classroom. Quizzes, match ups, word games, and much more. Teacher Printables Interactives 94,361,499 resources created	To get started, the user should visit the Wordwall website and click on the link to access and play the i-Cons 2.0 match up game. Access it here: https://wordwall.net/resource/61593608/islamic-banking-finance/i-cons-20-islamic-contracts-20
2	 Match up i-Cons 2.0 (Islamic Contracts 2.0) START Drag and drop each keyword next to its definition.	After clicking the provided link, the user will be directed to i-Cons 2.0. The front page of i-Cons 2.0 appears as shown. The user needs to click the start button to begin the game.

4

5

6

Once the game is completed, the total number of correct answers and the time taken will be displayed. Users can also view the leaderboard, review their answers, and replay the game.

IMPACTS OF INNOVATION

The i-Cons 2.0 product stands out as a unique and impactful educational tool specifically designed for teaching Islamic banking and finance. It provides a dynamic and enjoyable learning environment that helps users better understand complex financial terms and concepts through interactive gameplay. What makes this tool particularly valuable is its accessibility and inclusiveness. It is suitable for individuals of all age groups and social backgrounds, including adults, university students, and even school-going adolescents who are beginning to explore the basics of Islamic finance. This is also the first-ever match-up game specifically developed for the field of Islamic banking and finance, making it a pioneering tool in combining interactive learning with Shariah-compliant financial education.

One of the key advantages of i-Cons 2.0 is that it does not impose any time limits, allowing users to learn at their own pace. This flexibility helps players fully absorb and retain the definitions and functions of various Islamic financial contracts, promoting deeper understanding and long-term memory retention. By transforming traditional learning into an engaging and user-friendly experience, the game encourages active participation and self-directed learning (Sylvester, 2024). Furthermore, the i-Cons 2.0 platform presents strong potential for future development, making it an excellent foundation for continued learning, classroom use, or even corporate training in Islamic finance. In i-Cons 2.0, there are new terminologies added as additional feature.

COMMERCIALIZATIONS OF INNOVATION

This innovation has strong potential for commercialization, particularly among students pursuing studies in the field of Islamic banking and finance. By offering a practical, engaging, and user-friendly platform, it serves as an excellent supplementary learning tool that can enhance students' understanding of key concepts and terminology (Bajaj, 2024). Its interactive format not only supports academic learning but also encourages active participation, making it a valuable resource for classroom use, revision, or self-study.

In addition to its relevance for students, this innovation is also highly suitable for industry practitioners who wish to refresh or deepen their knowledge of Islamic financial principles. It can be used as a training tool within organizations, financial institutions, or educational programs aimed at professional development (Buckley et al., 2022). Furthermore, it is equally beneficial for members of the public who are curious or interested in gaining a clearer understanding of Shariah-compliant financial systems. With its broad appeal and flexible usage, this innovation holds great promise as an educational resource across various segments of society.

CONCLUSION

In response to the growing demand for greater understanding of Islamic banking and finance, especially among students and beginners, i-Cons 2.0 presents an innovative solution that bridges the gap between complex financial concepts and learner-friendly approaches. By integrating gamification and

educational technology through platforms like Wordwall, this tool simplifies the learning of Islamic financial terminology particularly Islamic contracts by presenting them in an interactive and engaging format. As the first match-up game of its kind in the Islamic finance field, i-Cons 2.0 effectively transforms traditional learning into a more enjoyable and accessible experience.

The innovation not only supports academic development but also promotes financial literacy grounded in *Shariah* principles. Its flexible, inclusive, and self-paced design makes it suitable for students, educators, practitioners, and the public alike. With strong potential for classroom use, individual learning, and even corporate training, i-Cons 2.0 stands out as a valuable educational resource. Ultimately, this innovation contributes meaningfully to the goal of increasing awareness and understanding of ethical Islamic financial practices, supporting both educational objectives and wider societal empowerment in Islamic banking.

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iDOOR3D: IMMERSIVE SKETCHUP LEARNING OF DOOR CONSTRUCTION IN QUANTITY SURVEYING EDUCATION

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ABSTRACT

Measurement work is a fundamental aspect of quantity surveying, particularly in taking of quantities for building elements such as doors. Traditional methods used in the Measurement of Construction Works II (QSA151) course rely heavily on textbooks with static illustrations and classroom hand sketches based on two-dimensional (2D) diagrams. While these may benefit students with strong spatial imagination, they pose challenges for those lacking such skills, resulting in reduced engagement and difficulty in grasping practical applications. To address this, iDoor3D—an immersive SketchUp-based learning tool was developed to enhance visual learning through interactive three-dimensional (3D) animation, thereby improving students' competency in measuring door elements. The tool integrates with the UFUTURE platform and YouTube for ease of access and navigation. This innovation aims to strengthen students' drawing interpretation skills, foster active learning, and enhance technical practices through an engaging, interactive approach.

Keywords: iDoor3D, SketchUp, QS education, Three-dimensional (3D), Door element

INTRODUCTION

Students in built environment disciplines such as architecture, engineering, surveying, and construction management are vital to the development of the construction industry. Their problem-solving abilities, teamwork, leadership skills, technical knowledge and adaptability to technological advancements directly influence industry credibility. Halid (2025) reported that over 70% of graduates are not adequately prepared for the work force, as highlighted in the *Pusat Kajian Pasaran Buruh Masa Hadapan* (EU-ERA) study. This finding underscores the urgent need for innovative teaching approaches that cater to today's learners who are highly visual and influenced by social media. Teaching tools must therefore evolve to become more interactive and visually engaging to align with modern learning preferences.

In quantity surveying (QS), accurate measurements impact cost estimation, material planning, and project execution. However, 2D drawings, manual exercises, and static visuals have proven insufficient

for preparing students for technology-driven work environments. For beginners, understanding technical drawings and performing quantity take-offs is often challenging (Chia et al., 2012). Vernadakis et al. (2011) noted that conventional lectures and demonstrations do not sufficiently engage students in hands-on and interactive learning. An interview with the teaching team of the QSA151 course in February 2025 confirmed that students struggle with visualising and interpreting 2D diagrams. These challenges call for creative teaching tools—such as iDoor3D—to enhance students' visual literacy and measurement competency. This paper introduces iDoor3D as an innovative solution designed to develop technical skills in taking measurements for door elements.

METHODS

The study focused on the panel door element and involved the following development stages:

- A) Needs Analysis: A preliminary study identified challenges students face in understanding, visualising, and measuring door elements. Data were collected through informal interviews with the teaching team and a review of current instructional tools.
- B) Content Creation: Based on existing lecture notes aligned with the QSA151 syllabus, iDoor3D content was developed using SketchUp for Web. The material provides step-by-step visual guidance.
- C) Platform Development: The UFUTURE platform, integrated with YouTube, was selected to facilitate user friendly access and enhance the learning experience.

RESULTS AND DISCUSSION

Measurement is a core responsibility of assistant quantity surveyors. Needs analysis revealed that students often struggle with interpreting 2D drawings, which hinders their ability to perform accurate take-offs in the QSA151 course. The lack of spatial imagination leads to limited visual engagement and practical understanding. The teaching team thus initiated the need for iDoor3D, a visual learning tool designed to improve student comprehension of door construction and measurement tasks.

iDoor3D enables users to visualise door components through 3D illustrations. By integrating SketchUp for Web, students can better interpret 2D drawings and perform accurate measurements. The UFUTURE platform and YouTube further ensure ease of use and flexible access. Figure 1 demonstrates the components of a panel door system.



Figure 1.: iDoor3D which shows components of a panel door system

Door Components Visualised in iDoor3D are as the followings:

a) Head and Jamb (Frame):

Illustrates how these elements connect structurally, including the groove or rebate for the door leaf.

b) Rebated Stopper:

Shows the indentation that accommodates door thickness and ensures alignment.

c) Architraves:

Displays decorative mouldings and their structural/aesthetic purposes.

d) Panel Door Leaf:

Depicts clearance, swing direction, hinge placement, and moulding types.

Figure 2 outlines the iDoor3D development framework. The tool's visual animations, when combined with traditional lectures, help students overcome interpretation challenges. The UFUTURE platform, along with YouTube, facilitated easy access and navigation for students to materials, enabling them to revisit content and engage in self-paced learning. The integration of traditional educational content with digital delivery methods utilising SketchUp for web in the development of iDoor3D presents a flexible learning model that is in harmony with contemporary educational trends. The iDoor3D provides a practical and significant method for teaching one of the essential components of Measurement of Construction Works II (QSA151). This approach seamlessly integrates visual learning, technical training, and the cultivation of soft skills, all presented in an engaging and cost-effective manner. This innovation enhances students' grasp of measurement tasks while equipping them to emerge as skilled

and self-assured assistant quantity surveyors in practical construction environments. In addition, iDoor3D has strong potential for commercialization within colleges, universities, polytechnics, and TVET institutions offering courses in Quantity Surveying, Construction Management, Architecture, or Building Technology, as an innovative tool for teaching and learning.

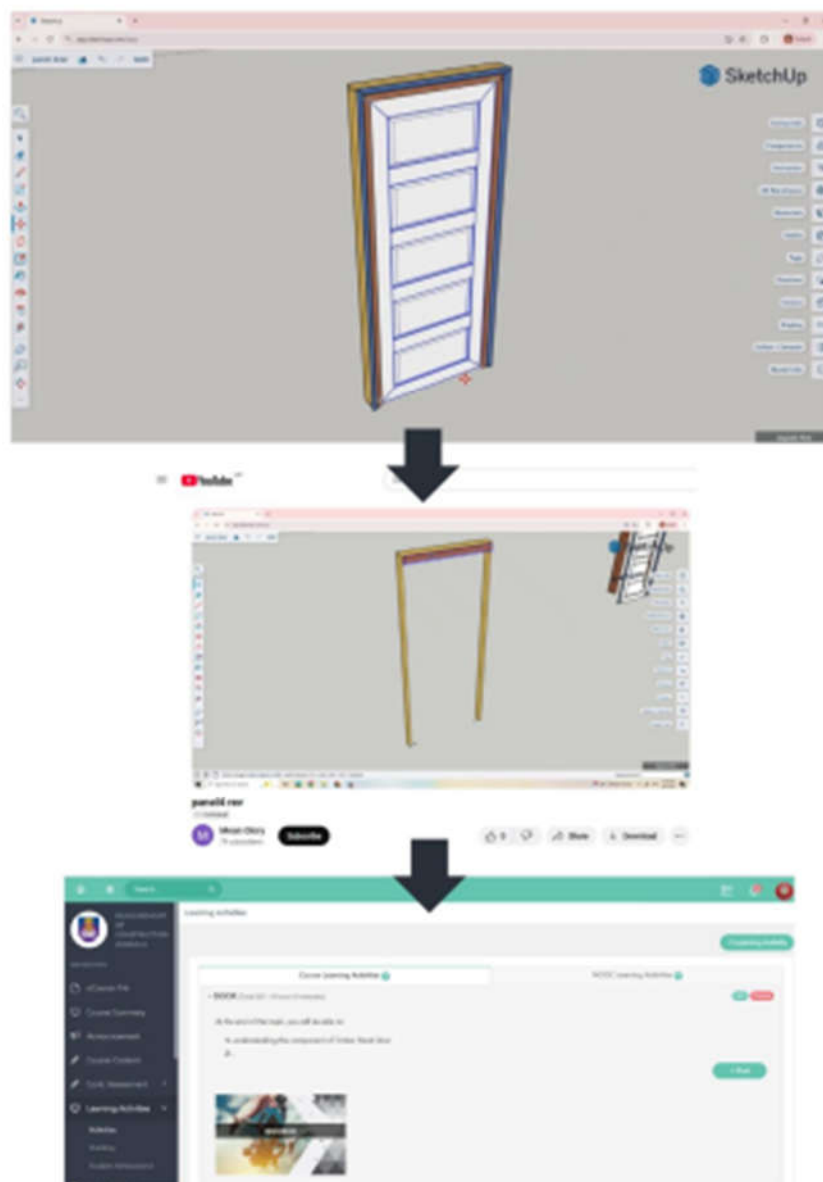


Figure 2.: The design and development of iDoor3D

CONCLUSION

iDoor3D demonstrates how simple yet innovative teaching tools can transform traditional classrooms into interactive and impactful learning environments. By focusing on the panel door, a fundamental building element, this tool enhances technical practices skills. The iDoor3D model can be extended to other construction elements such as windows, walls, and finishes. Integrating creativity into technical education through tools like iDoor3Dbetter prepares students to meet real-world measurement challenges in construction.

ACKNOWLEDGEMENTS

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IMPROVING FAULT ANALYSIS WORKFLOW: A TABLE- BASED APPROACH FOR PER UNIT EQUIVALENT CIRCUITS IN BASIC POWER ENGINEERING COURSE

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ABSTRACT

Fault analysis is a fundamental subtopic in the Basic Power Engineering course, a core subject within the Diploma in Electrical Engineering (Electronic) curriculum. A critical step in fault analysis involves deriving a per-unit equivalent circuit from a given one-line diagram of a power system network, which typically includes generators, transmission lines, transformers, and motors. Traditional methods for obtaining per-unit values often rely on a top-down calculation approach, which lacks systematic organization and can lead to errors. To address this limitation, this approach introduces a structured table-based method designed to streamline the calculation of per-unit values and the construction of equivalent circuits. This innovative approach guides students to focus on specific zones within the network, promoting clarity and reducing computational errors. Furthermore, the table-based format facilitates easier evaluation for lecturers, as it provides a clear and organized representation of the calculation process. A preliminary evaluation involving eight students demonstrated the effectiveness of the method, with seven students adopting the table-based approach. Among these, four students achieved fully correct solutions, while three made minor errors attributed to carelessness. The findings indicate that the table-based method enhances both student performance and teaching efficiency. These results suggest that the table-based approach enhances both student understanding and teaching efficiency. Future work will focus on refining the method and expanding its application to broader power system analysis topics.

Keywords: *Per unit equivalent circuit, fault analysis, power engineering, table-based method, power system*

INTRODUCTION

Fault studies are a critical area of focus in power system analysis. This subject was included in the Basic Power Engineering course under the Diploma in Electrical Engineering (Electronic). Data obtained from fault studies is typically utilized for accurate relay settings and coordination (Hadi Saadat, 2004). The power system network is commonly represented in a simplified and standardized format, where a single line is used to depict all three phases of the actual three-phase power system.

This approach is widely adopted in electrical engineering to streamline the visualization and analysis of complex power systems (Chapman, 2002). The one-line diagram, also referred to as a single-line diagram, serves as a concise and efficient graphical representation of the entire power system network. An example of such a representation is illustrated in Figure 1.

The one-line diagram typically includes critical technical details that are vital for system analysis and operation. These details often encompass the ratings of electrical machines, such as generators and transformers, which specify their capacity and operational limits. Furthermore, the diagram may also indicate the power consumption of loads or the power supplied by sources, offering a comprehensive snapshot of the system's operational parameters.

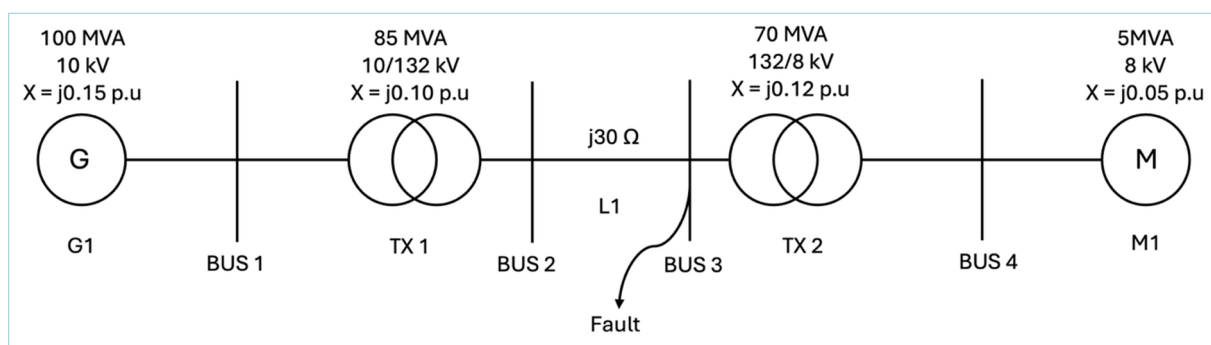


Figure 1.: Single-line diagram for a power system network

Given that the power system network operates on a three-phase basis, one of the most effective and efficient methods for analyzing such a network is to convert it into a per-unit equivalent circuit. The per-unit system is a normalized system of representation that simplifies the analysis of complex power systems by expressing electrical quantities, such as voltage, current, and impedance, as dimensionless ratios relative to predefined base values (Chapman, 2002). One of the key advantages of utilizing the per-unit system is that it eliminates the complications arising from voltage level changes introduced by transformers. This simplification is particularly significant in large-scale power systems, which typically include numerous transformers at various voltage levels.

To derive the parameters required for constructing the per-unit equivalent circuit of a power system, a series of calculations must be performed. However, there is no standardized or systematic methodology for performing these calculations. Traditionally, the process follows a top-to-bottom approach, where calculations begin with the determination of base values and proceed sequentially to the computation of per-unit impedances and fault currents. While this method is logically structured, it often poses challenges for students, particularly when they need to revisit earlier calculations to extract necessary information for subsequent steps. This backward referencing can lead to confusion and errors, especially when dealing with numerical values that extend to several decimal places. Such errors can significantly impact the accuracy of the results, making the analysis unreliable

Problem-solving is a critical skill in engineering education, especially in the 21st century. According

to (Adeoye & Jimoh, 2023), problem-solving skills have become a necessity to encourage innovation and solve complex problems across any discipline. Their study on the Creative Problem Solving (CPS) model reveals how its six-phase framework provides a robust foundation for processes involving technical problems. This theoretical foundation strongly supports the development of a table-based approach for improving fault analysis workflow, through structured documentation and visual organization of diagnostic information. Other studies conducted by Lai & Hwang (2014) and Shieh & Chang (2014) show that structured problem-solving skills may result in superior outcomes compared to an ad-hoc method.

Building on these foundations, the primary objective of this paper is to introduce a structured and systematic table-based approach for deriving the necessary parameters required to construct the per-unit equivalent circuit of a power system. Unlike the traditional top-to-bottom calculation method, which often lacks organization and can lead to inefficiencies, the proposed table-based approach provides a clear and structured framework for solving the problem. By organizing all calculations within a single table, this method ensures that each step of the process is logically connected and easily traceable, thereby reducing the likelihood of errors and carelessness. This is particularly beneficial when dealing with complex numerical values that extend to multiple decimal places, as the tabular format minimizes the risk of misplacing or miscopying data.

Furthermore, the table-based approach offers significant advantages for both students and educators. For students, it simplifies the learning process by providing a visual and organized representation of the calculations, making it easier to follow the sequence of steps and verify intermediate results. For lecturers and instructors, this method streamlines the evaluation process, as all calculations are consolidated in a single, coherent format. This not only enhances the clarity of the solution but also facilitates more efficient and accurate marking, saving time and reducing the potential for oversight. By adopting this structured approach, the paper aims to improve the accuracy, efficiency, and educational effectiveness of per-unit calculations in power system analysis.

METHODS

The table-based approach was designed to offer a structured, systematic, and efficient methodology for calculating per-unit values in power system networks and constructing the equivalent circuit necessary for fault analysis. This approach employs a tabular framework that organizes the calculation process into distinct, sequential steps, ensuring clarity and logical progression throughout the analysis. The structure of the table is adaptable, with the number of columns corresponding to the number of zones present in the power system network. As such, the table's dimensions are dynamic and will vary depending on the specific configuration of the power system being analyzed.

Each row within the table is dedicated to a specific parameter, including but not limited to base apparent power, base voltage, base impedance, base current, transformer ratings, and per unit values for each component within a specific zone. This organized arrangement ensures that all critical parameters are systematically calculated and documented, reducing the likelihood of errors and enhancing the overall accuracy of the analysis.

To illustrate the practical application of this approach, Figure 1 and Table 1 provide examples of a power system network comprising three zones, along with the corresponding table-based framework used to calculate the per unit values for the respective system. These figures demonstrate how the tabular method simplifies the process of deriving per-unit values, even in multi-zone power systems, by consolidating all calculations into a single, coherent format.

The table-based methodology is implemented through the following procedural steps:

Step 1: The number of zones is determined by the quantity of transformers within the network, as illustrated in Figure 1. In this example, the network is partitioned into three distinct zones.

Step 2: The base apparent power, denoted as *S_{base}*, is typically provided as a reference value. In this example, *S_{base}* is specified as 150 MVA. It is important to note that *S_{base}* remains consistent across all zones. Step 3: The rated capacities of all transformers are recorded according to their respective zones.

Step 4: The initial base voltage, *V_{base}*, is usually given as a reference. For example, *V_{base}* is set at 10 kV and is in Zone 1. The base voltages for Zone 2 and Zone 3 are subsequently derived using the prescribed formula presented in Table 1.

Step 5: The base impedance, *Z_{base}*, is then computed. In this scenario, since there is only one real impedance value of j30 Ω associated with the transmission line in Zone 2, *Z_{base}* is calculated exclusively for Zone 2.

Step 6: The base current, *I_{base}*, is also determined for Zone 2, given that the fault condition is located within this zone.

Step 7: The per-unit impedance is computed for all components within the power system, categorized by their respective zones. Given that transformers possess two sides, students may select one side of each transformer for the per-unit impedance calculation. In this example, if the primary side of transformer 1 is selected, the per-unit impedance will be calculated for Zone 1, thereby obviating the need for a separate calculation on the secondary side in Zone 2.

Table 1.: Table-based approach for per-unit equivalent circuit

Zones	1	2	3
<i>S_{base}</i> (MVA)		150	
Transformer rating (V)	10 k	132 k	8 k
<i>V_{base}</i> (V)	10 k	$\frac{132k}{10k} \times 10k = 132k$	$\frac{8k}{132k} \times 132k = 8k$

$Z_{base} (\Omega)$	N/A	$\frac{(132k)^2}{150M} = 116.16$	N/A
$I_{base} (A)$	N/A	$\frac{150M}{\sqrt{3}132M} = 656.08$	N/A
Per-unit impedance	G1: $j0.15 \times \left(\frac{150M}{100M}\right) \times \left(\frac{10k}{10k}\right)^2 = j0.225$	L1: $\left(\frac{j30}{656.08}\right) = j0.046$ L1: $\left(\frac{j30}{656.08}\right) = j0.046$	TX2: $j0.12 \times \left(\frac{150M}{70M}\right) \times \left(\frac{8k}{8k}\right)^2 = j0.257$
	TX1: $j0.10 \times \left(\frac{150M}{85M}\right) \times \left(\frac{10k}{10k}\right)^2 = j0.176$		M1: $j0.05 \times \left(\frac{150M}{5M}\right) \times \left(\frac{8k}{8k}\right)^2 = j1.5$

RESULTS AND DISCUSSION

The preliminary study aimed to evaluate the effectiveness of the table-based approach in improving students' ability to perform per-unit calculations and construct equivalent circuits for fault analysis. Out of the eight students enrolled in the Basic Power Engineering course, seven chose to adopt the table-based method, while one student preferred the traditional top-down approach. The solutions were evaluated based on three criteria: accuracy, organization, and clarity.

The results presented in Table 2 indicate that four out of seven students employing the table-based method attained fully correct solutions, reflecting a robust understanding of the process and effective application of the method. Two students demonstrated minor errors, largely attributable to carelessness in the transfer of values between steps; however, their overall workflow was organized and coherent. The remaining student utilizing the table-based method exhibited difficulties in conceptual understanding; however, the structured format proved beneficial, as it facilitated clear documentation and enabled easier error identification. The student employing the traditional approach also arrived at a correct solution; however, their work was less organized and required considerably more effort for evaluation. The table-based approach enhanced the evaluation process for the instructor by providing a logically organized and clearly documented framework for each step.

Table 2. Summary of preliminary results using a table-based approach

Method Used	Number of Students	Fully Correct Solutions	Minor Errors	Conceptual Errors	Organization & Clarity
Table-Based	7	4	2	1	High
Traditional	1	1	0	0	Low

CONCLUSION

The findings of this study indicate that the table-based approach can improve student learning and teaching efficiency in power system fault analysis. The result of four students getting fully correct solutions highlights the effectiveness of this approach in enhancing accuracy and conceptual comprehension. Students who made errors also benefited from the organized workflow, as it facilitated the identification and correction of mistakes more effectively than the traditional disorganized approach. The student employing the traditional method and attaining a correct solution demonstrates that this approach can still produce accurate results when utilized by a competent learner. However, the lack of organization and clarity in their work made the evaluation process more time-consuming and difficult for the instructor.

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INFECTICODE: THE MOLECULAR LOCKDOWN - UNLOCKING MOLECULAR MYSTERIES THROUGH AN EDUCATIONAL ESCAPE ROOM

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ABSTRACT

Systematic bacteriology is often seen as difficult and complex, leading to low student engagement and limited conceptual understanding. InfectiCode: The Molecular Lockdown was developed as an innovative escape room-style educational game using the Genial.ly platform. The game is set in a hospital outbreak scenario, in which participants assume the role of a clinical investigation team responsible for identifying the pathogen causing neonatal sepsis in a newborn. Clues are gathered through a series of guided tasks incorporating phenotyping and genotyping principles, to unlock a briefcase containing a reward. A pre-test and post-test using similar questions were given to evaluate the students' understanding, and a satisfaction survey form was administered to capture perceptions related to engagement and the learning experience. The Wilcoxon signed-rank test was performed to determine statistical differences in scores obtained before and after the game was conducted (p -value < 0.05). The results indicated significant improvements in understanding and high satisfaction levels regarding the game design and delivery. This game-based approach provided an effective alternative to conventional teaching methods by promoting deeper conceptual learning, collaboration, and learner motivation. Importantly, the simulation also fosters anticipatory thinking, one of the core competencies of Education for Sustainable Development, by encouraging learners to envision future public health scenarios and reflect on the long-term societal impacts of clinical microbiological decisions through systematic bacteriology. The outcomes suggest that game-based learning can help students learn complex scientific content more enjoyably and effectively.

Keywords: *Escape room, Game-based learning, Active learning, Student engagement*

INTRODUCTION

Systematic bacteriology is the branch of microbiology on the classification, identification and naming (taxonomy) of bacteria based on phenotypic (observable traits) and genotypic (DNA-based). Systematic bacteriology is a subject that is known to be included as part of the curriculum for students pursuing an undergraduate course in Microbiology. This bacterial identification is important for clinical diagnosis, effective treatment and public health to track outbreaks and emerging resistant strains. Systematic bacteriology is also crucial for agriculture and soil health, such as the detection of plant pathogens or support development of biofertilizers and biocontrol agents for sustainable farming. Besides, this contributes to the discovery of new bacterial species that may have environmental, industrial microbiology and biotechnology importance. This systematic bacteriology combines morphology, biochemical tests, molecular genetics and clinical relevance. The volume of information, combined with its complexity, can overwhelm learners and make the learners feel disconnected and reduced motivation (Walker et al, 2022). Traditional lecture-based methods tend to result in low engagement with limited conceptual understanding and difficult to relate to real-world applications, especially in a clinical context (Pineros et al, 2023). Therefore, there is a need to explore interactive, interactive and fun learning tools such as escape room-style educational games that connect learning to real-world microbiological applications and also promote deeper conceptual learning, fostering collaboration and increasing learner motivation (Alsawaier, 2018).

This study aims to design and implement an interactive escape room-style educational game titled '*InfectiCode: The Molecular Lockdown*', to improve student comprehension of complex topics in systematic bacteriology. By incorporating real-world clinical scenarios and guided problem-solving tasks, the innovation seeks to foster deeper conceptual understanding through active learning (Nieto-Escamez & Roldan-Tapia, 2021). To evaluate its effectiveness, pre- and post-tests were administered to measure students' gains in knowledge. Additionally, a structured feedback survey was used to assess student perceptions, focusing on their satisfaction with the game's design, delivery, and overall learning experience. Together, these objectives support the development of an engaging and flexible-learning tool that enhances both understanding and learner engagement in microbiology education. Notably, the simulation encourages anticipatory thinking, one of the core competencies of Education for Sustainable Development by guiding students to imagine future public health scenarios and consider the long-term societal implications of microbiological decisions in systematic bacteriology. The results indicate that game-based learning can make complex scientific content more accessible, engaging, and effective for students.

METHODS

Game Design and Development

InfectiCode: The Molecular Lockdown was conceptualized as an educational escape room-style game to enhance students' understanding of systematic bacteriology subjects related to phenotyping and genotyping. The game was developed using the Genial.ly platform, a web-based interactive tool embedded in a simulated hospital outbreak. Participants were placed in the role of a clinical investigation team assigned to identify the causative agent of neonatal sepsis in a newborn.

The game storyline was constructed through a series of sequential tasks designed to enhance the decision-making process in students related to knowledge in the related topics. These tasks incorporated phenotyping (Gram staining, cell morphology, biochemical tests) and genotyping (Polymerase Chain Reaction (PCR) amplification, sequencing, BLAST analysis, Multi Locus Sequences Typing (MLST)) approaches. Each task delivered clues essential to progress through the game and ultimately unlocking a virtual briefcase containing a "reward" representing successful pathogen identification.

The activities were designed to encourage students to think critically and solve problems. Game mechanics included clue discovery and password-protected interactive puzzles to simulate the pressure and complexity of real-world microbiological investigations. The game duration was approximately 15–20 minutes and was conducted in a single session in a classroom.

Participants and Setting

The study recruited 96 undergraduate students (diploma level) in semester 4 enrolled in a microbiology course at UiTM. Participation in the study was voluntary and conducted during scheduled class sessions. Students participated in the game individually to allow for independent decision-making, self-paced problem-solving, and to ensure the measurement of individual learning outcomes.

Pre- and Post-Assessment

To evaluate the impact of the game on students' conceptual understanding, a set of fifteen multiple-choice questions (MCQs) covering key concepts in systematic bacteriology was administered before the game (pre-test) and immediately after (post-test) the game session. The test items were designed to assess both knowledge recall and application of phenotypic and genotypic identification strategies. The same questions were used for both pre- and post-assessments to enable paired comparison of individual learning gains.

Student Feedback and Engagement Survey

A post-activity survey assessed students' perceptions based on the MEEGA+ (Model for the Evaluation of Educational Games for Computing Education) (Petri et al., 2018) was used to assess students' enjoyment, focus of attention, motivation, perceived learning, user experience and social interaction of the game. The instrument consisted of a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) and open-ended suggestions for feedback purposes.

Statistical Analysis

Survey responses were analysed, and mean scores and standard deviations were calculated for each item. Qualitative feedback was used to evaluate the learning experience, perceived benefits, and suggestions for improvement. The pre-test and post-test data were analysed using Wilcoxon Signed-rank test to evaluate the students' performance before and after the game-based intervention. A $p < 0.05$ was considered significant. All statistical analyses were performed using SPSS Version 26.0.

RESULTS AND DISCUSSION

Conceptual Understanding of Pre and Post-Test Findings

The effect of the escape room-style educational game on the students' understanding was conducted. The assumption of normality was first tested using Kolmogorov-Smirnov and Shapiro-Wilk tests. The results showed that significant deviation from normality ($W = 0.951$, $p = 0.002$) based on the Shapiro-Wilk test indicated that the data were not normally distributed. Thus, a nonparametric Wilcoxon test was used for further analysis.

The Wilcoxon test revealed a statistically significant increase in scores from pre-test to post-test with the results of $Z = -7.087$, $p < 0.001$. Out of 93 participants, 70 students showed an improved score (positive rank), five showed a decrease (negative ranks) and 18 students showed no change. The mean rank among positive ranks was 39.95 compared to negative rank 19.10 provides strong evidence that the game conducted has meaningful impact. These findings indicate that the game significantly enhances student comprehension of the complex microbiological concepts and thus fulfilling the objective of the study, which was to evaluate the effectiveness of the innovation in improving conceptual understanding. This improvement also aligns with the element confidence in MEEGA+ model where learners gain assurance in their understanding through gamified engagement.

Student Satisfaction and Feedback of the Educational Game

Students' satisfaction and feedback on the game's design and learning experience were captured by the post-game session's survey. The satisfaction survey was conducted with 145 participants based on 5-point Likert scale. The responses obtained showed positive feedback from multiple perspectives as shown in Figure 1. Majority of the students strongly agreed (80.7%) that the gamification method used in the course was fun and had an attractive and engaging interface (80.6%). Furthermore, 77.9% of students reported that the game increased their interest in the lesson, while an equal number of percentages expressed an overall satisfaction with the ease of using the game. Additionally, high levels of strong agreement among students regarding the effectiveness of the game in helping students learn the topic (77.2%), improving understanding (73.1%), and increase the comfort in learning (76.6%). The clarity of the game instructions showed 70.3% scores and the ability to gain additional information and share knowledge with peers (71.7%) further underscore the educational value and usability of the innovation. These results are in align with the several aspects in MEEGA+ models particularly in the

elements of fun, satisfaction, interaction and feedback. The strong rating ($> 70\%$ strongly agree) suggests that the educational game succeeded not only in delivering content effectively but also in fostering an enjoyable and intuitive learning environment.

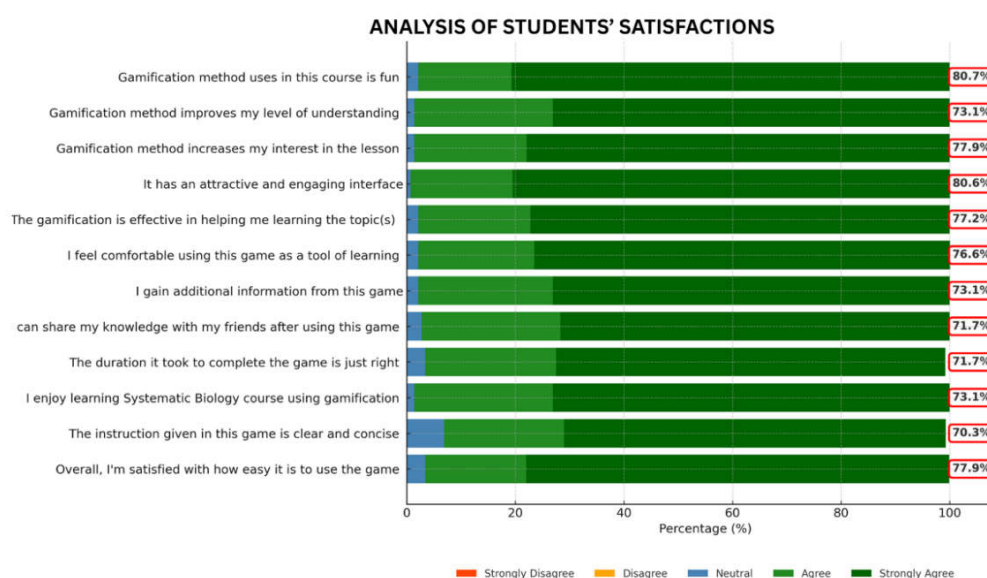


Figure 1.: Analysis of students' satisfaction post-game

Relevance to ESD and Flexible Learning Pathways

Apart from achieving the study objectives, this educational game also aligns with Education for Sustainable Development (ESD) and Flexible Learning Pathways. In ESD context, this game enhances anticipatory thinking which is reflected in one of the core competencies in ESD. Additionally, this game also supports the principle of flexible learning pathways by offering a self-paced, student-centred and adaptive learning experience while engaging with the game. These aspects resonate strongly with the national higher education agenda for more flexible and personalized learning models, particularly in STEM-related courses.

NOVELTY

The novelty of this game lies in its integration of escape room within a microbiological learning context, providing alternative to conventional learning. Using a clinical outbreak scenario, the game encourages students to apply bacteriological principles to solve the puzzles and unbreak the mystery which promotes the flexible and self-directed learning pathways. Moreover, the design aligns with the MEEGA+ model by embedding elements such as narrative-driven tasks, feedback loops, an intuitive interface, and motivational features like achievement tracking and challenge progression. These elements collectively boost student confidence, interest, and satisfaction, as demonstrated by strong post-intervention learning gains and positive perception ratings. Additionally, innovation contributes to Education for Sustainable Development (ESD) by fostering anticipatory thinking and decision-making enabling students to envision real-world implications of clinical diagnostics. Through its interdisciplinary design and evidence-based outcomes, this game-based learning tool represents a novel, scalable approach to enhancing microbiology education in line with 21st-century learning demands.

CONCLUSION

This study demonstrates that the gamified escape room-style educational game, *InfectiCode: The Molecular Lockdown*, significantly enhanced students' conceptual understanding of complex systematic bacteriology content. The statistically significant improvement in post-test scores, reflects the game's effectiveness in deeper understanding of phenotypic and genotypic classification principles. Furthermore, student satisfaction data indicate high levels of engagement, enjoyment, and perceived learning value. These outcomes affirm the potential of gamification as an impactful tool for microbiology education, especially in difficult topics into immersive and learner-centered experiences. We concluded the innovation in gamification for systematic bacteriology course would engage learners and improved cognitive comprehension demonstrated through improved scores. Such interactive approaches can play a key role in advancing education for sustainable development through deeper learning and anticipatory thinking in scientific fields.

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INNOVATING TRoW AS WORKFORCE GAME-BASED LEARNING FOR SUSTAINABLE EDUCATION

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ABSTRACT

Tactic Rush Workforce (TRoW) is a board game developed to simulate real-world human resource (HR) challenges and sustainable education in higher education. As a physical and interactive educational learning tool, TRoW engages students in workplace scenarios that require them to manage key HR functions, including recruitment, skill matching, workforce development, compensation planning, and strategic decision-making. The game employs experiential learning to help students explore essential HR practices and understand current labor market trends. Unlike digital simulations, TRoW is expected to encourage active, in-person participation, fostering collaboration, critical thinking, communication, and competencies vital to academic success and career readiness. Its design enhances both cognitive and social engagement, prompting students to reflect on policies, sustainability goals, and long-term planning in workforce management. This idea generation aligns with sustainable education principles by requiring players to consider the environmental, social, and economic implications of their decisions. This integration supports the development of well-rounded, future-ready skills consistent with the United Nations Sustainable Development Goals (SDGs). By combining game-based learning with strategic thinking and sustainability awareness, TRoW is introduced as a potential educational tool. It will prepare students not only for employment but also for responsible decision-making in complex, real-world contexts. This paper explores the game's design and potential to cultivate workforce competencies for various jobs available in different industries.

Keywords: Workforce, Human Resource, Board game, Sustainable education, Higher education

INTRODUCTION

Game-based learning (GBL) has shown sustained value in higher education as both a means of delivering course content and a platform for developing sustainability literacy, collaboration, systems thinking, and autonomous, reflective participation. Research in sustainability-focused contexts demonstrates that incorporating varied GBL elements such as sensory cues, rewards, game choice, and storytelling enhances the effectiveness of experiential learning, with both digital and non-digital board games improving students' knowledge and attitudes toward sustainability while leveraging the benefits of physical interaction to achieve course-level objectives (Waite et al., 2024; Ho et al., 2022). Beyond sustainability, digital GBL has proven effective in disciplines such as biochemistry and physiology, where it creates low-stress environments for reinforcing concepts, correcting misconceptions, and promoting self-assessment, thereby increasing motivation and deepening engagement even without direct links to exam performance (Tejada-Simon, 2024). Comparable outcomes have been reported in nursing education, where both digital and non-digital GBL support knowledge acquisition, skills development, and critical thinking (Nylén-Eriksen et al., 2025; Anwer & Abdullah, 2023). Non-digital games, in particular, provide flexible, screen-free opportunities for creativity, problem-solving, and collaborative dialogue, often surpassing screen-based alternatives in facilitating deeper cognitive processing (Debrenti, 2024; Ness et al., 2024). These approaches have also been associated with improved academic performance (Masich et al., 2025), highlighting their capacity to remove digital barriers, reduce screen fatigue, and remain adaptable across diverse instructional contexts and learning environments.

METHODS

This study adopted a qualitative approach that involved information search using academic databases accessible through Google Scholar and the university's digital library portal, including Scopus. The search was guided by keywords "game-based learning" or "game-based learning" on 13 July 2025. The Scopus database was selected as a primary source of academic literature for this study due to its comprehensive coverage, interdisciplinary scope, and rigorous indexing standards. However, only articles published between 2019 and 2025 were included to ensure recency and relevance to the evolving pedagogical landscape. The string used was TITLE-ABS-KEY ("game based learning" OR "Game-based Learning") AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (EXACTKEYWORD , "Game-based Learning")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2023) OR LIMIT-TO (PUBYEAR , 2024) OR LIMIT-TO (PUBYEAR , 2025)) Specifically, Scopus enables access to high-impact, peer-reviewed publications that align with the pedagogical, psychological, and technical dimensions of non-digital educational game design. This method enabled the grounding of TRoW in both pedagogical theory and evidence-based practice, ensuring its relevance as a teaching tool for the human resource management course.

RESULTS AND DISCUSSION

The following figure provides a quantitative overview of how GBL research is spread across various academic disciplines, revealing the interdisciplinary nature and growing relevance of this pedagogical approach.

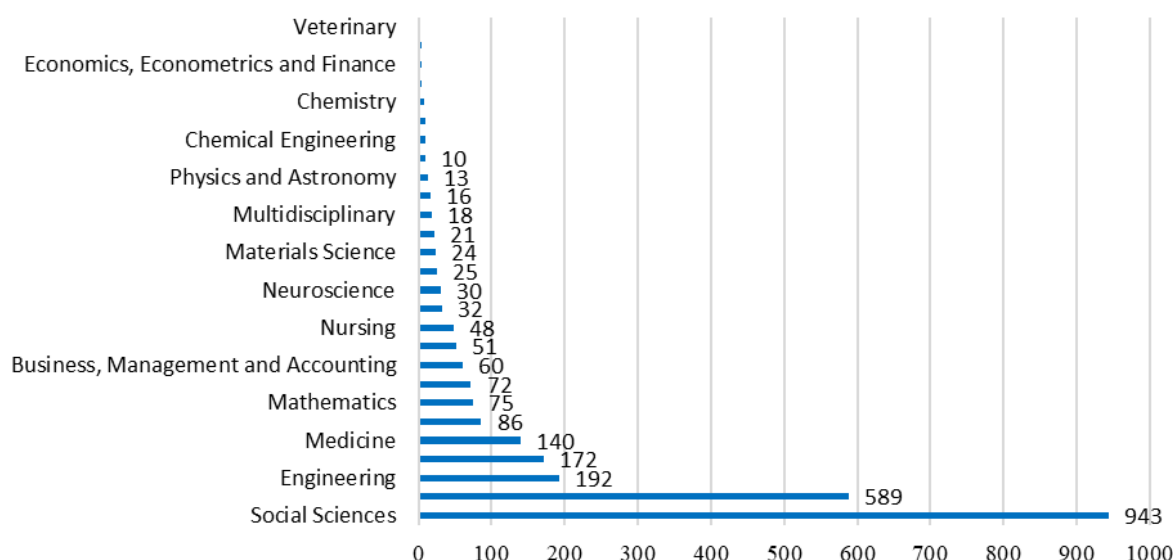


Figure 1.: Articles by subject area

Figure 1 illustrates the distribution of 1384 articles on game-based learning (GBL) indexed in the Scopus database, categorised by subject area from 2019 until 2025, for more than 100 articles recorded for every year. Social Sciences dominate the landscape, accounting for 943 articles, or approximately 68% of the total. This underscores the centrality of GBL in pedagogical research, learning theory, and educational innovation. The relatively low representation of business, management, and accounting with 60 articles suggests a significant gap in non-digital GBL research for workforce education and human resource development. TRoW, as a physical game aligned with sustainability and SDG outcomes, is well-positioned to contribute meaningfully to this underrepresented area. Its integration of decision-making, ethical dilemmas, and multi-goal sustainability makes it both timely and pedagogically valuable.

Effective educational game design requires a balance between narrative immersion, meaningful gameplay, and cognitive clarity. Ho et al. (2022) designed a physical and digital board game simulating global sustainability scenarios. Their study found both formats improved students' knowledge and attitudes towards sustainability, but physical games uniquely fostered peer dialogue and tactile learning. In addition, Whitney (2024) emphasized that physical, game-based activities allow learners to embody abstract concepts, leading to long-lasting cognitive imprints. In the case of Tactic Rush Workforce (TRoW), tactile elements like dilemma and scenario cards, rewards, and a modular board layout help simulate actual human resources (HR) functions such as human resources planning, performance

management, compensation strategies, and sustainability reporting, thereby reinforcing real-world applicability.

Moreover, this approach aligns strongly with Kolb's (1984) experiential learning theory (ELT), which provides a scientifically grounded framework that explains why physical board games a powerful pedagogical tool are. By aligning with each stage of Kolb's cycle consisting of experience, reflection, conceptualization, and experimentation, it is believed that board games transform passive learning into dynamic, adaptive, and socially enriched experiences. This not only enhances knowledge retention but also fosters higher-order thinking and real-world readiness. A recent study by Yaman et al. (2025) offers a systematic literature review on game-based learning (GBL), affirming the value of analogue tools like board games in enhancing engagement, collaboration, and conceptual learning through active, experience-based methods.

TRoW embraces these pedagogical advantages by encouraging active decision-making, team negotiation, and iterative learning cycles, helping students internalize complex HR scenarios and sustainable decision-making principles in a meaningful, memorable way. In addition, colour selection in educational board games plays a critical role in shaping cognitive engagement and emotional resonance, particularly in context-rich subjects like human resource (HR) management. Drawing on experiential learning theory by Kolb (1984), the integration of colours such as blue, green, orange, and grey in board game design supports distinct learning functions. Blue fosters trust and enhance creative, relational problem-solving as the key to HR ethics and leadership as mentioned by Mehta and Zhu (2009), while green, symbolizing balance and growth, has been shown to activate fairness and ethical judgment in learning environments. Orange stimulates collaboration and active engagement, ideal for simulating negotiation and recruitment strategies by Elliot and Maier (2014) while grey, serving as a neutral anchor, delineates rule-based zones and reduces cognitive load, thereby aiding in visual segmentation and clarity by Plass et al. (2015). In comparison, earlier board games like Career Racing by Soesilo et al. (2025) employed vibrant color palettes to sustain motivation but lacked conceptual alignment between color and content, leading to limited reflective engagement. The TRoW board game, by contrast, applies color psychology deliberately to reinforce learning outcomes: blue is used in leadership zones, green in growth scenarios like training and development, orange for team-based tasks, and grey for policy-related decisions. This deliberate alignment mirrors color-coded by Yaman et al. (2025) that thematically structured game environments align visual cues with pedagogical objectives, which supports efficient navigation of complex decision spaces and improves both knowledge retention and problem-solving accuracy. Hence, compared to earlier models that prioritized aesthetic appeal, this design demonstrates that a functionally integrated color scheme can support both emotional and cognitive learning goals in a measurable and sustainable way.

CONCLUSION

This study suggests the pedagogical efficacy of game-based learning (GBL), particularly non-digital board games, in enhancing student engagement, skill development, and sustainability-oriented thinking within higher education. Through the lens of experiential learning, the idea generation of Tactic Rush

Workforce (TroW) board game embodies core educational principles such as active participation, reflective learning, and real-world application by integrating physical game mechanics with human resource management (HRM) content. The deliberate use of color psychology, tactile elements, and scenario-based gameplay not only supports cognitive processing and emotional engagement but also mirrors professional HR practices in areas such as decision-making, planning, and ethics. TroW's alignment between design and learning outcomes offers a more robust and transformative educational experience. This is particularly significant given the underrepresentation of GBL in business and HR contexts, as revealed in the Scopus review. By addressing this gap, TroW contributes both to academic discourse and to practical instructional strategies for future-ready HR education. The findings reinforce that non-digital GBL, grounded in theory and evidence-based design, can serve as a powerful tool for fostering collaborative learning, systems thinking, and long-term knowledge retention across diverse higher education disciplines.

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INONAT TIME TRAVEL ADVENTURE

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ABSTRACT

Learning English prepositions of time using a tenses-themed board game is fun and exciting. The use of a board game promotes involvement and evaluation in learning English prepositions of time through challenges, incentives, and collaboration. Students often face difficulties in utilizing prepositions of time across various tenses. Past studies show that board games promote students' mastery of English grammar, especially prepositions of time, hence increasing the fun and context-dependent importance of language application. The "InOnAt Time Travel Adventure" board game was created to facilitate students' mastery of prepositions of time through repetition, immersive environments, and engaging, motivational, and memorable activities on past, present, and future tenses. A survey was administered to 53 third-semester diploma students selected for the study before and after a two-week grammar class to assess the effectiveness of a board game in assisting students' learning of prepositions of time. The results show that the "InOnAt Time Travel Adventure" significantly enhanced students' capacity to independently comprehend the designated grammar topic. The board game can be economically made and used, so it ought to be acknowledged as a helpful tool for individuals learning the English language. It is recommended that there should be an investigation of the impact of board games designed for the long-term mastery of prepositions of time, together with the performance of students from various faculties and cohorts.

Keywords: *Preposition of time, Board game, Simple tenses, Gamification*

INTRODUCTION

Over the past decade, gamification elements such as board games have turned dull lessons into playful exchanges in language classrooms. New forms are memorable when rote drills are replaced with card draws, dice rolls, and point badges. These hands-on activities are especially good for tricky grammar

points, such as the time prepositions ‘at,’ ‘on,’ and ‘in,’ as well as for the basic tenses present, past, and future.

Gamification, defined as the use of game-style badges, levels, and challenges outside games (Deterding et al., 2015), is a sturdy tool for raising energy and focus in any classroom. The dice game “Rolling InOnAt” lets students form sentences on the spot and raises test scores, which also involves laughter (Ong et al., 2025). Other studies show that star charts, scoreboards, and bonus marks encourage shy learners to tackle drills they once avoided (Lo & Hew, 2017; Rahardja et al., 2019). These prompts camouflage practice in friendly competition as they ease boredom and give grammar a fun new face.

Compared to digital games, playing physical games brings people physically together in the same room, requires players to take turns, which pushes everyone to converse in the target language. The face-to-face interaction also makes it easier for learners to recognise mistakes and correct them on the spot, boosting both accuracy and confidence. A game designed to practice time prepositions with a card that says, ‘Advance if your birthday is in July’ or ‘Step back if you never study on weekends’ forces players to use ‘on,’ ‘in,’ and ‘at’ accurately, where they would in everyday conversation.

Studies that examine learning interventions built around board games report marked gains in both content knowledge and social interaction skills among participants (Noda et al., 2019). When researchers compared these game-based lessons with traditional worksheets for English tenses instruction, learners who played the games found the sessions far more enjoyable than the latter’s demanding, dull, and repetitive exposure. The use of tense emerges naturally within a rich, unfolding context because game rounds repeat similar actions and decisions. The games also weave in time-related prepositions, as players routinely consider schedules, events, and order, making the format apt for teaching language content linked to time.

Gamification in language learning accords with constructive learning theories, which emphasise active learning for knowledge acquisition. The players preoccupy themselves with the game’s rules and linguistic structures through practice and social interaction. This corresponds with the usage-based theory of language acquisition, which asserts that grammar is internalised through contextual application rather than explicit instruction. Games such as “Rolling InOnAt” promote contextualised learning of prepositions of time through meaningful language drill practice (Ong et al., 2025). Board games that facilitate the use of prepositions of time, such as ‘The meeting starts at 8 a.m. today’ or ‘He prefers to study in the morning’ encourage learners to use targeted grammar components.

Some researchers warn against excessive gamification without pedagogical coherence, even though there is increasing endorsement for gamified grammar training. Despite motivation enhancement, the efficacy of gamification is contingent upon meticulous alignment with educational goals. The success of tools like “Step Into Vocabulary” (S.I.V.) further underscores the importance of designing gamified tools that are immersive and purposeful (Salim et al., 2025). Games should be crafted with linguistic objectives to guarantee learners stay focused while achieving quantifiable educational results. A game centred on prepositions of time should offer numerous opportunities to practise prepositions ‘at,’ ‘on,’ and ‘in’ in diverse environments to improve comprehension.

METHODOLOGY

This is a two-week study to examine the students' comprehension of the prepositions of time 'in,' 'on,' and 'at', with two separate classes occurring weekly in classrooms teaching English. The diploma students in the third semester were instructed to complete a pre-test questionnaire focusing on the preposition of time prior to the commencement of the courses. Subsequently, participants were administered a post-test form to assess their comprehension of the subject matter after they engaged with "InOnAt Time Travel Adventure."

The game accommodates two to four players, with all counters commencing at START. The Dice Roll Rules are employed by a player by rolling the dice to advance his or her counter on the board game. The player responds to one inquiry taken from Question Cards when his or her counter lands on a red circle. Prior to validating the responses from the Question Cards, the player provides his or her answers after reading from the Question Cards. The player will next advance their counter on the board game based on the reward or penalty indicated on the Question Cards. If the question is answered correctly, the counter will go two boxes forward. The counter will revert to one box if the response is incorrect. The subsequent player is now to roll the dice. The game concludes when any counter reaches END.

RESULTS AND DISCUSSION

The first section of the questionnaire had a question on the perception of the participants on whether the game "InOnAt Time Travel Adventure" helped them to learn prepositions. There were 53 participants in this study. For this question, a large majority (96.1%) of the participants gave a positive response, and only 3.9% responded negatively. This indicates that most of the participants in this study perceived the game "InOnAt Time Travel Adventure" as being effective as a tool for teaching prepositions.

In the second section, 27 questions received positive feedback from the respondents regarding their experiences while playing the game "InOnAt Time Travel Adventure". A 5-point Likert scale was employed where 1 = strongly disagree and 5 = strongly agree. This study found that participants agreed they were happy when playing the game "InOnAt Time Travel Adventure". This is interpreted from the high mean for questions asking about the students' feelings (I felt happy, $M = 4.37$, $SD = 0.662$, I enjoyed it, $M = 4.31$, $SD = 0.735$, and I thought it was fun, $M = 4.27$, $SD = 0.723$).

The study also found the participants agreed that the game "InOnAt Time Travel Adventure" was engaging and interesting (I was interested in the game's story, $M = 4.20$, $SD = 0.775$, I found it impressive, $M = 4.02$, $SD = 0.787$ and I was deeply concentrated in the game, $M = 4.02$, $SD = 0.860$).

Next, in the third section, participants' perceptions of negative feedback are presented. In this section, 23 questions with negative feedback when playing the game "InOnAt Time Travel Adventure" were collected, and the respondents answered using a 5-point Likert scale where 1 = strongly disagree and 5 = strongly agree. The findings revealed that the participants rejected all negative emotions while

playing the games. There were 10 statements with a mean below than 2.00 (I found it a waste of time, $M = 1.35$, $SD = 0.716$, I felt regret, $M = 1.59$, $SD = 0.829$, I felt ashamed, $M = 1.59$, $SD = 0.804$, I felt bad, $M = 1.61$, $SD = 0.723$, I felt irritable, $M = 1.67$, $SD = 0.887$, I felt annoyed, $M = 1.71$, $SD = 1.006$, It gave me a bad mood, $M = 1.71$, $SD = 0.965$, I felt pressured, $M = 1.76$, $SD = 0.907$, I felt bored, $M = 1.82$, $SD = 0.974$ and I felt frustrated $M = 1.86$, $SD = 1.000$).

In summary, the findings of this study reveal that the participants' learning outcomes and feedback on experience were dominated by positive perceptions. The participants' experience while playing the game "InOnAt Time Travel Adventure" was perceived as effective, enjoyable, and engaging. Negative responses were reported to be very low among the participants.

CONCLUSION

The learners quickly became absorbed in "InOnAt Time Travel Adventure" and believed it as a practical tool to master grammar. The board game merged fun with study in a way language classes often struggle to do by putting up the tricky prepositions of time in a light-hearted play. Their enthusiastic feedback shows that the activity built a relaxed, enjoyable atmosphere where repetition, conversation, and real-world context helped the students genuinely experience the grammar rules rather than just memorising it.

Interview feedback indicates that playing the board game eased the unpleasant feelings usually linked to grammar lessons - boredom, frustration, and performance pressure. Instead, learners reported high enjoyment, sharp focus, and steady engagement, evidence that low-tech classroom games can succeed in places where digital tools are scarce. Affordable and user-friendly, "InOnAt Time Travel Adventure" fits easily into diverse classrooms and lightens the teachers' load. Since the game focuses on prepositions of time, it could readily be adapted to other structures and even to pronunciation or vocabulary.

Long-term studies are needed to see how well the game boosts grammar retention over weeks or months and whether it works for mixed faculties, learners at different proficiencies, or classes that meet online or in hybrid formats. A digital version of this board game would broaden accessibility to allow researchers to study gameplay data alongside test scores. In short, "InOnAt Time Travel Adventure" offers a fresh, learner-centred way to teach grammar and matches the active, flexible goals set by today's education theories.

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InRES: A DIGITAL SOLUTION FOR ENHANCING RESEARCH ORIGINALITY AND SUPERVISION IN HIGHER EDUCATION

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ABSTRACT

This study introduces the Innovative Research Electronic System (InRES), a digital repository developed to address research topic redundancy and supervision inefficiency in UiTM Pahang's MGT651 course. A quantitative TAM-based study involving 40 students revealed high system acceptance (overall mean = 4.02/5, 74.1% favourable ratings). Perceived Usefulness (PU) emerged as the strongest predictor of Behavioural Intention ($\beta = 0.48$, $*p < .001$), particularly for enhancing topic originality (rated 4.25/5). Supervisor Impact significantly influenced adoption ($\beta = 0.18$; $*r^2 = 0.71$ with PU), and students with prior research experience reported 65% higher adoption intention than novices. User feedback prioritized feature enhancements: workflow tools like research timeline trackers (17.5% of suggestions), industry-academia collaboration (12%), and AI-driven topic matching (7.5%). Findings demonstrate that InRES success follows the formula: $\text{Adoption} = 0.48(\text{PU}) + 0.39(\text{Attitude}) + 0.18(\text{Supervisor Support})$, validating its potential to foster originality through accessible research management. Future development should integrate productivity automation and scalability features.

Keywords: Research originality, Technology Acceptance Model (TAM), Digital repository, Student research management, Higher education innovation

INTRODUCTION

The rising volume of student research in higher education demands efficient systems to manage, access, and evaluate academic output. As institutions expand, digital solutions are increasingly essential to uphold originality and academic integrity (Aziz, Jamil, & Zainuddin, 2020). Promoting research

originality remains a key priority, but challenges such as inadequate engagement with literature, plagiarism, and a lack of supportive research culture persist (Smith, 2023; Jones, 2022).

One major barrier to originality is students' limited understanding of existing academic work. Without deep literature engagement, identifying research gaps becomes difficult, reducing the potential for novel contributions (Taylor, 2023). Additionally, concerns around plagiarism—intentional or otherwise—can deter students from pursuing innovative ideas, leading to a cautious research environment (Brown, 2022).

To address these issues, universities are enhancing strategies to support originality, including fostering critical engagement with literature, interdisciplinary collaboration, and strong research cultures with adequate mentorship (Johnson, 2023; Williams, 2023). A balanced approach to academic integrity—combining education with accountability—can further encourage creativity while minimizing fear of penalties (Davis, 2023). Institutional frameworks that provide resources, ethical guidance, and practical tools are vital in empowering students to produce original research (Anderson, 2023).

At UiTM Pahang, the MGT651 (Research Methods) course has faced ongoing issues with topic repetition and ineffective supervision due to the lack of a centralized system. Students often duplicate research topics, diminishing novelty and academic contribution. Supervisors, too, struggle to monitor topic diversity across semesters, affecting research quality and learning outcomes.

To overcome these challenges, UiTM Pahang developed the Innovative Research Electronic System (InRES), a centralized digital repository for the MGT651 course. InRES systematically stores students' research titles, abstracts, and tables of content, helping to avoid redundancy and improve topic diversity. Its user-friendly design enables keyword searches, thematic browsing, and filtering by semester or methodology. Built-in analytics track research trends, aligning with the growing need for data-driven tools in academia (Rahman, Tan, & Musa, 2023).

Objectives of the Study

The main objectives of this study are to:

1. Develop and implement InRES to enhance the management of student research projects in the MGT651 course at UiTM Pahang.
2. Examine students' acceptance and behavioural intention to use InRES based on the Technology Acceptance Model (TAM).
3. Identify the key factors that influence students' attitudes toward using InRES, particularly focusing on perceived usefulness and perceived ease of use.

METHODS

This study used a quantitative approach to examine students' acceptance and intention to use the Innovative Research Electronic System (InRES) in the MGT651 course at UiTM Pahang. The Technology Acceptance Model (TAM) guided the study, focusing on Perceived Usefulness (PU),

Perceived Ease of Use (PEOU), Attitude Toward Using (ATU), and Behavioural Intention to Use (BIU).

The target population was 95 students from Part 5 and Part 6. Using G*Power 3.1, a sample size of 68 was determined, but responses were collected from all 95 to ensure sufficient data. Stratified random sampling ensured balanced representation between both parts.

Data were gathered via a structured TAM-based questionnaire, using a five-point Likert scale. SPSS was used for analysis, including descriptive statistics, reliability testing (Cronbach's $\alpha \geq 0.70$), Pearson correlation, and multiple regression to assess how PU and PEOU predicted BIU.

RESULTS AND DISCUSSION

Response Rate

The study targeted 95 students enrolled in Parts 5 and 6 of the MGT651 course. However, only 40 respondents provided complete data. Post hoc analysis confirmed adequate power (87%) for detecting large effects ($f^2 > 0.35$) but limited power (62%) for medium effects. Although the achieved sample size of 40 participants fell below the planned minimum of 68 determined through a priori power analysis (G*Power 3.1; $f^2=0.15$, $\alpha=0.05$, power=0.80), the regression analysis revealed robust associations consistent with Technology Acceptance Model principles. While the sample limitation necessitates caution regarding generalizability, the strength and consistency of these relationships with established TAM pathways suggest the core findings regarding adoption drivers remain valid for the studied population.

Construct Reliability (Cronbach's Alpha)

Internal consistency for all Technology Acceptance Model (TAM) constructs exceeded established thresholds (Cronbach's $\alpha > 0.85$), confirming measurement robustness.

Demographic Profile

Demographic analysis revealed a female cohort (85%), with 62.5% aged 22–23 and 80% having prior research experience. Most respondents (80%) were in Semester 6, reflecting advanced research engagement.

Table 1. Mean Scores

Construct	Mean	Std Dev	% ≥ 4 (Positive)
Overall	4.02	0.62	74.1%
PU	4.18	0.71	79.0%
PEOU	3.94	0.85	70.5%
ATU	4.11	0.78	77.5%
BI	4.08	0.74	76.7%
SI	3.85	0.82	68.0%

Based on Table 1, overall acceptance of InRES was high (mean = 4.02/5, SD = 0.62), with 74.1% of responses scoring ≥ 4 (favourable). Perceived Usefulness (PU) received the strongest endorsement (mean = 4.18, 79% favourable), particularly for enhancing topic originality ("helps find non-repetitive topics": 4.25/5) and providing research insights (4.30/5). Behavioural Intention (BI) scores (mean = 4.08) indicated strong adoption willingness, with 76.7% of students likely to recommend the system (highest-rated item: 4.35/5).

Correlation Analysis

Table 2. Key Relationships (Pearson's r)

Relationship	r	p-value
PU $\rightarrow$ Behavioural Intention	0.83	<0.001***
PEOU $\rightarrow$ Attitude Toward Use	0.78	<0.001***
Supervisor Impact $\rightarrow$ PU	0.71	<0.001***
ATU $\rightarrow$ Behavioural Intention	0.85	<0.001***

Correlation analysis using Pearson's r revealed statistically significant relationships among all core Technology Acceptance Model (TAM) constructs, demonstrating strong interconnections within the InRES adoption framework (all $*p < .001$, $*n = 40$) (Table 2). The strongest observed correlation emerged between Attitude Toward Use (ATU) and Behavioural Intention (BI) ($*r = 0.85$, $*p < .001$), indicating that positive feelings about the system directly translated to usage intent. This large effect size (Cohen's $d = 1.96$) suggests students' emotional responses to InRES were deterministic of their adoption decisions. Equally compelling was the relationship between Perceived Usefulness (PU) and Behavioural Intention (BI) ($*r = 0.83$, $*p < .001$), confirming that students who recognized the system's capacity to enhance research originality and supervision quality were significantly more likely

to commit to its continued use. The strength of this association ($d^* = 1.81$) reinforces PU's theoretical primacy in TAM frameworks. A notably strong linkage surfaced between Perceived Ease of Use (PEOU) and Attitude Toward Use (ATU) ($r^* = 0.78$, $p^* < .001$), demonstrating that system usability directly shaped emotional engagement. This large effect ($d^* = 1.48$) implies that navigation simplicity and technical accessibility served as foundational prerequisites for positive user attitudes. The significant correlation between Supervisor Impact (SI) and Perceived Usefulness (PU) ($r^* = 0.71$, $p^* < .001$) revealed that supervisory engagement critically amplified utility perceptions. This large-magnitude relationship ($d^* = 1.20$) highlights how faculty-mediated guidance transformed system functionality into tangible academic value.

All interconstruct correlations exceeded $r^* > 0.60$, confirming coherent theoretical relationships. The consistently large effect sizes (all $d^* > 1.20$) indicate these were not merely statistical artifacts but represented robust psychological linkages. Crucially, the correlation patterns validated TAM's core proposition that cognitive evaluations (PU/PEOU) precede affective responses (ATU), which subsequently drive behavioural outcomes (BI). The significant SI-PU linkage ($r^* = 0.71$) further established supervisor involvement as an extrinsic moderator enhancing intrinsic motivation—a critical nuance for academic technology adoption. These findings collectively confirm that InRES acceptance operates through theoretically coherent psychological pathways despite the constrained sample size.

Regression Analysis

Regression analysis ($R^2 = 0.76$) identified Perceived Usefulness (PU) as the dominant predictor of Behavioural Intention ($\beta = 0.48$, 95% CI [0.25, 0.72], $p < .001$), explaining 38.2% unique variance. Attitude Toward Use ($\beta = 0.39$, $p = .002$) and Supervisor Impact ($\beta = 0.18$, $p = .043$) also significantly influenced adoption, while Perceived Ease of Use (PEOU) showed no significant relationship ($p = .401$). The large effect size ($f^2 = 0.76$) and alignment with meta-analytic TAM findings underscore the robustness of these pathways despite sample limitations.

Discussion

The study shows strong acceptance of the InRES system among MGT651 students at UiTM Pahang (mean = 4.02/5), with Perceived Usefulness (PU) rated highest (mean = 4.18). The system effectively supports topic originality, especially in helping students avoid repetitive research topics (mean = 4.25). PU was the strongest predictor of Behavioural Intention ($\beta = 0.48$, $p < .001$), indicating students value functionality over ease of use. Supervisor Impact (SI) also influenced adoption ($\beta = 0.18$, $p = .042$), with a strong correlation to PU ($r = 0.71$), showing the importance of faculty support. Students with prior research experience reported higher PU and intention to use InRES, highlighting the need for onboarding support for beginners.

CONCLUSION

InRES has proven effective in reducing topic redundancy and improving supervision in UiTM Pahang's MGT651 course. With strong student acceptance (mean = 4.02), its usefulness in identifying novel topics was especially valued. The TAM model confirmed Perceived Usefulness as the key predictor of adoption ($\beta = 0.48, p < .001$), showing students prioritize functionality. Supervisor engagement and prior research experience significantly influenced adoption, highlighting the need for faculty training and beginner support. The acceptance formula—Adoption = $0.48(\text{Usefulness}) + 0.39(\text{Attitude}) + 0.18(\text{Supervisor Support})$ —offers a framework for wider implementation. Future studies should focus on long-term impact and broader application across institutions.

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INSPECT TO INVEST: ESG-DRIVEN REAL ESTATE LEARNING

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ABSTRACT

In alignment with the global call to transform education, drive innovation, and advance lifelong learning for an empowered world, this project introduces an innovative Project-Based Learning (PBL) model that merges technical skill development with Environmental, Social, and Governance (ESG) principles in real estate education. The initiative challenges students to engage in immersive property inspection simulations—either virtual or physical—where they identify structural issues, assess sustainability performance, and develop actionable insights aligned with real-world industry standards. Through this approach, learners cultivate not only professional competencies in inspection and reporting but also critical ESG awareness—evaluating properties for energy efficiency, social inclusivity, health and safety, and regulatory compliance. The project fosters 21st-century skills, including critical thinking, ethical decision-making, and effective communication, preparing students to become responsible and adaptable professionals in a rapidly evolving global industry. Scalable, interdisciplinary, and rooted in authentic problem-solving, Inspect to Invest exemplifies how education can be transformed to empower individuals, promote innovation, and embed lifelong learning that meets the needs of both industry and society.

Keywords: Project-Based Learning, Real Estate, ESG, Scalable Learning Solution

INTRODUCTION

In response to the global call to transform education, drive innovation, and advance lifelong learning, this project introduces *Inspect to Invest*—an innovative Project-Based Learning (PBL) model designed for real estate education. According to UN DESA (2023), education and training across the life course are critical to sustainable development, reinforcing a skilled workforce that supports ESG-informed

growth and the realization of the SDGs. The initiative integrates Environmental, Social, and Governance (ESG) principles into immersive property inspection tasks, enabling students to gain not only technical knowledge but also sustainable and ethical awareness. In line with the theme *“Transforming Education, Driving Innovation, and Advancing Lifelong Learning for an Empowered World,”* this model seeks to address the disconnect between traditional curricula and industry demands for responsible, future-ready professionals. Larmer and Mergendoller (2015) stated that a well-designed PBL approach should teach “students the important content standards, concepts, and in-depth understandings that are fundamental to school subject areas and academic disciplines.” They also emphasized the importance of PBL focusing on “success skills” such as critical thinking, self-regulation, and collaboration. While ESG elements are included in the curriculum, they will enhance student skills and integrate the ESG elements during inspection. By engaging in project-based learning that addresses real-world environmental issues, students can strengthen their critical thinking and problem-solving abilities while navigating complex interdisciplinary challenges (Michel et al., 2020).

METHODOLOGY

The influence of ESG in education can be evaluated using both quantitative indicators and qualitative insights gathered from students, educators, and other stakeholders involved in ESG-driven initiatives (EY, 2022). This study will only use students’ awareness towards PBL and ESG implementation. The project employed a project-based learning approach where students participated in simulated property inspections using both physical walkthroughs and digital tools. Learners were tasked with identifying structural issues, assessing ESG performance (e.g., energy efficiency, safety compliance, social inclusivity), and preparing professional-grade inspection reports. The methodology emphasized interdisciplinary teamwork, real-world scenarios, and reflective assessment. Data was collected through surveys and reflections to evaluate engagement, skill development, and perception of ESG integration among students in the Department of Estate Management, UiTM Shah Alam. The pedagogical model was implemented with 73 undergraduate real estate students. The project involved a sequence of guided virtual and/or physical inspection activities, supported by digital walkthroughs and structured reflection tasks. Students were asked to assess properties not only for physical defects but also ESG indicators such as energy efficiency, social inclusivity, and regulatory compliance. A structured Likert-scale survey was administered post-project to assess perceptions across four domains: learning experience, skill development, technology & accessibility, and ESG awareness.

RESULT AND DISCUSSION

Preliminary findings indicate increased student engagement and improved competencies in building evaluation and reporting. Students reported enhanced understanding of ESG elements and demonstrated greater confidence in applying sustainability concepts to real estate scenarios. The virtual walkthrough tools proved effective in overcoming access barriers, particularly for students in remote areas. The model also fostered critical thinking, ethical reasoning, and collaborative skills—attributes essential for

21st-century professionals. The results support the scalability and adaptability of the PBL-ESG model across disciplines and geographic contexts.

Table 1.: Analysis of the student experience using the PBL learning

Source: Author (2025)

	N	Mean	Std Deviation
Have you taken any real estate-related subjects before?	73	.79	.407
Do you have access to a reliable internet connection for virtual learning? Learning Experience [The project-based approach made the learning experience more meaningful.]	73	1.00	.000
Learning Experience [I was actively engaged during the inspection-based activities.]	73	4.26	.553
Learning Experience [I was actively engaged during the inspection-based activities.]	73	4.16	.667
Learning Experience [The learning tasks felt relevant to real-world real estate practice.]	73	4.18	.674
Learning Experience [The learning tasks felt relevant to real-world real estate practice.]	73	3.99	.717
Learning Experience [I found it easier to understand ESG concepts through this project.]	73	4.15	.739
Learning Experience [I found it easier to understand ESG concepts through this project.]	73	4.32	.739
Learning Experience [The virtual walkthrough tools enhanced my understanding of building inspection.]	73	4.15	.664
Learning Experience [The virtual walkthrough tools enhanced my understanding of building inspection.]	73	4.26	.646
Skill Development [This learning experience improved my critical thinking.] Skill Development [I gained confidence in analyzing real estate properties.] Skill Development [I am better prepared for sustainability-oriented decision making.]	73	4.16	.727
Skill Development [This learning experience improved my critical thinking.] Skill Development [I gained confidence in analyzing real estate properties.] Skill Development [I am better prepared for sustainability-oriented decision making.]	73	4.21	.706
Skill Development [This learning experience improved my critical thinking.] Skill Development [I gained confidence in analyzing real estate properties.] Skill Development [I am better prepared for sustainability-oriented decision making.]	73	4.18	.733
Skill Development [I developed collaboration and communication skills during the project.]	73	4.14	.673
Technology & Accessibility [The digital tools used were easy to access and navigate.]	73	4.12	.781
Technology & Accessibility [The digital tools used were easy to access and navigate.]	73		
Technology & Accessibility [This model could work well even for students in remote or underserved areas.]			
Technology & Accessibility [I would prefer more courses using virtual and project-based methods.]			
Valid N (listwise)			

The survey, administered to 73 students, evaluated the impact of an innovative Project-Based Learning (PBL) approach integrated with ESG principles and virtual inspection tools in real estate education. Findings revealed strong positive responses across all dimensions.

Regarding **learning experience**, students found the project-based approach highly engaging and meaningful ($M = 4.26$), with tasks perceived as relevant to real-world real estate practice ($M = 4.18$). The integration of ESG content was effective, with students reporting improved understanding of sustainability concepts ($M = 3.99$). Additionally, the use of virtual walkthrough tools significantly enhanced their grasp of inspection processes ($M = 4.15$).

In terms of **skill development**, the PBL model improved students' critical thinking ($M = 4.32$), analytical confidence ($M = 4.26$), and preparedness for sustainability-focused decision-making ($M = 4.16$). Communication and collaboration skills were also strengthened ($M = 4.21$), aligning with key 21st-century competencies.

The project also demonstrated **technological feasibility and accessibility**, with students finding the digital tools easy to navigate ($M = 4.18$). Notably, respondents believed the model could effectively support learning in remote or underserved areas ($M = 4.14$) and expressed a preference for more courses using similar virtual and project-based methods ($M = 4.12$).

These findings validate the effectiveness and scalability of the PBL approach in enhancing technical, ethical, and sustainability-oriented competencies in real estate education.

CONCLUSION

This project demonstrates how PBL, enhanced by virtual tools and ESG-focused tasks, transforms real estate education into an inclusive, meaningful, and future-oriented learning experience. It not only equips students with technical and soft skills but also fosters ethical awareness crucial for modern property professionals. The model is scalable, adaptable, and aligned with the Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education) and SDG 11 (Sustainable Cities and Communities).

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I-SYARIAH CHECK: A DIGITAL LEARNING TOOL TO ENHANCE ETHICAL UNDERSTANDING IN ISLAMIC FINANCE EDUCATION

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ABSTRACT

In response to the growing need for practical financial ethics education, especially in Islamic finance, i-Syariah Check is introduced as an interactive mobile application to support teaching and learning among students in Malaysia. This innovation serves as a digital learning tool that enables students to explore and evaluate the ethical compliance of Syariah-based financial products. By integrating real-world data, Fatwa rulings, and Syariah advisory input, the app allows users to simulate financial product assessments using ethical parameters such as the avoidance of riba (interest), gharar (uncertainty), and non-halal investments. In a classroom context, i-Syariah Check encourages critical thinking through case-based learning, promotes ethical awareness, and supports active student engagement in financial literacy topics. Educators can incorporate the app into lesson plans, group activities, or assessment tasks to bridge theory and real-life application of Syariah principles. This teaching innovation not only enhances students' understanding of Islamic finance but also nurtures responsible decision-making in line with Syariah values. It aligns with the national education goal to strengthen applied knowledge and ethical competence in higher learning institutions.

Keywords: *Islamic finance education, syariah compliance, mobile learning tool, riba, gharar*

INTRODUCTION

The increasing complexity of global financial systems and the rapid growth of Islamic finance have highlighted a significant gap in practical financial ethics education, particularly among students in Malaysia. Despite Malaysia's position as a leading hub for Islamic finance, there remains a pressing need to bridge theoretical knowledge with real-world application, especially in understanding ethical compliance rooted in Syariah principles. Traditional educational approaches often lack interactive and experiential components, making it challenging for students to critically assess financial products in

line with Islamic ethical standards such as the avoidance of *riba* (interest), *gharar* (uncertainty), and non-halal investments. Recent studies, as stated by Muna Azuddin, et al. (2025), emphasize that integrating technology and innovative digital platforms into Islamic finance education can enhance accessibility, engagement, and ethical competence among learners, yet the availability of such interactive tools remains limited.

To address this educational gap, the i-Syariah Check mobile application has been introduced as an innovative digital learning tool designed to support teaching and learning in Islamic finance. By incorporating real-world data, Fatwa rulings, and Syariah advisory input, the app enables students to simulate the ethical evaluation of Syariah-based financial products. This interactive approach encourages critical thinking, ethical awareness, and active engagement through case-based learning and practical assessments. Educators can seamlessly integrate i-Syariah Check into lesson plans, group activities, and assessment tasks, thereby fostering responsible decision-making and strengthening applied knowledge in line with national educational goals. There is an article stated by Nor Halida Haziaton Mohd Noor, et al. (2023) proves which the adoption of such technology-driven solutions align with recent advancements in educational technology, which have been shown to significantly improve learning outcomes and support the development of ethical and financial literacy in Islamic finance education.

METHODOLOGY

This research study used qualitative methods to examine perceptions and acceptance of i-Syariah Check among finance students. A total of 127 respondents from higher education institutions in Malaysia responded to a survey, using Google Forms. The questionnaire consisted of structured (for demographic data) and open-ended items. It was designed to ascertain students' challenges when learning Islamic finance, the degree of interest in the app, and the likelihood of the students recommending the app as a learning tool.

The students' responses were analyzed descriptively using frequencies, percentages, and thematic analysis of open ended responses. Important indicators, including awareness of Islamic finance principles, degree of excitement about interactive tools and usefulness were analyzed relative to understanding the impact and market readiness of the app, i-Syariah Check.

RESULT AND DISCUSSION

In total, 127 students completed the survey, and most students emphasized that the lack of practical tools was the most significant impediment to understanding Islamic finance. This was due to limited knowledge about the principles of Islamic finance (51.18% of respondents) and a lack of completely digital tools (48.82%).

The students were asked if they would be interested in using i-Syariah Check, and 94.49% (120 students) answered interested or very interested in using the application. Furthermore, 74.80% (95

students) stated they would recommend the application to fellow students, confirming their perception of the application as an effective practical learning tool.

Thus, students have a strong inclination toward digital, interactive tools in their academic work. i-Syariah Check promotes critical thinking and conscientious decision-making towards Syariah standards by integrating authentic ethical dilemmas. Students' strong reception towards i-Syariah Check provides solid evidence for its future applicability to wider academic and professional training programs in Islamic finance.

Table 1.: Summary of Survey Finding

Survey Element	Result
Total Respondents	127 respondents
Lack of knowledge about Islamic finance	65 respondents (51.18%)
Lack of digital tools	62 respondents (48.82%)
Interested or very interested in using i-Syariah Check	120 respondents (94.49%)
Not interested in i-Syariah Check	7 respondents (5.51%)
Would recommend i-Syariah Check	95 respondents (74.80%)

CONCLUSION

i-Syariah Check confronts the urgent demand for functional and ethically designed learning tools for education in Islamic finance. It offers a platform that is interactive and simulated and bridges theoretical knowledge and practical knowledge. i-Syariah Check has generated strong interest, with 94.49% of students agreeing when surveyed, and 74.80% recommended use. With interest from students, we have documented that i-Syariah Check has the potential to change future Islamic finance education in Malaysia. The app would help to develop critical thinking, ethical thinking, and applied competence, where first-year finance students in Malaysia will be professionally trained as potential finance professionals with knowledge of Syariah compliance, become ethically minded, and become mindful, responsible decision makers.

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KYSS: KNOW YOUR STORY STRUCTURE

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ABSTRACT

UNESCO Institute of Statistics reported that Malaysia literacy rate stands at almost 95%. Despite the strong literacy presence, local academics are deeply concerned about the lack of a reading culture. As a result, students often struggle to narrate stories effectively and face difficulties in structuring ideas in writing. To bridge the gap between these challenges and the mechanistic writing instruction commonly practiced in writing classes, KYSS (Know Your Story Structure) has been developed as an innovative teaching and learning tool. It aims to sharpen students' skills in structuring narratives with purpose. This innovation enables students to identify the four types of narrative structures- linear, circular, parallel, and flashback -through an interactive gameplay experience. With each turn, participants draw upon their writing knowledge to identify story structures while actively listen to their peers. The unique blend of linguistic challenges and engaging activities provides a fresh and dynamic experience, allowing students to refine their listening and writing skills while strategizing to outsmart their opponents. KYSS benefits language teachers by diversifying their teaching methods and enriching their writing class materials. Students also gain a significant advantage as they learn to structure narratives effectively in an enjoyable and interactive way. This innovation holds immense potential for commercialization as it fulfills the learners' needs that the market has yet to offer.

Keywords: language game, writing skills, narrative structure, teaching tool

INTRODUCTION

Writing Process

Writing is an important skill in English. It involves expression of thoughts, ideas, information, or stories in written form. While the writing process is described differently among scholars, it is generally known to involve four main stages namely 1) Planning, 2) Drafting, 3) Revising and 4) Editing, (Seow, 2002). However, writing is rarely a straightforward, linear process. When writing,

writers often revisit prior stages and rewrites the essay. This is in line with Krashen (1984); ‘many good writers employ a recursive, non-linear approach-writing of a draft may be interrupted by more planning, and revision may lead to reformulation, with a great deal of recycling to earlier stages’.

Thus, it is imperative that students should be exposed to the writing process. The recursive process of writing could be a challenge for students. Challenges may arise stemming from the writers’ own lack of language proficiency (D Rohayu et. al, 2023), L1 interference (Nur Amalina & Hanita Hanim, 2021), and motivation (Tessem 2005), among others. Their essays may suffer from lack of clarity, no definitive structure, grammar mistakes and lack of cohesiveness if they are not exposed to continuous practice throughout each stage of the writing process.

Teaching Narrative Writing to Undergraduates

Although challenges in the writing process exist, proper use of writing strategies may mitigate the effects. One of the strategies is teaching students narrative writing. Teaching narrative writing to L2 undergraduates presents both distinct challenges and valuable opportunities. It provides a chance to enhance linguistic fluency, encourage personal expression, and foster cross-cultural awareness. Through storytelling, students can connect their personal experiences with language learning, leading to deeper engagement and improved communicative competence. However, a significant challenge lies in limited vocabulary and grammatical range, which can restrict students’ ability to convey complex ideas or emotions. Additionally, coherence and sequencing often pose difficulties, particularly when students are unfamiliar with common narrative structures (Lu & Pan, 2024). Even with strong creative ideas, learners frequently require guidance to organize their thoughts within a clear and effective structural framework that successfully engages readers (Kihlstedt & Izquierdo, 2021).

The KYSS (Know Your Story Structure) card game can support students in overcoming these challenges by helping them recognize and formulate ideas using key narrative structures—circular, linear, parallel, and flashback—through repeated exposure in an engaging format. By encouraging inference-making, vocabulary development, and structural awareness across multiple genres, KYSS enhances students’ ability to craft coherent and compelling narratives in their own writing.

Narrative Writing Structure

Narrative structure outlines the method by which a story is developed and conveyed. It is crafted to help the writer develop the story’s progression effectively. Although many narratives include an introduction, development, and ending, creating a powerful story often involves more nuance. Talented writers arrange content by deliberately following certain structures to maintain interest and momentum. Narrative structures vary, including linear, which presents events in chronological order; circular, which returns to the story’s starting point; parallel, which unfolds multiple storylines simultaneously; and flashback, which interrupts the timeline to reveal past events, each shaping the story’s flow and meaning in distinct ways. This thoughtful organisation draws readers in and sustains their engagement throughout the piece.

To support learners in recognizing and applying these structures, the KYSS game includes 20 story cards across five themes—romance, humor, mystery, adventure, and fantasy—with each theme represented in all four structures. Each card contains a short story designed to highlight the defining

features of its structure, encouraging players to analyze narrative elements and infer patterns in an interactive format.

INNOVATION OBJECTIVES:

1. To identify students' ability to recognize and distinguish between three narrative structures; linear, circular, and parallel through the KYSS card game.
2. To evaluate the extent to which students improve their listening and writing skills after participating in the KYSS card game.

METHODOLOGY

This study proposes the use of a custom-designed card game to enhance the ability to identify and narrate stories from four different types of story structures. KYSS, a card game, will be introduced among undergraduate students of UiTM Cawangan Johor, Kampus Pasir Gudang for two weeks during English classes.

KYSS is a card game that helps players practice identifying different types of story structures—circular, linear, parallel, and flashback—while also making inferences and building vocabulary and story comprehension skills. The game includes 20 cards, based on five themes: romance, humor, mystery, adventure, and fantasy. Each theme includes one card for each of the four story structures. This means that across the deck, each narrative structure appears once per theme (Figure 1).

To play (Figure 2), the cards will be shuffled and dealt evenly to all players. On each turn, a player reads a short story from one of their cards. The other players must listen carefully and infer which structure the story represents. If someone guesses correctly, they can ask for a card with that structure to help complete their set. The goal is to collect one card of each theme that shares the same structure. The first player to collect all four cards of the same structure wins.

A pre-test and post-test will be administered to measure students' ability to recognize and distinguish between linear, circular, and parallel narrative structures, as well as to assess improvements in their listening and writing skills. Additionally, a student feedback form will be distributed to gauge their engagement with the KYSS card game and its perceived usefulness in enhancing narrative understanding. The data collected will be analysed descriptively to evaluate the effectiveness of the innovation. Although implementation has not yet taken place, this proposed methodology outlines the framework for future validation.

HOW TO PLAY KYSS

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graph LR; A((1. Shuffle all cards)) --> B((2. Read the cards)); B --> C((3. Guess the cards)); C --> D((4. Complete all sets)); D --> E((5. Winning the game))
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- Shuffle all cards**
Each team will get equal number of cards.
- Read the cards**
One team reads a card aloud,
- Guess the cards**
The other teams listen and guess the story structure.
- Complete all sets**
Complete all sets of cards (according to its story structure) by listening carefully.
- Winning the game**
The team with the most sets of cards collected wins!

309

RESULTS AND DISCUSSION

Findings from Dimailig et.al, (2024) suggest that narrative structure is important for organizing a literary work, acting as its backbone and helping readers understand the story more clearly. Utilizing the KYSS deck in class offers several educational benefits. By engaging with different storytelling frameworks, students can better understand various narrative structures. The range of themes in the deck can also encourage creativity and increase motivation in writing. Additionally, pairing themes with specific narrative structures can help students see how these patterns affect story development and coherence. This supports Sirhajwan's (2016) findings that skilled ESL writers focus on developing ideas during the pre-writing phase by using particular structures to expand their thoughts.

The KYSS game creates opportunities for students to explore narrative styles in an interactive and reflective way, which promotes deeper comprehension of how stories are built. Through collaborative guessing and analysis, learners become more attuned to how plot elements function within a specific structure. This not only strengthens their analytical skills but also nurtures cooperative learning in the classroom. Overall, these approaches may improve narrative organization, writing skills, and encourage collaborative learning. When students practice activities that improve their thinking skills, they are better able to overcome weak thinking strategies that might limit their ability to create and develop ideas (Sirhajwan, 2016).

CONCLUSION

In conclusion, this study outlines the ideas and development of KYSS, an innovative card game aimed at enhancing students' narrative comprehension. By integrating listening, inference, and storytelling in an interactive and engaging gameplay, KYSS helps students to identify and recognize key features of various narrative structures. This proposed card game holds significant implications for both students and English teachers. For students, they benefit in the language learning process through a fun and joyful approach, which promotes their active participation and critical listening skills. This approach is an alternative to traditional listening and writing lessons, where students are not immersed in the learning process. KYSS offers an attempt for students to reapply the game in writing classes by copying the narrative structure they have learnt while playing it. For teachers/educators, KYSS provides a versatile tool that facilitates the teaching of narrative structures in an engaging and interactive way. This card game can be viewed as another classroom strategy to encourage educators to adopt more interactive pedagogy, aligned with current technology trends in learning English. Additionally, the ideas and concepts of KYSS can be adapted and expanded for other language learning objectives, as an alternative resource in the English language classroom. Overall, KYSS helps streamline lesson planning and fosters a dynamic classroom environment focused on collaborative learning and critical thinking.

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LAB SAFETY REIMAGINED: BRIDGING THEORY AND PRACTICE THROUGH TASK-BASED ASSESSMENT

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ABSTRACT

Preservice science teachers often struggle to understand and apply the HIRARC framework (Hazard Identification, Risk Assessment, and Risk Control) because traditional teaching focuses heavily on theory with limited real-life laboratory practice. This gap hinders their ability to apply safety concepts effectively. This innovation presents a task-based assessment framework that engages students in authentic problem-solving by addressing safety gaps in a newly relocated laboratory without formal safety protocols. The initiative is packaged into a teaching pack containing project guidelines, assessment rubrics, tasks, and sample outputs. Students worked in groups for one month to tackle real laboratory safety issues. They collaborated with the lab assistant and coordinator to ensure practical and relevant solutions. Tasks included creating safety posters, drafting lab rules and regulations, labelling equipment and chemicals, developing inventory systems, writing standard operating procedures, and compiling a comprehensive safety manual. Outputs were showcased and evaluated during the Occupational Safety and Health (OSH) Day. Students showed improvement in understanding and applying HIRARC principles, and their work contributed directly to long-term improvements in lab safety infrastructure. This task-based approach bridges theory and practice, encouraging meaningful, ethical problem-solving. It aligns with values-based education principles such as responsibility, integrity, collaboration, and sustainability, while developing key competencies in critical thinking, problem solving, and teamwork. Several student-produced materials are now in active use, forming part of the lab's permanent safety system. This scalable model offers a practical and sustainable strategy for embedding scientific safety skills in teacher education.

Keywords: HIRARC, Laboratory safety, Task-based assessment, Collaborative learning

INTRODUCTION

Laboratory safety is a critical component in science education, especially for preservice teachers who will be responsible for conducting practical sessions in schools. However, numerous studies indicate that science teacher education often emphasizes theoretical knowledge, with minimal opportunities for applying safety concepts in authentic laboratory contexts (Gericke et al., 2023; Hussein et al., 2022). In Malaysia, safety-related incidents continue to occur in school laboratories due to gaps in safety awareness, inadequate training, and the lack of structured risk assessment practices such as HIRARC (Hazard Identification, Risk Assessment, and Risk Control). While the HIRARC framework is widely adopted in industrial and higher education contexts, its application in school-level science laboratories remains underexplored and inconsistently practiced (Edmondson et al., 2016).

To address this gap, this study introduces a task-based assessment model (HIRARC Project) designed to help preservice science teachers apply the HIRARC framework through real-life laboratory safety challenges. By embedding safety tasks into a final project and packaging them into a structured teaching pack—including guidelines, rubrics, and sample outputs—this innovation aims to bridge the gap between theory and practice. It also seeks to cultivate values-based competencies such as responsibility, integrity, and collaboration, in line with Education for Sustainable Development (ESD) and Sustainable Development Goals (SDG 3 & SDG 4). The main objective is to assess students' practical understanding of safety principles while contributing sustainable safety resources to the institutional lab infrastructure.

This innovation is grounded in the principles of experiential learning theory, where knowledge is constructed through meaningful, real-world experiences (Kolb, 1984). By engaging students in solving actual safety problems, the project embodies the "learning by doing" approach, encouraging active exploration, reflection, and application. It also draws on inquiry-based learning, where students investigate safety issues, consult relevant stakeholders, and co-construct solutions—mirroring the practices of professional educators and lab managers. The assessment structure follows a backward design model, beginning with the desired learning outcomes (understanding and applying HIRARC), then designing authentic tasks and rubrics aligned with those goals. These pedagogical foundations support the integration of Education for Sustainable Development (ESD) and the development of future-ready, values-driven science teachers.

METHODS

This innovation was carried out as the final assessment project for the *Science Laboratory Safety (SCE513)* course, involving 134 preservice science teachers from the Faculty of Education, Universiti Teknologi MARA. The project aimed to equip future science teachers with practical competencies in applying the HIRARC framework (Hazard Identification, Risk Assessment, and Risk Control) by addressing real safety challenges in a newly relocated laboratory that lacked formal safety protocols.

Students were organised into small groups and provided with a task-based teaching pack containing

project guidelines, real lab safety issues, assessment rubrics, and examples of expected outputs. The project ran over two months. In the initial phase, students conducted brainstorming sessions to analyse and discuss potential safety interventions based on HIRARC principles. These ideas were first presented to the course lecturer for verification in terms of relevance, educational value, and technical feasibility.

Once verified, students engaged in consultation sessions with the laboratory assistant and lab coordinator to refine their solutions and ensure that all outputs were practical, accurate, and implementable in the actual lab setting. The final products such as safety posters, SOPs, lab rules, chemical labels, inventory systems, and manuals were required to be fully functional and ready for use.

The culmination of the project was a formal presentation during the faculty's Occupational Safety and Health (OSH) Day. Here, student groups presented their products to a panel of evaluators comprising science education lecturers, science and technology experts, and industry representatives. During this session, students were required to explain how the HIRARC framework was embedded in their products, demonstrate the practicality and potential impact, and justify the quality and usability of their outputs based on real laboratory needs.

RESULTS AND DISCUSSION

The implementation of the task-based assessment significantly improved students' understanding and application of the HIRARC framework. As shown in figure 1, the pre- and post-assessment data showed a marked increase in mean scores across all three components: Hazard Identification, Risk Assessment, and Risk Control. Before the project, students demonstrated moderate understanding, with mean scores ranging between 2.0 to 2.5 on a 5-point scale. After completing the project, mean scores increased to approximately 4.5, indicating a high level of conceptual understanding and practical competence.

The integration of real-life safety problems encouraged students to actively engage in critical thinking, teamwork, and ethical decision-making—core competencies in Education for Sustainable Development (ESD). Through collaboration with lab assistants and coordinators, students were exposed to real-world expectations, enhancing both the relevance and impact of their work. Outputs such as SOPs, safety posters, inventory systems, and user friendly safety manuals are now actively used in the faculty laboratory, contributing to a safer and more structured working environment.

During the OSH Day evaluation, student groups were able to present how HIRARC principles guided their solutions clearly. They demonstrated not only technical understanding but also the educational and institutional value of their outputs. Evaluators from science education, technology, and industry backgrounds commended the students for producing functional, high-quality, and sustainable safety resources. These findings affirm the effectiveness of task-based assessments in bridging the gap between theoretical instruction and real-world application, while promoting values-based, future-ready science educators. Figure 2 shows some of the products of the HIRARC Project and the evaluation day, OSH Day.

The substantial improvement in student understanding and application of the HIRARC framework mirrors findings from recent research investigating preservice science teachers' laboratory safety knowledge. For instance, Bilen (2025) reported that while many preservice teachers could select correct answers on safety scenarios, they frequently failed to justify their choices accurately, indicating a gap between theoretical awareness and deep conceptual understanding. HIRARC Project intervention goes beyond mere recognition as it mandates authentic task-based application, cognitive reflection, and stakeholder consultation, resulting in both improved comprehension and student-generated safety outputs.

In contrast, prior studies on professional development in laboratory settings, such as traditional apprenticeship models (Brown & Melear, 2007), focus primarily on knowledge acquisition without translating into enduring institutional change. Unlike these models, HIRARC project ensures that outputs are not only assessed but deployed in the faculty laboratory, thereby providing tangible infrastructure improvement. This dual impact—on both student learning and institutional safety—enhances the innovation's scalability and sustainability, aligning strongly with ESD principles and SDG 3 & 4.

What sets this innovation apart from conventional project-based assessments is its structured integration of real world consultation and institutional implementation. Students not only solve authentic safety issues in an unsystematized laboratory but also engage in multiple levels of stakeholder consultation, including subject lecturers, laboratory assistants, and lab coordinators. Furthermore, the final products are formally presented to evaluators from academia and industry during OSH Day, ensuring external validation. Unlike typical classroom projects, the outputs are required to be fully functional and ready for real use, many of which are now actively implemented as part of the faculty's lab safety infrastructure.

This innovation demonstrates strong potential for commercialisation and scalability beyond its original implementation. The task-based teaching pack comprising project guidelines, rubrics, sample outputs, and real safety problems situations, can be adapted into a modular training kit for use in teacher education institutes (IPGs), universities, STEM-based schools, and professional development programs. Future developments may include transforming the teaching pack into interactive digital modules, e-learning micro-credentials, or printed lab safety kits complete with SOP posters and student-friendly manuals. Plans are also underway to explore copyright and intellectual property protection, enabling broader dissemination and potential licensing for use in national-level science safety training and teacher induction programs.

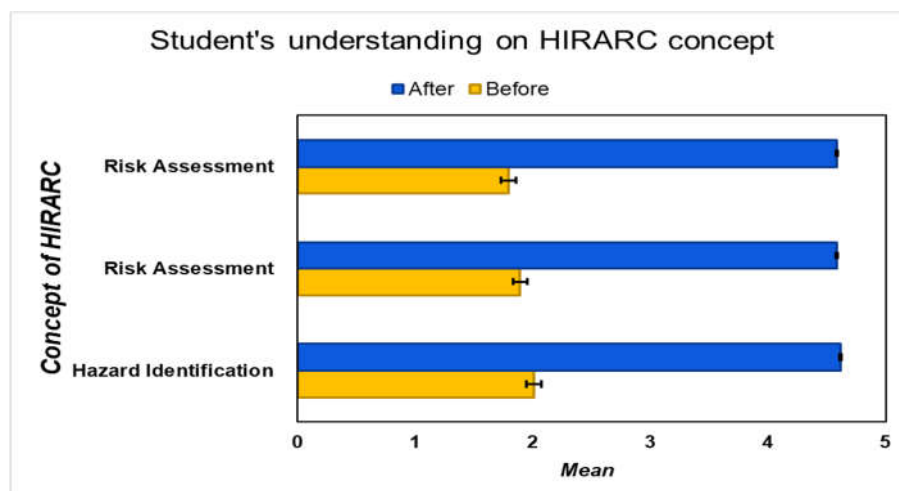


Figure 1.: Comparison of students understanding on HIRARC concept before and after HIRARC Project



Figure 2.: HIRARC Project presentation during OSH Day. (A) and (B) Students showing their product, (C) Presentation evaluation OSH Day, (E), (F) and (G) Products from HIRARC Project

CONCLUSION

This project successfully bridges the gap between theory and practice by enabling preservice science teachers to apply the HIRARC framework through real-life laboratory safety challenges. It not only enhances students' understanding and professional readiness but also produces sustainable safety resources that support institutional needs. Aligned with Education for Sustainable Development (ESD) and Sustainable Development Goals (SDG 3 & 4), this task-based assessment model offers a scalable and practical approach to nurturing responsible, future ready science educators.

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LEARN & LEAD STUDY LOG: INNOVATIVE PEDAGOGIES IN MANAGEMENT ACCOUNTING

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ABSTRACT

Today's students learn and engage differently than in the past; they're more accustomed to quick-paced content like YouTube video tutorials and memes rather than traditional academic content, making lecture formats seem outdated. This phenomenon has led to an ongoing dilemma about how educators can curate learning experiences that impart technical competence and foster critical thinking, engagement and adaptability. Learn & Lead is a study log whose main objective is to compile and showcase some innovative teaching methodologies practiced in the management accounting and control courses. These methods deepen conceptual understanding, enhance student engagement, and bridge the gap between theory and practice. It is everyone's collective commitment when it comes to creating a joyful and engaging learning experience, even though students may have diverse perspectives and preferences. By collaborating, we can make learning a more engaging and fulfilling educational experience for everyone involved. Learn & Lead study log includes project-based learning, team teaching, technology-enhanced learning, peer review, collaborative teaching with industry professionals, and a digital flipbook. The array of teaching modalities contributes to improving student engagement and critical thinking, enhancing knowledge retention, and supporting effective collaborative teaching methods in addressing today's generation's expectations in the evolving world of AI. The innovative approaches mentioned above, integrated with technology, revolutionise accounting education. It is worth noting that various teaching and learning methods are crucial in preparing future accounting professionals to thrive in a modern and dynamic work environment.

Keywords: *Technology-enhanced learning, Project-based learning, Team teaching, Collaborative teaching, Digital flipbook*

INTRODUCTION

Learn & Lead Study Log is an educational innovation designed to enhance teaching and learning experiences in management accounting through a structured compilation of progressive pedagogical approaches. It serves as both a reflective and practical tool that documents innovative strategies such as project-based learning, team teaching, technology-enhanced instruction, peer feedback, and industry collaboration aimed to foster deeper conceptual understanding, student engagement, and real-world application. By bridging theory with practice and integrating digital, Learn & Lead promotes a dynamic, student-centred learning environment aligned with the expectations of today's learners and the demands of a rapidly evolving professional landscape.

BACKGROUND OF EDUCATIONAL INNOVATION

For the past few years, many students on the Management Accounting and Control (MAF551) course have found it difficult to achieve excellent results. Although most students understood the topics taught, they struggled to apply their knowledge effectively during assessments. One common problem was that students did not know how to structure their answers in a way that would help them score high marks.

This challenge highlighted the need to improve how the course is being taught. Traditional lectures were no longer enough to fully engage students or help them think critically and apply what they learned. Thus, we created the Learn & Lead Study Log which is an educational project that brings together several innovative teaching methods. These include team teaching, project-based learning, peer review, digital tools, and collaboration with industry professionals. By using a variety of approaches, this innovation aims to make learning more effective, engaging, and relevant for students, while also preparing them for real-world challenges in the accounting field.

The Learn & Lead Study Log educational innovation project was developed to address persistent challenges in student performance and engagement in the MAF551 Management Accounting and Control course. At its core, the initiative aims to enhance students' ability to apply theoretical knowledge in real-world contexts by integrating project-based learning and case studies, thereby strengthening their critical thinking, problem-solving, and professional communication skills. To boost motivation and engagement, the project incorporates dynamic teaching strategies such as team teaching, peer review, and flipped classroom models that encourage interactive and participatory learning aligned with students' digital learning habits. Furthermore, the project seeks to bridge the gap between academic theory and industry practice by involving industry professionals in collaborative teaching sessions, allowing students to contextualise abstract accounting concepts through real-world examples and develop industry-relevant competencies. It also promotes collaborative teaching and continuous professional development among educators through the team-teaching model, which fosters reflective practice, knowledge sharing, and pedagogical co-creation. In addition, the development of a digital flipbook introduces a flexible, accessible, and sustainable learning tool that supports timely content updates and interactive engagement beyond printed materials. Finally, by embedding structured peer review and feedback mechanisms, the project fosters student autonomy and encourages reflective

learning, empowering students to monitor their progress and contribute meaningfully to their peers' understanding.

TEACHING AND LEARNING PEDAGOGIES

The Project-based Learning (PBL)

The PBL component, implemented through student case study analysis, is a core activity each semester aimed at deepening engagement and practical comprehension. Students are provided with a case study approximately 10 pages long to assess their problem-solving skills, application of relevant theories, written communication, and originality. This exercise moves beyond basic scenario analysis and calculations, challenging students to produce corporate-style memos, email drafts, and presentation notes like those expected in professional consultancy settings. The approach is designed to cultivate a professional mindset and better equip students for real-world workplace demands.

Team Teaching/Collaborative Teaching

Team teaching has been widely recognised for its pedagogical value, allowing educators to combine their expertise to introduce varied perspectives and innovative teaching methods (Malak & Gambescia, 2023). Such collaboration enriches course delivery and content while fostering professional growth through ongoing feedback and reflective dialogue (Ito & Lim, 2025). Reflecting this approach, lecturers from UiTM Puncak Alam conducted five online collaborative teaching sessions in the previous semester, which engaged close to two hundred students. These sessions significantly supported students' comprehension of management accounting and control. At the conclusion of each session, students completed a feedback form and a short quiz, with the most offering positive evaluations and demonstrating strong understanding through their quiz responses.

Technology-Enhanced Learning

Technology-enhanced learning through digital platforms plays a key role in supporting assessment within collaborative activities. It also enables flipped classroom models, allowing students to engage with materials in advance and arrive better prepared to apply accounting concepts in class (Zheng et al., 2020). Digital tools such as virtual campuses and Web 4.0 technologies have significantly reshaped accounting education by increasing student engagement and supporting continuous learning (Fernández Araya, S. Ortiz-Vidal et al., 2024; Immonen & Kinnunen, 2015; Venter et al., 2022). Moreover, blended learning which combines in-person teaching with digital instruction aids the development of practical, skills-based competencies (Hernández & Buitrago, 2018). For the Management Accounting and Control course, educators employ platforms like Google Classroom, Padlet, and UFuture to share materials. These platforms offer robust features, including content delivery, storage, online assessments, discussion forums, and tracking tools to enhance teaching and learning.

Gamification is also integrated into the learning process through platforms such as Kahoot! And Slido. By incorporating elements like points, badges, leaderboards, and challenges, lessons become more

engaging and immersive. These game-based features enhance student motivation by making learning goal-oriented and enjoyable, while also promoting active learning through interactive tasks such as quizzes and simulations. This approach encourages participation and improves knowledge retention.

Peer Review

Peer review processes, where students evaluate one another's work, enhance information literacy, social interaction, and critical evaluation skills (Pollock et al., 2023). At the campus level, this method ensures comprehensive group learning by accommodating diverse learning styles and problem-solving approaches. Through knowledge exchange and collaborative discussions, students gain a deeper understanding of course content. Additionally, evaluating tutorial sessions and providing feedback fosters reflection and improves learning outcomes by clarifying misconceptions and broadening perspectives.

Future plans to be incorporated

Digital Flipbook

The educators of the MAF551 course propose launching a digital flipbook as a practical learning toolkit, integrating interactive elements to enhance student engagement, comprehension, and the overall benefits of e-learning (Vonti et al., 2023). In previous semesters, a hardcopy study guide prepared by UiTM Puncak Alam lecturers helped students organise key information from textbooks, lectures, and notes. It includes summaries, definitions of key terms, and practice questions to promote active learning and conceptual clarity. However, the pandemic and the need for timely content updates highlighted the limitations of printed materials. A digital flipbook addresses these concerns by allowing continuous revisions and easy distribution across platforms such as email and social media. Accessible on various devices without the need for specialised software, it also offers a more sustainable and cost-effective alternative to traditional printed guides.

Collaborative Teaching Featuring Industry Professionals

To enhance classroom relevance, collaborative teaching can incorporate industry professionals to share their expertise and real-world experiences. Research shows that both students and educators respond positively to this approach, as it enriches classroom learning and deepens understanding of complex accounting concepts (Lehmann & Schwarzkopf, 2022). This highlights the need for interdisciplinary collaboration in accounting education to meet the evolving demands of the global business landscape. In line with this, a new initiative has been introduced for the upcoming semester to connect academic content with industry practices, specifically focusing on transfer pricing principles and applications. As part of this initiative, professionals from audit firms will be invited to engage students through talks and discussions on current topics in Management Accounting and Control (MAF551). These sessions aim to clarify challenging course content through real-world examples and offer students the opportunity to ask targeted questions, ultimately supporting more meaningful learning outcomes.

PRACTICAL CONTRIBUTIONS

The Learn & Lead Study Log has shown improvements in both student learning outcomes and teaching practices. Students have shown clearer understanding and stronger application of management accounting concepts in assessments, with more structured and higher-quality responses observed in their coursework. The use of project-based learning, peer review, and industry collaboration has not only deepened conceptual understanding but also improved students' professional communication and problem-solving skills.

Interactive and technology-enhanced teaching methods have increased student engagement, making learning more motivating and participatory. At the same time, the collaborative teaching approach specifically through team teaching and expert-led sessions has enriched lecturers' instructional delivery by breaking down teaching silos and fostering knowledge sharing.

Importantly, the project addresses the evolving learning preferences of today's digital-native students by integrating digital tools such as a flexible, accessible flipbook. This shift towards student-centred, tech-enabled instruction ensures that the curriculum remains relevant, dynamic, and aligned with industry needs, ultimately preparing accounting graduates for the demands of a modern and fast changing professional environment.

CONCLUSION

In conclusion, the diverse teaching approaches enhance student engagement, foster critical thinking, improve knowledge retention, and promote effective collaboration. This is imperative to align well with the expectations of today's learners in an AI-driven era. These innovative and technology-integrated strategies are transforming accounting education, equipping future professionals with the skills needed to succeed in a rapidly evolving business environment.

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LINGOLAND: THE ACADEMIC QUEST

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ABSTRACT

This study introduces LingoLand: The Academic Quest, a board game that is designed to assist in the development of Academic English skills among undergraduate learners at a public university in Perak. The game incorporates key language domains such as grammar, vocabulary, speaking, writing, and cultural awareness within a gamified framework that initiates collaborative learning and active participation among the students. Players engage in meaningful language tasks that enhance fluency, accuracy, and critical thinking by passing through thematic zones and skill-targeted challenges. The flexible design accommodates physical play, making it adaptable to be played by students in class. Preliminary classroom implementation suggests that LingoLand effectively motivates learners and fosters peer interaction, providing a novel and scalable approach to academic language acquisition.

Keywords: board game, gamified framework, language acquisition

INTRODUCTION

Academic English proficiency is a critical component of success in higher education, particularly for undergraduate students who are preparing to participate in global academic discourse. It encompasses a broad range of language competencies, including the mastery of academic vocabulary, grammatical structures, speaking fluency, writing clarity, reading comprehension, and cultural literacy. These skills are essential not only for academic performance, such as engaging in class discussions, writing essays, and understanding scholarly texts, but also for future professional and research pursuits.

Despite its importance, the teaching and learning of Academic English often remain constrained by traditional pedagogical methods. Such approaches typically emphasize rote memorization, grammar exercises, and decontextualized tasks, which may lead to passive learning and limited student engagement. These methods often fail to address the integrative nature of language skills and do not adequately support learners in applying their knowledge to real-world academic contexts. Moreover, many students struggle with motivation and confidence when learning academic English, particularly in settings that lack interactivity and peer collaboration.

To address these challenges, recent research has highlighted the potential of gamification and collaborative learning as innovative strategies in language education. Gamification involves the

application of game design elements such as competition, rewards, and progress tracking—in non-game contexts to increase learner motivation and engagement. When paired with collaborative learning, which emphasizes teamwork, peer communication, and shared problem-solving, these methods can create a more dynamic and supportive learning environment. Together, they provide an opportunity to shift from passive to active learning, encouraging students to take ownership of their progress while practicing language in meaningful, contextualized ways.

In response to this pedagogical need, the present study introduces LingoLand: The Academic Quest, an original educational board game developed to support undergraduate students in acquiring and practicing Academic English. The game integrates key language domains like vocabulary, grammar, speaking, writing, and cultural awareness through a series of themed challenges and activities designed to promote critical thinking and authentic language use. Players navigate a quest-like journey in which they complete tasks collaboratively or competitively, simulating academic scenarios that require the application of multiple language skills.

Notably, LingoLand is available in both physical and digital formats, making it highly adaptable to a range of instructional settings, including face-to-face, hybrid, and online learning environments. Its modular design allows educators to tailor content to meet specific curricular goals and student proficiency levels, further enhancing its practicality and relevance.

This study investigates the effectiveness of LingoLand in improving Academic English proficiency through a mixed-methods approach. Quantitative measures assess gains in vocabulary knowledge, grammar accuracy, and speaking fluency, while qualitative data explore learners' motivation, engagement, and peer interaction. By examining both performance outcomes and student experiences, this research contributes to the growing body of evidence supporting gamified, collaborative learning as a viable and impactful method for Academic English instruction.

METHODS

This study employed a mixed-methods research design to evaluate the effectiveness of LingoLand: The Academic Quest in enhancing academic English proficiency among undergraduate students. The integration of both quantitative and qualitative methods allowed for a comprehensive analysis of language skill development, learner motivation, and engagement.

A convergent parallel design was used, in which quantitative and qualitative data were collected simultaneously and analyzed independently before being integrated during interpretation. This approach enabled the triangulation of findings, enhancing the reliability and depth of the results.

The study involved 40 undergraduate students enrolled in an academic English course at a Malaysian public university. Participants were selected through purposive sampling to ensure they had similar academic backgrounds and language proficiency levels (intermediate to upper-intermediate). Students were divided into groups of 2 to 4 players and participated in weekly game sessions over a six-week period. Participation was voluntary, and informed consent was obtained from all students.

The primary instructional tool was LingoLand: The Academic Quest, a custom-designed educational board game available in both physical and digital formats. The game consisted of five thematic zones: Vocabulary Valley, Grammar Grove, Debate Desert, Essay Island, and Culture Cliffs. Each zone featured interactive tasks targeting specific academic English skills. Supplementary materials included printed instructions, digital access guides, and tracking sheets for task completion and scoring. The study was conducted over six consecutive weeks during the academic semester. At the beginning of the intervention, students completed pre-tests that assessed vocabulary knowledge, grammar accuracy, and speaking fluency. These assessments were designed based on course-aligned learning outcomes and rubrics approved by language lecturers.

Each week, students participated in one 90-minute gameplay session facilitated by the course instructor. Tasks within the game required students to collaborate on writing prompts, complete grammar puzzles, engage in academic discussions, and respond to culturally themed questions. Peer feedback and in-game rewards were incorporated to maintain motivation and accountability.

At the end of the intervention, students completed post-tests using the same instruments administered at the beginning of the study. In addition, students completed a survey questionnaire and participated in focus group interviews to gather qualitative insights into their motivation, engagement levels, and perceptions of the learning experience. Classroom observations were also conducted by the instructor using a standardized observation checklist to document interactions, language use, and collaborative behaviors.

Quantitative data from pre- and post-tests were analyzed using paired sample t-tests to determine statistically significant improvements in vocabulary, grammar, and speaking skills. Descriptive statistics were used to summarize survey results. Qualitative data from surveys, interviews, and observations were analyzed thematically using coding and content analysis. Recurring themes such as motivation, collaboration, enjoyment, and perceived learning gains were identified and interpreted in relation to the quantitative findings.

RESULTS AND DISCUSSION

This section presents the findings from the quantitative and qualitative data collected to assess the effectiveness of LingoLand: The Academic Quest in improving undergraduate students' English proficiency.

Quantitative results demonstrated statistically significant improvement in students' vocabulary knowledge, with scores rising from $M = 62.5$ to $M = 75.8$ ($p < 0.05$). Grammar scores improved slightly but not significantly ($M = 68.2$ to $M = 71.4$; $p > 0.05$). Speaking fluency scores significantly improved from $M = 3.1$ to $M = 3.9$ ($p < 0.01$), indicating that the game was particularly effective in promoting oral language use.

Qualitative feedback revealed high levels of learner motivation, enjoyment, and collaboration. Students appreciated the fun, competitive nature of the game and highlighted the value of working with peers.

Many expressed that the game helped reduce their fear of speaking English and allowed them to use academic language in context. Observations confirmed these findings, showing active peer interaction, increased participation, and spontaneous use of target vocabulary and structures.

CONCLUSION

The findings of this study support the use of LingoLand: The Academic Quest as an effective pedagogical tool for developing English skills among undergraduate learners. Statistically significant improvements in vocabulary and speaking fluency demonstrate the game's potential to engage students in meaningful language practice. While grammar accuracy showed only modest gains, the trend suggests that extended exposure and integration of game elements could yield stronger outcomes over time.

Qualitative results affirm that the game fosters motivation, active participation, and a supportive collaborative environment which are essential conditions for language acquisition. These findings align with research on the benefits of gamification and peer learning, which suggest that learners are more likely to succeed when they are engaged, emotionally invested, and socially supported.

Educators are encouraged to explore game-based methods as complementary tools in academic language instruction, particularly when teaching mixed-skill areas. Future studies could examine long-term effects, scalability across institutions, and the incorporation of digital feedback tools to enhance the learning experience further.

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LINGUABRIDGE – ACADEMIC DIGITAL SCAFFOLD

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ABSTRACT

LinguaBridge is an innovative AI-enabled digital platform designed to enhance academic literacy among TESL (Teaching English as a Second Language) students. Integrating advanced natural language processing (NLP), adaptive learning algorithms, and collaborative tools, LinguaBridge effectively addresses the challenges TESL students face when navigating complex academic texts. Its key features include NLP-driven text simplification, contextual cues, dynamic glossaries, multimodal learning supports (videos, podcasts), spaced repetition quizzes, and real-time analytics. Preliminary pilot studies demonstrate that learners using LinguaBridge significantly improved reading comprehension scores (an average increase of 15%) and vocabulary retention (up to 20 percentage points higher) compared to traditional study methods. Remarkably, study time was reduced by 30–50%, enhancing learning efficiency. Furthermore, LinguaBridge promotes global teaching readiness by offering region-specific teaching examples and recommending targeted, high-impact ELT resources. The platform uniquely employs a hybrid AI-human scaffold approach, combining cognitive, social, and pedagogical support, fostering deeper comprehension and engagement. Overall, LinguaBridge represents a transformative approach to TESL teacher education, effectively bridging the gap between theory, practice, and cultural adaptability.

Keywords: TESL education, Adaptive learning, Natural Language Processing (NLP), Reading engagement, Cognitive load reduction.

INTRODUCTION

Navigating complex academic texts is a well-known challenge for students training to teach English as a Second Language (TESL). These students—often non-native English speakers—must grapple with dense theoretical literature and research papers to develop their pedagogical skills. Prior studies highlight that language learners and even trainee teachers can feel overwhelmed by specialised vocabulary and intricate syntax in academic readings (Johnson & Wang, 2020). There is a pressing

need for tools that bridge this academic literacy gap and prepare TESL students for global teaching contexts, including both English as a Second Language (ESL) and English as a Foreign Language (EFL) environment (Stein & Graham, 2021). **LinguaBridge** is an AI-enabled digital platform designed to address this need by providing an academic scaffold that helps TESL students comprehend and engage with complex texts more effectively. Blending natural language processing with pedagogical strategies, LinguaBridge offers adaptive support that simplifies reading while preserving content, aiming to enhance comprehension, retention, and overall learning efficiency (Wang, Liu, & Zhang, 2023).

This extended abstract presents the LinguaBridge platform and reports on preliminary evaluation results from pilot studies. We describe the platform's key features—including text simplification, contextual learning aids, and collaborative tools—grounded in current educational technology research (Smith & Reinders, 2021; Li & Dede, 2022). We also discuss how LinguaBridge targets global teaching readiness by addressing ESL/EFL contextual differences and by recommending high-impact English Language Teaching (ELT) resources. Early results demonstrate significant gains in reading comprehension and vocabulary retention, alongside substantial reductions in study time, highlighting the promise of this hybrid AI-human approach to teacher education.

METHODS

Pilot Implementation and Evaluation Design

We conducted two complementary pilot studies to evaluate LinguaBridge's effectiveness, employing both between-subject and within-subject designs to triangulate findings.

Study 1: Comparative Assessment (N=30)

The first study employed a controlled experimental design with 30 TESL undergraduates randomly assigned to either an experimental group (using LinguaBridge) or a control group (using traditional study methods). Participants were matched for English proficiency, prior academic performance, and demographic factors to minimise confounding variables. Over a 4-week period, both groups studied identical research articles on TESL methodologies, with the experimental group accessing content through the LinguaBridge platform while the control group used conventional reading approaches.

Assessment measures included:

- Pre- and post-intervention reading comprehension tests using validated instruments
- Vocabulary acquisition assessments with immediate and delayed (1-week) testing
- Time-tracking logs for all study activities
- Engagement surveys adapted from established educational engagement scales

Study 2: Experience Evaluation (N=15)

The second study employed a within-subject crossover design where 15 TESL graduate students alternated between LinguaBridge and traditional reading methods for different texts. This approach allowed participants to directly compare their experiences with each method while controlling for individual differences in reading ability and learning preferences.

Data collection included:

- Comparative surveys addressing perceived comprehension, effort, enjoyment, and usefulness
- Semi-structured interviews exploring user experiences in depth
- Think-aloud protocols during reading sessions
- Feature utilisation tracking to identify most valued platform elements
- Qualitative feedback on potential improvements and feature requests

Both studies incorporated rigorous controls for text difficulty, topic familiarity, and time constraints to ensure valid comparisons. Ethical approval was obtained from the institutional review board, and all participants provided informed consent with the option to withdraw at any point without consequence.

RESULTS AND DISCUSSION

Improved Comprehension and Retention

The pilot studies yielded encouraging results. Students using LinguaBridge demonstrated significantly higher comprehension scores compared to those in the control group ($p < 0.05$). On average, the LinguaBridge group scored about 15 points higher (out of 100) on reading comprehension tests than the control group, an improvement of over 20%. Vocabulary post-tests one week after study showed the LinguaBridge users could recall approximately 80% of new terms, versus 60% in the control, indicating a substantial boost in retention. These findings align with prior research that AI-mediated scaffolding can enhance language learning outcomes (Wang, Liu, & Zhang, 2023; Li & Dede, 2022). By simplifying complex text and providing just-in-time explanations, the platform likely lowered the cognitive barriers to understanding, allowing learners to focus on core ideas (Johnson & Wang, 2020). Additionally, the spaced repetition practice contributed to better memory consolidation of terminology, as expected from established benefits of spaced learning (Smith & Reinders, 2021).

Time Efficiency

One of the most notable results was the reduction in study time. Participants reported needing fewer hours to complete their readings when using LinguaBridge. Log data confirmed a **30–50% reduction** in total study time for the experimental group compared to the control group to achieve similar or better mastery of the material. For busy TESL students, this efficiency gain can be transformative – it means

they can cover more material in the same time or allocate saved time to other activities. The platform’s features such as quick-access glossaries and summarisation of key points helped streamline the learning process without sacrificing depth. Table 1 summarises key quantitative outcomes from the pilot comparison, comparing Preliminary Pilot Results Comparing Traditional Reading vs. LinguaBridge.

Table 1.: Preliminary Pilot Results Comparing Traditional Reading vs. LinguaBridge

Metric	Traditiona l Reading	With LinguaBrid ge	Improveme nt
Reading Comprehension Score (0–100)	70 (average)	85 (average)	+15 points (+21%)
Vocabulary Retention (after 1 week)	60% of terms	80% of terms	+20 percentage points
Study Time per Week (hours)	10 hours	6 hours	–4 hours (– 40%)

The qualitative feedback from students further illustrates the platform’s impact. Many participants highlighted the dynamic glossaries and contextual videos as particularly useful for clarifying difficult concepts. They also appreciated the real-time annotation and discussion features, which made them feel less isolated when tackling challenging readings. This sense of peer support and instructor presence (even if virtual) addresses the social dimension of learning. As noted by Stein and Graham (2021), effective scaffolding often requires not just cognitive aids but also social and emotional support, which LinguaBridge’s community features help provide.

Global Readiness and ESL/EFL Contexts

LinguaBridge was intentionally designed to prepare TESL trainees for diverse classroom environments. The platform tailors examples and case studies within the reading content to the user’s regional context. For instance, a discussion of an English idiom in an article might be accompanied by a note explaining how that idiom could be taught differently in an ESL context (where students are immersed in English daily) versus an EFL context (where exposure to English outside class is limited). By providing these nuanced, region-specific annotations, the platform alerts future teachers to adjust their teaching strategies to local needs – a skill essential for global teaching readiness (Stein & Graham, 2021). Furthermore, LinguaBridge’s resource recommendation engine suggests high-impact ELT resources (such as seminal papers, teaching guides, or proven classroom activities) relevant to the topics students are reading. This not only enriches their understanding but also familiarises them with go-to resources used by the international ELT community, thus bridging the gap between theory and practice.

Hybrid AI-Human Scaffolding

A distinctive aspect of LinguaBridge is how it merges automated support with human guidance. While the AI components handle instant simplifications, quick feedback, and data-driven adaptivity, human instructors or mentors remain in the loop. During the pilots, an instructor moderated the online discussion board and intervened when students had deeper pedagogical questions or needed reassurance. This hybrid model reflects a growing consensus that AI in education works best when augmenting, not replacing, human teachers (Li & Dede, 2022). The cognitive scaffolding provided by the AI (e.g., breaking down complex text) is reinforced by social scaffolding (peer discussion and mentor encouragement) and pedagogical scaffolding (expert guidance aligning with course outcomes). Such a multi-faceted support system can cater to learners' academic and emotional needs more holistically than either AI or human support alone.

CONCLUSION

LinguaBridge illustrates how an AI-enabled platform can serve as a powerful academic scaffold for TESL students, blending technology with pedagogy to overcome longstanding challenges in language teacher education. The introduction of adaptive text simplification, contextual glossaries, multimodal resources, and collaborative tools into the reading process enables deeper comprehension and more efficient learning. Preliminary results from pilot studies are promising and users of LinguaBridge achieved better understanding of complex texts, retained new vocabulary at higher rates, and saved considerable study time. These improvements not only enhance individual learning outcomes but also have broader implications – future English teachers who are more confident with academic content will be better equipped to translate theory into practice in their own classrooms.

The platform's design addresses both cognitive and practical aspects of teacher training. By accommodating ESL/EFL differences and providing exposure to global ELT resources, LinguaBridge helps prepare well-rounded, globally aware educators. At the same time, its hybrid AI-human support model ensures that the human element of mentorship and community is preserved, aligning with best practices in educational technology integration (Li & Dede, 2022).

While this work demonstrates clear benefits, ongoing research will seek to expand the platform's capabilities and validate its effectiveness on a larger scale. Future studies will involve more diverse participant groups, longer intervention periods, and an examination of how LinguaBridge usage translates into improved teaching performance during practicum or in-service training. Additionally, user feedback will guide new features – for example, integrating more interactive elements like quiz games or an AI chatbot to answer content questions.

In conclusion, LinguaBridge represents a step toward a new paradigm of technology-enhanced teacher education. By providing comprehensive scaffolding for academic literacy, it empowers TESL students to become more efficient learners and, ultimately, more effective English teachers in a global context. The convergence of AI and human support in this platform exemplifies a balanced approach to innovation in education, one that could be extended to other domains facing similar challenges.

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MAGICAL WORDLAND AND EXPLODING GRAMMAR

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ABSTRACT

Magical Wordland and Exploding Grammar is an interactive and imaginative flashcard game that aims to support children's passion for language and their quest for learning. The primary objectives of this project are to design a game-based flashcard system for ESL learners aged 6 to 11 years old by incorporating gaming elements such as designs based on Trading Card Games (TCG) and Health Points (HP) to make language learning engaging and motivating while also improving grammar comprehension and vocabulary development through interactive and socially engaging gameplay. This set of grammar flashcards offers a more fun and engaging experience compared to the simple and monotonous ones available on the market. Each flashcard in the set is designed with different HP values to encourage children to stay motivated and socialise more with their friends and families as they "level up" together while learning and mastering new vocabulary and grammar concepts. The flashcards were developed using insights gathered from surveys with parents, teachers, siblings, guardians, and the general public, alongside field observations conducted at multiple bookshops to analyse existing flashcard products. These observations offered insightful notes on aspects of the design and market trends, ensuring the flashcards' relevancy and appeal. This study highlights the potential of how gamified tools can make learning more fun and collaborative while encouraging educational growth and family engagement.

Keywords: Flashcards, Language Learning, Vocabulary, Grammar, Trading Card Games (TCG) 1.0

INTRODUCTION

Grammar and vocabulary are essential elements for learning to read and write, and when a child knows more words, they gain more knowledge about the world and how to express themselves creatively. One of the most effective and accessible methods for children to learn new words is through fun and engaging game-based flashcards. Flashcards are widely recognised as great and effective learning tools,

especially for children. These cards typically present simple and easy-to-comprehend information, such as words, phrases, questions, photos, or numbers, all related to a certain subject or study topic. Flashcards help children absorb new information quickly while being visually appealing and engaging. According to Wulandari and Chafadi (2022), flashcards are a creative and engaging tool that enhances vocabulary retention, boosts student motivation, and supports effective teaching and learning. Putu and Agung (2021) stated that the use of flashcards as a learning strategy in studying English vocabulary is evident, as it is preferred and found interesting by students at both the elementary and high school levels, especially when the flashcards incorporate a variety of images and colours. As Budden (2019) highlighted, flashcards are helpful tools for every stage of learning, from introducing and practicing new vocabulary to reinforcing it through review. These flashcards are designed specifically for children aged 6 to 11 years old, with vocabulary carefully selected to suit their developmental needs as young ESL learners, aligning with CEFR levels A1 to A2. A1 (beginner) and A2 (elementary) are the Common European Framework of Reference for Languages (CEFR) levels for children aged 6 to 11 (British Council, 2024). This age range covers both early learners and those progressing into more complex language skills, making it an ideal stage for introducing new words and reinforcing key grammar concepts while still being engaging and manageable for learners in this age range.

The design of these flashcards draws inspiration from trading card games (TCG), which have had a significant cultural impact and are experiencing a resurgence in popularity as 1990s nostalgia makes a strong comeback. The appeal of trading cards lies in their strategic gameplay, collectible value, and the appeal of 'rare' cards like those from Pokémon, Yu-Gi-Oh! and Magic: The Gathering. According to Cole (2024), because of their immense popularity, TCG have become cultural icons, with their themes and characters becoming deeply embedded in popular culture, and for many, TCG are more than just cards but tangible links to cherished childhood memories. TCG provide players with opportunities to interact, compete, and trade cards with each other, fulfilling their need for belongingness and helping foster the formation of friendships and communities (William, 2023). By incorporating the collectible and interactive elements of trading card games into the flashcards, this product will help bridge the gap between learning and playing. Aslan (2011) noted that flashcards can replace the feeling of studying and make it feel more like playing a game and are effective at helping children expand their vocabulary when used with the right English course.

The growing trend of game-based learning tools in education highlights the relevance of this project. The aesthetic appeal of trading cards, combined with their ability to encourage social interaction, makes them an ideal medium for engaging children in educational activities. According to Alotaibi (2024), game-based learning in early childhood education offers several advantages, including increased engagement, promoting active learning, and the development of various skills. One of the key features of the flashcard is the inclusion of varying Health Points (HP) on each card, with increasing values to add a sense of progression and achievement. This gamified element encourages children to engage more actively with the flashcard and work to gather cards with higher HP to 'level up' or accomplish a particular goal. According to Yousef (2021), game-based learning has been shown to increase motivation by offering immediate rewards and feedback.

The set of flashcards will come in a single box consisting of 30 noun cards and 30 verb cards, each featuring three words, creating a manageable, yet diverse, vocabulary collection. Additionally, there

will be a guideline for parents to help understand the product better and helper cards that introduce adjectives, adverbs, conjunctions, and linking verbs that are simple for kids to understand and learn. Conjunctions like ‘and’ and ‘so’ will help children to connect ideas, while auxiliary verbs will assist in building more complex sentences.

PROJECT OBJECTIVE / PURPOSE

There are two underlying objectives guiding this project. They are:

1. To design a game-based flashcard system for ESL learners aged 6 to 11 years old by incorporating gaming elements, such as Trading Card Games (TCGs) and Health Points (HP) to make language learning engaging and motivating.
2. To improve grammar comprehension and vocabulary development through interactive gameplay that encourages creativity and social interaction.

METHODOLOGY



Figure 1.: Flowchart of the Project

The flowchart above illustrates the procedure for creating these flashcards. Before creating the flashcards, an online survey was conducted to understand the current demand and trends in ESL learning tools, which provided insights into potential buyers' preferences and existing product gaps. The survey was distributed through social media platforms such as Instagram and WhatsApp. Physical observations were made at locations such as Kinokuniya, BookXcess, and MPH bookstores, as well as online on platform sites like Amazon and Clap Clap Hands. Field notes were taken to analyse available products

on the market, focusing on their content, design, and appeal. By identifying market gaps, this process guided the development of a unique and engaging product.

The Common European Framework of Reference for Languages (CEFR) served as the basis for curating the flashcards' content, which is done by cross-checking the chosen words with the CEFR levels for children aged 6 to 11 years old, using British Council guidelines and a text analyser to identify the level of each word, ensuring that the words are suitable linguistically for the target age group. The card designs were developed using Canva Pro, which required a subscription for access to advanced features, amounting to RM 30 per month. The app offered vibrant elements and an easy-to-use layout, which were key in making the flashcards more engaging and visually appealing. Additionally, printing costs for the prototype flashcards were factored into the project's budget. A prototype of the flashcards was made for further evaluation after the design and content were finalised. Following the prototype development, a post-survey was carried out with 30 respondents to assess the final product's effectiveness and appeal. Information gathered from surveys and field observations was scrutinized to refine the product.

RESULTS AND DISCUSSION

The questionnaires consisted of two sections: one focused on demographic information and the other on user feedback. The purpose of the pre-survey was to gather insights into the initial perceptions of educational card games, while the post-survey focused on evaluating the flashcard design and their effectiveness. A total of 30 individuals responded to the survey. The following section presents the findings from both surveys, followed by a discussion of the results.

Pre-survey

During the pre-survey, 100% of respondents showed a preference for interactive and fun learning methods, confirming the importance of engaging educational tools.

However, respondents rated card games as highly effective for learning vocabulary, with 36.7% giving a rating of 4 and 63.3% a rating of 5 on a scale of 1 to 5.

Post-survey

The majority 83.3% of respondents found the flashcard design and its visuals appealing, highlighting the importance of vibrant and fun designs in engaging young learners.

96.7% of respondents confirmed that the vocabulary on the flashcards was suitable for children aged 6- 11, suggesting that the word choice aligns with the target age group.

CONCLUSION

In summary, Magical Wordland and Exploding Grammar aim to support children's love and journey towards language and learning by providing them with interactive flashcard sets designed to enhance vocabulary acquisition for children aged 6 to 11 years old. This project aims to develop a fun and effective way for young learners to improve their linguistic skills. Through engaging designs, visuals, and game-like features, the flashcards create an enjoyable and dynamic learning experience. By combining education with playful gaming elements, the project encourages children to explore language in a more engaging and motivating way, reinforcing their vocabulary skills through repetition and fun challenges. Additionally, the interactive format can encourage children to engage with friends, family, and peers, which also promotes social interaction and enhances communication skills and teamwork.

Respondents, such as parents, teachers, siblings, and guardians, provided helpful insights on the appeal, effectiveness, and potential market for such educational tools. The surveys' findings demonstrated a high level of support for interactive learning methods, with many participants acknowledging the effectiveness of card games for their ability to foster creativity, critical thinking skills, and enhancing vocabulary. The feedback on the flashcard design and content further highlights the importance of fun visuals and age-appropriate vocabulary. The willingness to buy educational card games shows a promising market for such products, validating the potential of this project.

Overall, this project emphasises the importance of incorporating engaging and effective learning tools into children's education to create an impactful educational tool that not only promotes language development but also cultivates a love of learning by combining interactive gaming elements, appealing visuals, and opportunities for social interaction with friends and family. Future iterations of this project could explore more customisation, such as digital forms and additional educational content, to meet the evolving needs of young learners.

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MATHVENTURE: NUMBERS BECOME AN ADVENTURE!

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ABSTRACT

Peperiksaan Semester Program Matrikulasi (PSPM) 23/24 examination report cite students perform poorly in Integration. To rectify the issue, students will be allowed to explore Integration using a historical story-mode setting whereby students amend their “timeline” on misconceptions, correct, and learn at their own pace using MathVenture. With game-setting mode, students are challenged to better themselves at Integration. Recurring issue of students demonstrating subpar analytical skills during Integration were identified, even with extensive guidance. This led to a target group of 14 students being selected and an intervention plan devised. The MathVenture product was utilized to create an engaging learning environment, fostering active student participation for these students. Digital tools like Quizizz were designed to assess student understanding and misconceptions. Data on students’ performance, including scores on Quizizz and formative test results were collected to measure the impact of MathVenture on students’ proficiency. Students’ emotions and feedback were reviewed through post-intervention discussion, obtaining qualitative insights on their experience. It was observed that 14 students who were given intervention using MathVenture displayed improved scores in formative-test1 displaying mastery of 80% score from 4 type of function given. Upon undergoing cycle 2, students displayed better scores in formative-test 2 of 90%. Qualitative feedback also indicated students enjoy more, remember steps better and could avoid misconception which was happening before the intervention. In line with 21st century learning skills, special activities such as gamification should be carried out to ensure better personal and meaningful learning.

Keywords: Integration, Game Learning, Fun-Learning, Future Education

INTRODUCTION

The teaching and learning of Mathematics at Perak Matriculation College has been drafted in line with 2022/23 curriculum outlined by Matriculation Department. Lessons are conducted via lectures and tutorial sessions. Integration plays an important role in Mathematics syllabus throughout Semester 2. Many topics rely upon students' knowledge of Integration. Failure to grasp the skill or having misconceptions would affect students' progress in other chapters namely Differential Equations and Random Variable for Semester 2. These topics carry 56 marks out of 100 marks. A worst-case scenario would mean, failure of student not being able to carry out Integration would constitute total 50 marks lost. Realizing the importance of technology in education as future way forward, most lecturers create videos on YouTube and TikTok for teaching and learning. However, students still exhibit carelessness and have lack of motivation in carrying out the Integration process. Students often use application such as Photo Math and ChatGPT as shortcuts to obtain quick answers not understanding "why" answer given such. In 21st century learning, it is important for lecturers to be innovative in optimizing technology to aid personal learning and improve pedagogical concept contributing to meaningful learning. This will be crucial in uplifting student performance to integrate correctly and equip them with 21st century learning skills.

Table 1.: Summary of Intervention

Problem: Students display misconception and struggled carrying out Integration		
Action Plan : Incorporate MathVenture in Integration		
Objective	Data Collection Technique	Analysis Method
To demonstrate a minimum mastery of 80% score of integration skill for 4 types of function	Diagnostic and Formative tests	Content Analysis
To evaluate how the use of gamified learning tools (MathVenture) affects student motivation and participation in Maths lesson	Interview and post-survey	Thematic analysis

METHODS

Target Group

Group of 14 students from class X, students of Module 3: One-Year Science programme. Students consist of 4 male and 10 female students. The class was selected for obtaining low score in diagnostic test for Integration.

Implementation

Figure 1 below shows the summary of intervention using MathVenture. Intervention was carried out as two-cycle. The first cycle involves students aiming to achieve 80% Integration skill proficiency under gamification using MathVenture. The second cycle would be trying to improve the students' proficiency level by correcting remaining misconceptions to achieve a better score. The four stages involve planning, implementing, observing, and reflecting. Under the traditional approach of teaching and learning, students demonstrated unsatisfactory results.

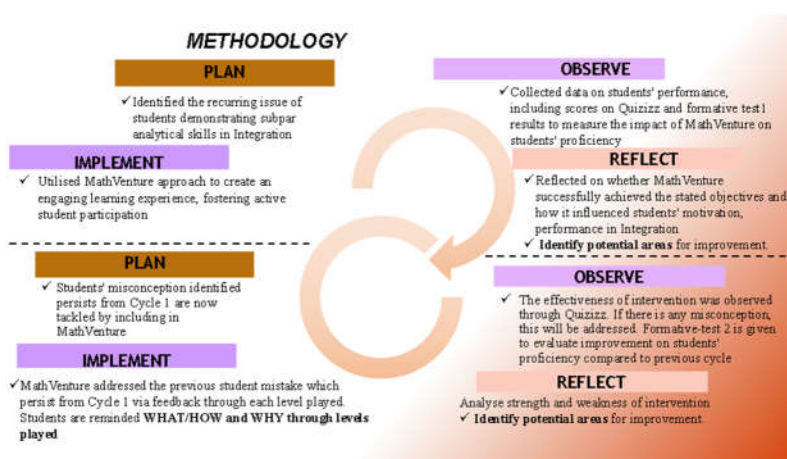


Figure 1.: Summary of Intervention using MathVenture

Planning

11 out of 14 students scored less than 50% indicating poor grasp of Integration knowledge, lack of drive to attempt and displaying misconceptions. Under lecture setting, students have already studied Integration of 4 types of functions before tutorial session. To gain better insight into the issue, students were asked to share their thoughts on the shortcomings. This is hoped with these insights; the stated issue could be tackled. The summary is stated as follows:

Forgetfulness: All students who were interviewed mentioned they struggle to remember steps of Integration. 7 students cited they have problem remembering the necessary steps.

Lack of motivation: 8 students mentioned they do not feel motivated to carry out the task.

Confusion in simplifying the Integration: 6 students reported they are confused with how simplification is done to ensure it is ready for Integration. Problem lies mainly with algebra which is from early days of high school.

Lack of support system: 7 students mentioned although PhotoMath aids students to confirm the Integration steps, support such as immediate feedback will be helpful during the learning process.

Fast-paced: 8 students feel the pace in lecture is fast-paced and although it is slower in tutorial, they wish they have some slower time to explore.

The self-reflection combined with qualitative insights from lecturers and students then shaped the intervention of learning Integration using MathVenture.

Action And Observation

MathVenture Intervention: The implementation of gamification for Integration using MathVenture follows an organized process as follows:

Table 2.: Implementation Steps of Gamification for Integration Using MathVenture

Implementation Steps	Description
Preparation	Students are briefed on how MathVenture will be used. There will be 4 levels consisting of 4 functions. They will be aided by YouTube shorts for each of the stages. YouTube consists of videos of tips and tricks to carry out Integration.
MathVenture game	Students will be working in pairs to play the game. They are required to clear each level before progressing to next stage.
Quizizz stage	Lecturer will create Quizizz based on the potential misconception of students for Integration. This misconception list was compiled from student errors and feedback from lecturers. Based on students answering pattern, lecturer discusses errors committed via Quizizz answer analysis.
Post-session feedback	Students will be interviewed to share their experience and feedback on the use of MathVenture. A post intervention survey will be carried out too. A formative test 1 and 2 will be given to test the effectiveness.

RESULTS AND DISCUSSION

A formative test was conducted to assess the intervention which aims to demonstrate a minimum mastery of 80% score of Integration skill from 4 type of functions given. The marking was done by an experienced lecturer from Mathematics Unit to avoid any form of biasness. Figure 2 below is the data of diagnostic-test (before intervention) and formative-test1&2 (after intervention using MathVenture).

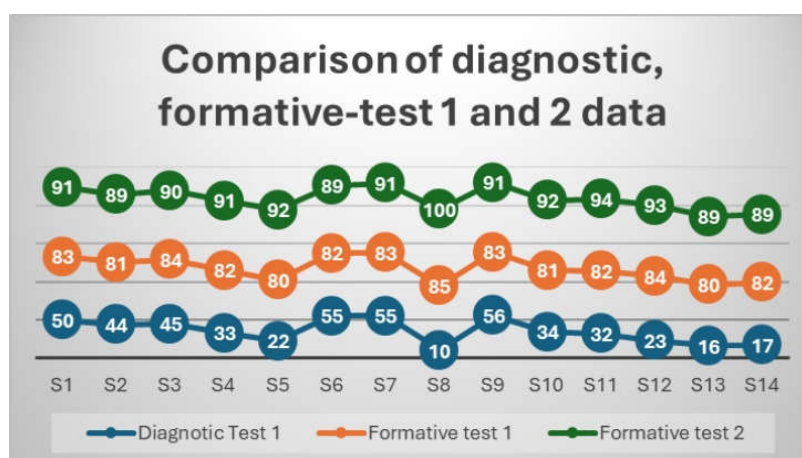


Figure 2.: Comparison of Diagnostic, Formative 1 and Formative 2 Test marks

The quantitative data obtained indicates the research objective achieved. The diagnostic tests results did not have students attaining the minimum 80% of Integration skill proficiency and class average at 35.1%. After intervention, all 14 students attained the required skill. However, there were still students committing errors on certain integral which hindered better score. This was mainly due to algebra which requires repeated practice. Hence, students were addressed on the mistakes and errors committed. In cycle 2, they were treated to another set of MathVenture which was designed to tackle the remaining mistakes and misconceptions (process described in Figure 1). Formative test 2 was then administered to see the effectiveness of MathVenture in improving the proficiency of students. Almost every students display an increase in score. Students average rose from 82.3% to 91.5% with 10 out of 14 students obtaining above 90%. Minor mistakes such as with indices were the reason they lost marks. Qualitative data were next obtained from students to gain insights into the effect of MathVenture in reshaping students learning experience. Below are some excerpts from the interview after the session:

Student 1: “The time traveling concept used in MathVenture makes me feel like I’m a traveller on a mission”

Student 2: “YouTube shorts with mnemonics help me to remember the steps better. It’s a rule card which I must go through just like before I play any board game hence abide to it”.

Student 3: “Since MathVenture is telling me write/ wrong in a very funny way, I try to be very careful before I answer. Hence, I think before answering since I don’t want to keep repeating the same mistake.”

Student 4: “The immediate feedback during the use of MathVenture helps my understanding better. It also helps my confidence during the learning process”.

Student 5: “I focus on every tiny details now that my lecturer always stresses in teaching. I see the connections”.

Student 6: “I played MathVenture many times as I feel I can do at my own time. Then I feel excited to answer Quizizz”.

The finding above is in line with several other similar studies and environment of effective learning. Zakaria et al., (2008) through a study on Matriculation students revealed the association between Mathematics anxiety and achievement amongst students. It is generally found students with Mathematics anxiety tend to score lower in achievement tests. Mathematics anxiety is positively correlated with motivation. Students who have anxiety tend to stay away from Mathematics problems whereas those who have less anxiety stick with problems longer. The author suggested apart from creating awareness amongst teachers about the maths anxiety, efforts need to be made to reduce them. Among suggestions were, a laid-back surrounding is created. The use of cooperative learning environment in line with social constructivist theory would aid learning. A slower learning pace is also recommended to overcome maths anxiety. Game called *Diff-Game* was introduced and its effectiveness was tested on 117 1st year high school students in Denmark. They noted almost all students with different ability showed improvement in their understanding for the Differentiation chapter. Differentiation is a chapter which requires continuous and extensive practice for the mastery of skill (Pedersen et al., 2016) thus, the objective was achieved via gamification. Based on the above data on diagnostic test, formative test 1 and formative test 2 as well as qualitative analysis it is evident that MathVenture has positively impacted students understanding, eliminate misconceptions, improve students’ motivation and participation in Integration.

CONCLUSION

The implementation of gamification through MathVenture in teaching Integration has transformed the learning experience by significantly improving student engagement. While teaching, it became evident that embedding historical elements into mathematical contexts promoted cross-curricular thinking and encouraged narrative driven learning. The integration of goal-oriented game mechanics, aligned with the engagement theory, kept students immersed in the tasks. Partner based activities were observed to enhance the Zone of Proximal Development (ZPD), as described by Vygotsky, whereby timely and appropriate support allowed students to achieve tasks they couldn't do alone. Upon reflection, students demonstrated better retention, increased awareness of their mistakes, and more careful application of concepts. The improvement was also reflected in the reduced need for reteaching, a common issue in previous semesters. Integration, taught in Semester 2 at Matriculation College, is foundational for other advanced topics and university level coursework. Previously, lecturers had to conduct additional sessions to revisit core ideas. Now, MathVenture allows students to revise independently, anytime and anywhere, facilitating on the go learning. Through platforms like Quizizz, misconceptions can be tracked and corrected in real time, ensuring students develop accurate mental schemas before advancing. The gamified platform provides immediate feedback, a crucial component for constructivist learning, and allows students to progress in stages only after mastering prior knowledge. This approach aligns with the broader digitization of education, addressing modern learners' needs by making concepts accessible and meaningful. MathVenture promotes meaningful learning by helping students

connect prior knowledge to new ideas and ensures self-paced progression beyond classroom hours. Furthermore, its flexible design supports adaptability across various Mathematics topics. Future plans include cross-disciplinary collaboration to develop integrated modules, allowing students to build comprehensive knowledge blocks regardless of location or subject area.

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MineLab 360: Safe Science, Infinite Discovery

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ABSTRACT

MineLab 360: Safe Science, Infinite Discovery is an educational innovation that leverages the immersive potential of Minecraft Education Edition to transform the way science is taught in schools. Designed as a multidisciplinary virtual lab, MineLab 360 enables students to explore hazardous experiments in Biology, Chemistry, and Physics within a safe, engaging, and gamified environment. The innovation addresses key challenges in science education, including limited access to functional laboratories, safety restrictions on physical experiments, and low student engagement with abstract scientific concepts. By simulating real-life experiments—such as virtual dissections, compound synthesis, pH testing, circuit construction, and motion analysis, students develop scientific inquiry skills without the risks associated with traditional lab settings. Unique features of MineLab 360 include curriculum-aligned virtual worlds, built-in lab safety training, interactive NPC guides, and in-game journals for student documentation and reflection. This approach supports both in-person and remote learning, making it accessible to schools with limited infrastructure or during disruptions such as pandemics. The innovation promotes equitable STEM education, enhances digital fluency, and supports the integration of 21st-century skills into science instruction. MineLab 360 has been implemented in science teacher education programs has received positive feedback from both educators and learners. MineLab360 is in the process of intellectual property registration under MyIPO as a digital instructional module and immersive science teaching kit. MineLab 360 represents a sustainable, scalable solution for safe, inquiry-driven, and future-ready science education.

Keywords: Virtual Laboratory; Minecraft Education Edition; Science Education Innovation; Laboratory Safety; Gamified Learning

INTRODUCTION

Practical experimentation is fundamental to effective science learning, yet access to well-equipped

laboratories remains a significant challenge, particularly in underfunded schools or during crisis situations such as pandemics. Safety concerns further restrict students from engaging in hands-on exploration of scientific phenomena (Dewitt et al., 2021). In response to these pressing issues, MineLab 360: Safe Science, Infinite Discovery was conceptualized as an immersive digital learning innovation using Minecraft Education Edition. This multidisciplinary virtual laboratory redefines how science is taught by transforming traditionally risky or inaccessible experiments into safe, engaging, and inquiry-based simulations. MineLab 360 allows students to conduct simulated experiments in Biology, Chemistry, and Physics, thereby making abstract scientific concepts tangible and accessible. By embedding virtual environments with interactive non-playable characters (NPCs), curriculum-aligned tasks, and real-world laboratory protocols, MineLab 360 bridges the gap between theoretical knowledge and experiential learning. The tool enhances students' scientific inquiry skills and digital fluency while fostering a culture of curiosity and experimentation. The aim of this innovation is to support safe, equitable, and scalable science education across diverse educational contexts.

METHODS

MineLab 360 was developed using a design-based research (DBR) methodology that integrates iterative development, implementation, and refinement based on stakeholder feedback. The innovation is grounded in constructivist learning theory and the principles of gamified learning, emphasizing active knowledge construction, exploration, and reflection (Papert, 1980; Hamari et al., 2014).. The development process included four main phases. During the first phase, a needs analysis was conducted through surveys and interviews with science teachers and students to identify the challenges in current lab-based science instruction. Concurrently, the national STEM curricula were reviewed to ensure that the virtual lab activities aligned with the expected learning outcomes (Ministry of Education Malaysia, 2017).. In the second phase, modular virtual labs for Biology, Chemistry, and Physics were designed and developed within Minecraft Education Edition. This included creating interactive NPCs that guide students through the experiments, integrating in-game journals for documentation and reflection, and incorporating built-in lab safety tutorials and gamified tasks to maintain engagement (Dewitt et al., 2021). The third phase involved the implementation and pilot testing of the innovation with 42 pre-service science teachers across three universities. Data were collected through classroom observations, user activity analytics, surveys, and focus group interviews. In the final phase, the gathered feedback was used to refine the virtual lab environments. Improvements were made to the learning pathways, NPC instructions, and difficulty levels of the tasks. Throughout the process, the biology lab featured simulations such as frog dissections, osmosis experiments, and microorganism cultures. The chemistry lab included virtual activities like compound synthesis, pH testing, and distillation, while the physics lab involved circuit construction, force and motion analysis, and energy transformation simulations. Pedagogically, all tasks were closely aligned with the Malaysian KSSM syllabus and were designed to be adaptable for use in other curricula. The system also emphasized real-world laboratory protocols, formative assessments, gamified progress tracking, and reflection tools

RESULTS AND DISCUSSION

Findings from the pilot implementation revealed several key outcomes. Firstly, student engagement and motivation significantly increased. Surveys and interviews showed that learners found science lessons more enjoyable and exploratory due to the gamified elements and narrative-driven tasks in MineLab 360. This increased engagement fostered a greater sense of ownership and agency in learning. Secondly, there was a notable improvement in students' conceptual understanding and scientific inquiry skills. Pre- and post-tests demonstrated statistically significant gains in content knowledge and problem-solving abilities. Observation records supported these findings, showing improved student capabilities in forming hypotheses, analyzing results, and deriving conclusions. The use of digital tools further enhanced students' digital literacy, 3D navigation, and familiarity with collaborative virtual environments. Additionally, the innovation promoted accessibility and inclusivity by enabling practical science learning in environments lacking physical laboratories or during periods of remote instruction. Teachers recognized the platform's potential to level the playing field by providing all students, regardless of geographic or economic limitations, with meaningful lab experiences. Educators also responded positively to the system's alignment with their curriculum and ease of use. They reported that the built-in training modules and intuitive interface helped them integrate MineLab 360 seamlessly into their teaching practices. Furthermore, the scalability and sustainability of the innovation were evident. As a modular system, MineLab 360 can be expanded to include more disciplines or tailored to meet different curriculum standards. It is also undergoing intellectual property registration with MyIPO as a digital instructional module and immersive teaching kit. Its digital nature, compatibility with widely available devices, and potential for use in both in-person and remote settings make it a long-term solution for modern science education challenges.

CONCLUSION

MineLab 360 represents a transformative approach to science education that addresses the pressing need for safe, engaging, and accessible laboratory experiences. By leveraging the immersive environment of Minecraft Education Edition, it empowers students to engage with scientific concepts through exploration, experimentation, and critical reflection. Its curriculum-aligned and gamified design fosters inquiry-based learning and digital fluency while providing inclusive access to high-quality science instruction. The pilot study confirmed that MineLab 360 enhances student engagement, inquiry skills, and conceptual understanding, while also increasing teacher readiness for digital pedagogies. As schools move toward blended and hybrid learning environments, MineLab 360 offers a scalable and sustainable model for delivering effective science education in both well-equipped and resource-constrained settings.

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and refinement process. The innovation is currently in the process of intellectual property registration under MyIPO (Malaysia) as a digital instructional module and immersive science teaching kit.

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MIX & MATCH: COST ME IF U CAN

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ABSTRACT

Game-based learning has emerged as a significant educational strategy that incorporates game elements into the learning process, thereby improving student engagement, motivation, and academic performance. In contrast with traditional classroom approaches, it encourages active engagement and experiential learning via structured challenges, prompt feedback, and rewards. This study aims to create an interactive game-based learning tool, named Mix & Match: Cost Me if U Can, intended to assist students in the process of learning. Mix & Match: Cost Me if U Can is an educational tool that employs game-based learning to help students understand the fundamentals of cost accounting, particularly cost classification, through clear definitions and relatable examples. The game enhances the learning experience by incorporating images and vibrant colours that capture students' attention and make the process more engaging. This visual appeal ensures that learners are not limited to word-by-word memorization but are also stimulated by an exciting, interactive environment. The game also promotes the enhancement of problem-solving and decision-making abilities by engaging learners in goal-directed scenarios. Aimed at both accounting and non-accounting students enrolled in cost accounting courses, Mix & Match: Cost Me if U Can reflects how advancing technology can support personalized, student-centered learning aligned with the needs of 21st-century education.

Keywords: Game-based learning, education, student engagement, critical thinking, active learning

INTRODUCTION

Game-based learning (GBL) is generating significant interest as an innovative method of teaching that integrates game components such as rewards, challenges, and immediate feedback into the learning environment to enhance student engagement and learning outcomes. Studies indicate that GBL works better than the traditional methods of learning. First, it results in enhanced learning and improved academic performance across many subjects (Ding and Yu, 2024). Next, it enhances engagement, especially among millennials who are familiar with interactive entertainment (Nadeem, Oroszlanyova

& Farag, 2023). In addition, it increases student motivation in educational environments by including interactive components that align with students' preferences for engaging and enjoyable learning experiences. Research indicates that the incorporation of game mechanics, such as leaderboards, points, and badges, fosters a competitive spirit and a sense of achievement, which in turn boosts intrinsic motivation and encourages active participation in the learning process (Kuang, Agustina & Monalisa, 2024).

In the context of higher education, particularly in accounting education, students often struggle to stay engaged due to the abstract and technical nature of the content. To address this issue, this study introduces an interactive learning tool called the Mix & Match: Cost Me if U Can, a game-based learning platform designed to improve student engagement and facilitate better learning in cost accounting courses. The framework for this study draws on two key theoretical models: the Student Course Engagement Questionnaire (SCEQ) developed by Handelsman et al. (2005) and the Technology Acceptance Model (TAM) by Davis (1989).

METHODS

The research method employed in this study involved the distribution of questionnaires to gather data. We adapted the measures in the questionnaires from the Student Course Engagement Questionnaire (SCEQ) (Handelsman et al., 2005) and the Technology Acceptance Model (TAM) (Davis, 1989). There are three sections involved. The first section asked about the basic demographic profile of the students. Next, section two about SCEQ to measure student engagement across four dimensions: skills, emotional, participation/interaction, and performance. Lastly, the third section is the questionnaires on TAM to assess perceived usefulness (PU) and perceived ease of use (PEOU) on the game-based tool. Section two and three are rated on a 5-point Likert scale ranging from (1) Strongly Disagree; (2) Disagree; (3) Neutral; (4) Agree; (5) Strongly Agree.

The primary goal of the questionnaires was to determine the elements that influence the student's engagement and acceptance of the game-based learning, which will serve as the basis for the product's development. The targeted respondents were students enrolled in the Faculty of Accountancy at UiTM Perak Branch, Tapah Campus. A total of 83 responses were received from the participants. We used descriptive statistics to summarize the data. This approach provided an overview of students' engagement levels and their perceptions of the usefulness and usability of gamified learning. The results were presented and interpreted to identify overall trends and patterns in student responses.

RESULTS AND DISCUSSION

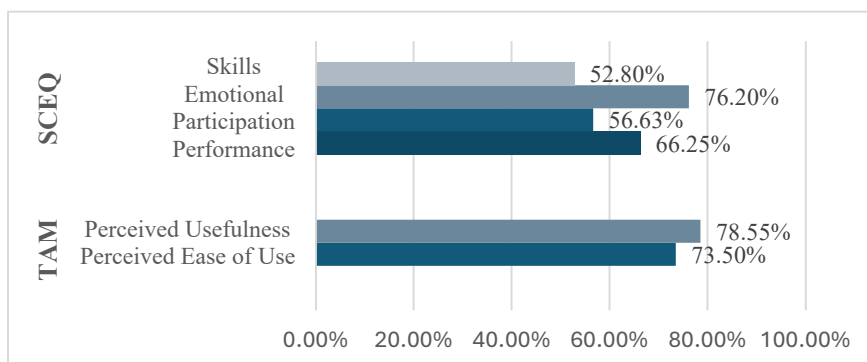


Figure 1.: Student Course Engagement Questionnaire (SCEQ) and the Technology Acceptance Model (TAM) towards Game-based Learning

Figure 1 illustrates the feedback obtained from students regarding their engagement and acceptance towards GBL. The data is segmented into two main categories: SCEQ and TAM. Each category contains several statements rated on a scale, with the total rating percentage of agreed and strongly agreed for each statement displayed. A total of 83 students responded to the survey (72.3 % are female and 27.7% are male). The findings indicate generally positive student engagement and perceptions of game-based learning among the respondents. First, The SCEQ findings revealed that students exhibited the highest engagement in the emotional dimension (76.20%), indicating strong interest and motivation toward gamified learning. This was followed by performance engagement (66.25%), showing a moderate level of effort and achievement orientation during game-based tasks. Meanwhile, participation/interaction engagement was moderate (56.63%), suggesting that students were somewhat involved in peer interaction and discussions. The lowest score was recorded for skills engagement (52.80%), indicating that students applied fewer academic strategies such as note-taking and time management during gamified activities. These findings align with previous research by Handelsman et al. (2005), which suggests that tools enhancing active learning can positively influence multiple aspects of engagement.

Second, in terms of technology acceptance, students demonstrated a positive perception toward game-based learning. Perceived usefulness (PU) scored 78.55%, indicating that students believed gamification improved their academic performance and learning outcomes. Similarly, perceived ease of use (PEOU) recorded a strong score of 73.50%, reflecting that students found gamified tools easy to use and accessible. This result is consistent with research by Ramesh et al. (2025), which indicated that gamifying improves student participation in the classroom since students had a favourable view of the approach. Hence, these findings affirm the potential of gamified learning in higher education, particularly in enhancing motivation and perceived learning benefits. Furthermore, it also supports the Technology Acceptance Model (Davis, 1989), which highlights the importance of both PU and PEOU in technology adoption.



Figure 2.: Interface of the Mix & Match: Cost Me if U Can

In summary, the findings from both SCEQ and TAM indicate that interactive and accessible game-based learning can enhance meaningful engagement and encourage acceptance among learners. Educators who want to improve digital learning practices in the classroom will find these ideas very helpful. The introduction of Mix & Match: Cost Me if U Can is believed to be able to integrate game-based learning strategies to make use of these advantages. It is an innovative game-based learning tool because it combines several well-known game mechanics into a single, cohesive experience. Instead of focusing on just one type of gameplay, we creatively integrate multiple mini games such as Tic Tac Toe to challenge strategic thinking, Hidden Object to improve attention to detail and Matching Items to Answers to reinforce learning of key cost accounting concepts. This multi-game approach keeps learners engaged by offering variety and interactivity, reducing the risk of boredom or fatigue during learning sessions. Furthermore, the game enhances the learning experience by incorporating images and vibrant colours that capture students' attention and make the process more engaging. This visual appeal ensures that learners are not limited to word-by-word memorization but are also stimulated by an exciting, interactive environment. In addition, the Mix & Match: Cost Me if U Can's target market includes accounting and non-accounting students who register for cost accounting courses. Rosmaria et al. (2024) found there is an increase in student engagement and enthusiasm, indicating that games can make learning accounting more accessible and enjoyable for all students, including the non-accounting students, who reported that the game helped them understand the topic.

CONCLUSION

This study examines the feedback that students provide in response to the need for integrating game-based elements into educational practices. It uses a sample of 83 respondents among accounting students. Given this finding, it becomes evident that integrating game-based learning into educational programs can significantly enhance student engagement and support technology acceptance in cost accounting education. The combined use of SCEQ and TAM provides a robust framework to assess both educational effectiveness and user experience. With the primary objective of integrating a digital game into education, the Mix & Match: Cost Me if U Can transforms complex management accounting topics into a fun, immersive, and interactive learning experience. It's more than just a game but it represents promising for a smart educational tool designed to make learning effective, engaging, and enjoyable.

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MODALS IN ACTION: EXPLORING GRAMMAR THROUGH PADLET & CHATGPT

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ABSTRACT

Learning and mastering modal verbs have always been challenging for ESL learners, as the usage can be varied depending on the context. The traditional way of teaching modal verbs often relies on explicit instruction and controlled practice. This classroom-based innovation combines Padlet and ChatGPT to help ESL Part 2 Diploma students improve their understanding and use of modal verbs in sentences. The lesson focuses on the four main functions of modals, such as possibility, ability, necessity, and permission. Students worked in pairs to generate sentences using modals, received instant feedback from ChatGPT and posted their drafts to a Padlet wall. This approach helps to reinforce their grammar knowledge, and it also encourages creativity, critical thinking, and learner independence. Based on the implementation, the learners showed confidence and engagement when using modal verbs in their writing. As a simple and cost-effective method, this idea has strong potential to be used with other grammar topics or adapted to different ESL learning contexts.

Keywords: *Modal verbs, grammar, ChatGPT, Padlet*

INTRODUCTION

Traditional grammar lessons often leave students memorising rules without truly understanding how modal verbs such as “can”, “will”, or “could” function in writing. While textbooks provide plenty of practice, they rarely show students how proper modal verbs usage can make their arguments more persuasive and engaging. Technology-based and AI-integrated grammar learning exposes students to more personalized and instant feedback, which enhances students’ understanding and increases engagement.

Studies on grammar learning that utilize the advancement of AI tools have reported that the

incorporation of AI tools in teaching and learning encourages personalised and adaptive learning as AI gives feedback in real time, adapts to difficulty, and is able to address various needs of the learners (Aladini et al., 2025). Usage of AI tools in grammar learning has also shown an increase in engagement and motivation among learners as gamification and interactive features boost learners' confidence and motivation (Aladini et al., 2025; Song & Song, 2023). Another study reported that the usage of AI tools in writing lessons enhanced autonomy and self-regulation among learners, and it also fostered independent learning and self-efficacy (Bognar et al., 2024).

The use of an AI tool such as ChatGPT in grammar lessons has been widely used in recent years. A past study on the application of AI tools in grammar lessons focused on the combination of Grammarly and ChatGPT to improve learners' proficiency in grammar, and it was found that there is an improvement in test scores of the learners (Lalira et al., 2024). One more study also reported on their findings that learners displayed positive impacts on language skills, especially in writing, grammar, and vocabulary acquisition after the utilization of ChatGPT in lessons (Behforouz & Ghaiti, 2024; Sanchez, 2025). Past papers have shown a high frequency of ChatGPT usage in grammar lessons. This creates an opportunity to explore how the integration of ChatGPT and Padlet can enrich learners' learning experience and address challenges in learning grammar, particularly modal verbs, in a more interactive way.

This study will address the following research questions:

RQ1: What is the level of acceptance among ESL learners regarding the use of ChatGPT and Padlet in learning modal verbs?

RQ2: What are the learners' attitudes toward the use of ChatGPT and Padlet in learning modal verbs?

METHODOLOGY

This section presents the method employed in this study. This study employed a small-scale quantitative research design to investigate ESL learners' acceptance and attitudes toward the integration of Padlet and ChatGPT in grammar instruction, specifically in learning modal verbs.

A total of 68 Semester 2 diploma students from a public university in Malaysia participated in this study: 45 females and 25 males. All participants enrolled in an English language proficiency course, and their proficiency level was estimated to be at the B2 level. Purposive sampling method was used in the selection of participants in this study, as this sampling technique allows a researcher to select individuals based on criteria relevant to the objective of the study. This allows for the gain of an in-depth understanding of the participants' acceptance and attitude towards the usage of ChatGPT and Padlet in grammar lessons.

Data were collected through a post-lesson questionnaire (20 items) that combined elements from the Technology Acceptance Model (TAM) (Davis, 1989) and Attitude towards Computer-Assisted Language Learning (A-CALL) (Aydin, 2013). In this study, there are 11 items adapted from TAM,

which consist of three elements: Perceived Usefulness (PU; 4 items), Perceived Ease of Use (PEOU; 4 items), and Behavioral Intention to Use (BI; 3 items). The adaptation of the items in the questionnaire survey was relevant to this study as it involves a specific classroom-based instructional context, and this also ensures that the items are relevant to the objectives of the study. Similar adaptations were found and validated by a past study by Dizon (2016), who confirmed the relevance of PU, PEOU, and BI in exploring learners' acceptance of technological tools in their learning. To explore the learners' attitude, 9 items were adapted from A-CALL (Aydin, 2013), which are most relevant to the context of this study. The instrument used a 5-point Likert scale to assess students' perceived usefulness, perceived ease of use, behavioral intention, general attitudes, as well as affective and motivational aspects toward the use of ChatGPT and Padlet in learning modal verbs.

The lesson was conducted physically, and students were instructed to bring their own device. The majority of learners preferred to use a laptop, an iPad, or a tablet, while some of them used their smartphones. At first, learners were instructed to write sentences with their partner for each modal verb that is in the category of possibility, ability, necessity and permission. Next, they post their sentences on Padlet based on the respective modal verbs category. After they have written their sentences, the learners are then instructed to log in to ChatGPT, and they prompt ChatGPT to analyse and give suggestions for improvement on the sentences that they have written. The learners do this for each category of modal verbs. After completing the activity, the learners were invited to complete an online questionnaire anonymously.

The data collected in this study were analysed using SPSS version 22. The guidelines for the interpretation of mean scores of the results were based on Norasmah and Salmah (2011) which categorizes the scale according to "low" (1.00-2.00), "moderately low" (2.01-3.00), "moderately high" (3.01-4.00), and "high" (4.01-5.00).

FINDINGS

In this section, the results of this study will be outlined and discussed. Based on the results gathered, the participants seem to display a high level of acceptance and attitude towards the integration of ChatGPT and Padlet in modal verbs lessons. The results were categorized into learners' acceptance and learners' attitude towards the use of ChatGPT and Padlet in learning modal verbs.

Learners' Acceptance of the Use of ChatGPT and Padlet in Learning Modal Verbs

Table 1.: Learners' Acceptance of The Use of ChatGPT and Padlet

Items	Mean	Standard Deviation	Interpretation
1. Using ChatGPT and Padlet helps me understand modal verbs better.	4.148	0.652	High
2. ChatGPT enhances my ability to write grammatically correct sentences using modal verbs.	4.102	0.577	High
3. Padlet allows me to collaborate effectively in grammar activities.	4.074	0.581	High
4. ChatGPT and Padlet improve the overall quality of my grammar learning.	4.103	0.550	High
5. It is easy for me to use Padlet during grammar lessons.	4.177	0.571	High
6. I find ChatGPT easy to interact with when learning about modal verbs.	4.191	0.652	High
7. Learning to use both Padlet and ChatGPT was easy for me.	4.191	0.580	High
8. I can use these tools without needing much help from others.	4.015	0.782	High
9. I plan to use ChatGPT and Padlet for future grammar exercises.	3.956	0.609	Moderately high
10. I would recommend these tools to my peers for learning grammar.	4.147	0.675	High
11. I intend to explore more ways to use technology in my English learning.	4.309	0.580	High
Overall acceptance level	4.128	0.449	High

The results from Table 1 show that the overall mean score for learners' acceptance of using ChatGPT and Padlet in learning modal verbs is 4.128, which falls under the high category. This suggests that, generally, the students accepted the use of these tools positively during grammar lessons, particularly in modal verbs lessons.

The highest mean score is recorded for the item "*I intend to explore more ways to use technology in my English learning*" with a mean score of 4.309. This indicates that the use of ChatGPT and Padlet not

only supported their understanding of modal verbs but also encouraged learners to be more open in using technology for other aspects of English learning. Other items with high mean scores include:

“I find ChatGPT easy to interact with when learning about modal verbs” (M = 4.191)

“Learning to use both Padlet and ChatGPT was easy for me” (M = 4.191)

“It is easy for me to use Padlet during grammar lessons” (M = 4.177)

These results demonstrate that learners find both tools easy to use, which is an important factor in supporting learning engagement and reducing stress, especially when dealing with challenging grammar lessons like modal verbs.

The only item with a moderately high interpretation is *“I plan to use ChatGPT and Padlet for future grammar exercises”* (M = 3.956). This slightly lower score suggests that learners appreciate using the tools in the current lesson, but this also shows that some may need more exposure or confidence before fully integrating the tools into their independent learning routines.

Learners’ Attitude Towards the Use of ChatGPT and Padlet in Learning Modal Verbs

Table 2.: Learners’ Attitude on The Use of ChatGPT and Padlet

Items	Mean	Standard Deviation	Interpretation
1. I enjoy learning modal verbs through digital tools like ChatGPT and Padlet.	4.118	0.680	High
2. Using ChatGPT & Padlet makes learning modal verbs more interesting.	4.191	0.580	High
3. I feel more confident in grammar (especially modal verbs usage) after using ChatGPT.	4.162	0.660	High
4. I prefer learning grammar through a combination of technology and traditional methods.	4.294	0.575	High
5. Learning modal verbs using ChatGPT and Padlet is less stressful than traditional lessons.	4.029	0.732	High
6. I feel motivated to participate in class when using ChatGPT & Padlet.	4.118	0.702	High
7. The visual and interactive features of Padlet help me stay engaged.	4.132	0.570	High
8. My lecturer's enthusiasm for using ChatGPT and Padlet	4.088	0.640	High

Items	Mean	Standard Deviation	Interpretation
encourages me to use them.			
9. I learn better when my lecturer combines traditional teaching with technology tools.	4.368	0.570	High
Overall attitude	4.167	0.482	High

The results in Table 2 show that the overall mean score for learners' attitude towards the use of ChatGPT and Padlet in learning modal verbs is 4.167, which falls under the high category. This suggests that learners generally have a positive attitude toward integrating these tools in their grammar lessons, particularly in learning modal verbs.

Among all the items, the highest mean score is recorded for the item *"I learn better when my lecturer combines traditional teaching with technology tools"* ($M = 4.368$). This shows that learners value a blended approach that balances both conventional and digital methods, and they respond well when their lecturer takes the initiative to incorporate tools like ChatGPT and Padlet into the lesson.

Another item with a high mean score is *"I prefer learning grammar through a combination of technology and traditional methods"* ($M = 4.294$), which further supports the idea that learners appreciate variety in teaching strategies. The use of technology does not replace the traditional way but complements it, making the learning process more meaningful and accessible.

Several other items also show high mean scores, such as:

"Using ChatGPT and Padlet makes the modal verbs lesson more interesting" ($M = 4.191$)

"I feel more confident in grammar (especially modal verbs usage) after using ChatGPT" ($M = 4.162$)

"The visual and interactive features of Padlet help me stay engaged" ($M = 4.132$)

These findings show that learners not only enjoy the tools but also feel that their understanding, confidence, and engagement have improved. In addition, learners agree that these tools reduce stress compared to traditional lessons. This is supported by the item *"Learning modal verbs using ChatGPT and Padlet is less stressful than traditional lessons,"* which has a mean score of 4.029.

Lastly, items related to motivation and teacher influence also score high:

"My lecturer's enthusiasm for using ChatGPT and Padlet encourages me to use them" ($M = 4.088$)

“I feel motivated to participate in class when using ChatGPT and Padlet” (M = 4.118)

The items above suggest that the students are influenced by their lecturer’s effort to use the tools. Thus, this reflects on how the lecturer’s role and usage of the tools positively shape students’ experience and attitude.

CONCLUSION

In summary, the incorporation of ChatGPT and Padlet in modal verbs lessons has proven to display learners’ engagement and interest in learning more about the correct use of modal verbs in sentences. This will eventually improve learners’ performance in writing. Learners reported high levels of acceptance and positive attitudes toward the usage of ChatGPT and Padlet in their grammar lessons.

This study can be further developed in the future as it does not include pre-tests and post-tests investigation due to time constraints. The number of participants is limited as this is a small-scale study. This study focused on determining students’ acceptance and attitude toward technology rather than measuring their performance or proficiency in writing sentences using the correct grammatical rules. Other studies in the future may use a larger scale of participants to gain more insight into the learners’ perceptions and performance in grammar skills.

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MOOC RC DESIGN

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ABSTRACT

Reinforced Concrete (RC) Design is an educational innovation designed to enhance civil engineering subject by offering a flexible, globally accessible and industry-relevant course through an e-learning platform Massive Open Online Course (MOOC). This course focuses on the design of key RC building elements, i.e. slabs, beams, columns, shear walls and foundations, and delivered through structured modules aligned with Malaysia UBBL and Eurocodes. RC Design supports lifelong learning and improves students' competency by integrating interactive and outcome-based learning methods. This course features comprehensive assessments comprising of design assignment, project and online tests to strengthen critical thinking and practical application. Special features include virtual site visits to connect theory with real-world practice, gamified quizzes to enhance engagement and the application of design software to expose learners to digital tools utilised in the industry. Original teaching videos, real-world design cases and forums for instructor-student interaction enhance the overall learning experience. RC Design was developed using a systematic instructional design approach, implemented with clear learning outcomes and interactive content and monitored via learner engagement data and surveys. Feedback shows strong satisfaction: 70% of learners find this course beneficial and about 90% of respondents cite its effectiveness. This innovation supports the Malaysia Education Blueprint 2015–2025 and Sustainable Development Goal 4 (Quality Education) by ensuring equitable access to technical education and promoting lifelong learning through digital transformation in engineering education. RC Design not only bridges the education gap but also re-defines how future engineers are prepared for complex problem-solving in the digital era.

Keywords: e-learning, MOOC, Outcome-based Education, Reinforced Concrete Design, SDG

INTRODUCTION

Malaysia's higher education system is undergoing a strategic shift toward digital transformation, with a strong emphasis on flexible and accessible learning models, such as Massive Open Online Courses (MOOCs) to support quality education while aligning with the Malaysia Education Blueprint (2015–2025). MOOCs have proven effective in broadening access to quality engineering education, especially in resource-constrained environments (Illi & Elhassouny, 2025). Interactive content and gamified assessments in MOOCs integrated with flipped classroom strategies improve learner performance and learner autonomy as well as reduce dropout rates (Zakaria et al., 2024; Zhou, 2023). MOOCs also link theory to practice using tools like video demonstrations and virtual visits (Huang et al., 2024) and support deep learning through real-time feedback mechanisms and visualisation tools (Topali et al., 2023). However, challenges remain. Many Malaysian institutions, especially regional campuses, face limitations in delivering high-quality engineering design education due to insufficient lab resources, untrained instructors, a lack of access to digital tools, and a failure to engage students or reflect real-world design challenges (Hamed et al., 2025; Sulistiana & Imron, 2024). This gap creates a pressing need for flexible, interactive and industry-aligned e-learning platforms. Motivated by these challenges, the MOOC Reinforced Concrete (RC) Design was developed to serve as a scalable and engaging solution for this gap, specifically for civil engineering and architectural education in Malaysia. This extended abstract aims to present the distinctive features, implementation strategy and effectiveness of this e-learning course based on feedback and survey results from its initial cohorts, which was published in 2022 and has been continually maintained by the developers. It can be assessed at https://ufuture.uitm.edu.my/mooc/course_detail.php?course=ECS559.

RC Design was developed and hosted on Universiti Teknologi MARA's (UiTM) Learning Management Platform *uFuture*. This course is built with several innovative features to empower learners to study at their own pace, tailored for civil engineering undergraduates and professionals who seek to build or reinforce their competencies in the design of RC structures. Structured around two key learning outcomes, content is delivered through professionally produced video lectures, downloadable notes, and various engaging learning activities. Six major topics enable learners to equip themselves with fundamental engineering and design knowledge on RC building design including slabs, beams, columns, shear walls and foundations based on Malaysia UBBL and Eurocode 2. Learners are encouraged to actively engage with the content through quizzes and online tests. The incorporation of gamified assessments, via platform like Quizizz, adds an element of competition and instant feedback, and helps in sustaining engagement while reinforcing key concepts. This course also incorporates a virtual site visit, where students observe real-world construction scenarios that enable a deeper contextual understanding. Since its launch in 2017, MOOC RC Design has attracted over 250 active users, with high levels of participation in assessments and discussion forums. The use of design software ESTEEM bridges the gap between theoretical knowledge and real-world design application, equipping learners with tools commonly utilised in industry practice. Assignment and project are crafted to simulate professional scenarios, encouraging critical thinking and problem-solving. Most importantly, this course fosters interactive learning through embedded comment sections, peer forums, and instructors feedback. This promotes a learning community that supports collaboration, reflection, and continuous improvement. The platform also ensures continual quality improvement (CQI) through

structured surveys and analytics, enabling instructors to refine content based on learner needs and performance trends. The innovation also includes an automated tracking feature that monitors course progress and triggers certificate generation upon completion, issued by UiTM. **Figure 1** shows the key features of MOOC RC Design.

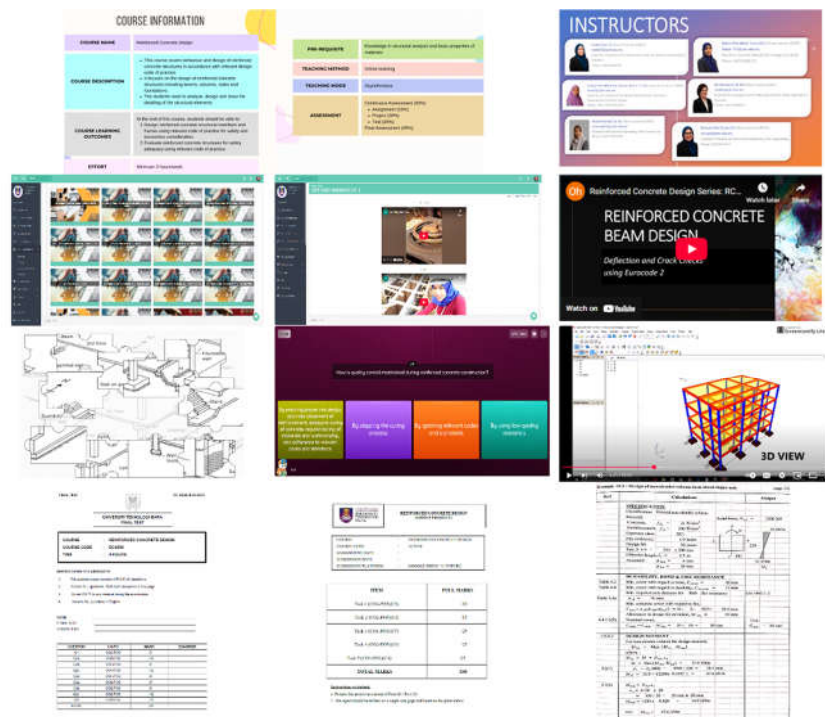


Figure 1. MOOC RC Design key features

METHOD

A quantitative survey-based study was conducted among undergraduate civil engineering students to evaluate the effectiveness of MOOC RC Design. The survey aims to assess learners’ perceptions and experiences with various components of the innovation, including course structure, content, learning activities, assessments, accessibility and perceived benefits. A structured questionnaire was developed comprising of six main parts: 1) prior understanding of RC Design, 2) course structure and delivery, 3) content and learning activities, 4) assessments, 5) accessibility and learning environment, and 6) benefits of taking RC Design. An additional open-ended section was included for qualitative feedback and suggestions for improvement. The questionnaire items were adapted and validated from previous MOOC effectiveness studies, ensuring content relevance and clarity.

The survey used a five-point Likert scale to measure levels of agreement or satisfaction, ranging from “Strongly Disagree” (1) to “Strongly Agree” (5), and “Very Unsatisfactory” (1) to “Very Satisfactory” (5), depending on the nature of the question. A total of 74 respondents from the Civil Engineering

undergraduate programme voluntarily participated in the survey after completing this course. Participation was anonymous and informed consent was obtained from all participants. Data collection was conducted online using a secure Google Form from May to June 2025. Responses were automatically tabulated for analysis. The data were downloaded in spreadsheet format and cleaned to ensure completeness and consistency. Descriptive and inferential statistical analyses were then performed to interpret the results. Open-ended responses were analysed using thematic analysis to extract key qualitative insights. Recurring themes were identified in the learners’ comments, which provided additional context to the quantitative findings, particularly in areas related to motivation, user interface design, and instruction clarity.

RESULTS AND DISCUSSIONS

The results, as illustrated in **Figure 2**, provide insight into learners’ understanding and satisfaction with MOOC RC Design. In **Figure 2a**, a significant majority of respondents (>80% recorded for “Very Much” and “Much” responses) indicate they understood the purpose and benefits of this course, suggesting that learners possess a strong grasp of what MOOC RC Design offers in terms of educational value. A small portion (12.2%) remained “Unsure,” while minimal responses were recorded for “Little” (5.4%) and “Very Little” (1.4%), indicating a low level of misunderstanding or unfamiliarity among learners. In **Figure 2b**, learners’ satisfaction regarding the effectiveness of MOOC RC Design is similarly positive. The majority of respondents (63.5%) agreed, and a further 28.4% strongly agreed that RC Design course offered through MOOC is effective, showing a cumulative 91.9% positive satisfaction level. Only a minor percentage remained undecided (8.1%), and notably, no respondents disagreed or strongly disagreed.

These results highlight the positive perception and effectiveness of MOOC RC Design in delivering meaningful learning experiences. The high levels of understanding and satisfaction among respondents support the continual integration of RC Design into formal and informal education frameworks. The findings also suggest that the instructional design and content delivery of MOOC RC Design effectively meets learner expectations.

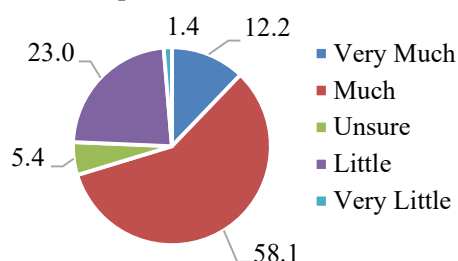


Figure 2a.: Level of understanding of the purpose and benefits of e-learning through MOOC RC Design

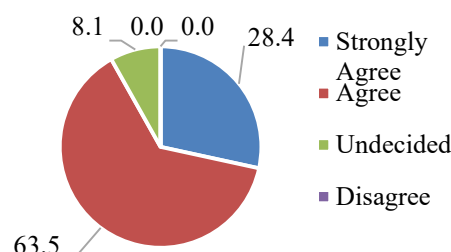


Figure 2b.: Overall satisfaction level on effectiveness of e-learning through MOOC RC Design

For the instructional design and content delivery of MOOC RC Design, the survey results demonstrate a high level of student satisfaction with this course, as shown in **Table 1**. A majority of respondents, 53% strongly agree and 39% agree, that the downloadable PDF lecture notes are useful indicating that learners value having accessible reference materials to support self-paced learning. Similarly, the short video lecture format (2–10 minutes) is well received, with 46% strongly agree and 41% agree responses, signifying that the video duration is appropriate. This suggests that microlearning strategies used in the MOOC aligned well with learner preferences and attention spans, contributing to higher engagement and retention.

The structure of learning activities over 10 sessions was also positively evaluated, with 55% respondents strongly agree and 34% respondents agree that the distribution was appropriate. This reflects effective modularization of the content, which is particularly important in sustaining motivation and enabling gradual progression in technical courses. The clarity of instruction was another strength, with 30% and 40% participants strongly agree and agree, respectively, that the content delivery was clear and easy to follow. This shows the effectiveness of the pedagogical approach, particularly the use of clear explanations, structured sequencing, and visual demonstrations in video lectures.

With regards to the use of educational technology, 32% respondents strongly agree and 33% respondents agree that the tools used are interesting and easy to navigate. While the majority response remains positive, the slightly lower percentage on disagreement spectrum suggests room for enhancement in terms of inter-activity or user interface design. For the assessment format, which comprising tasks with durations of 2–5 minutes, is seen as adequate by most learners (28% strongly agree and 36% agree). This indicates that concise assessments are effective in reinforcing key concepts without causing fatigue or cognitive overload. The relatively low percentages of disagreement (below 5%) and neutral responses (3%–11%) suggest that the majority of learners found this course to be a well-designed and engaging learning experience. Nevertheless, these minor neutral and negative responses highlight the potential areas for further improvement, particularly in enhancing technological engagement and refining content interactivity to better support diverse learning preferences.

Table 1.: Learners’ Responses on MOOC Features

Percentage Response (%)						
Responses	Lecture notes given in PDF file and can be downloaded	Video lectures given with duration range of 2-10 mins is appropriate	The learning activities were delivered throughout 10 sessions is acceptable	Instructional given in every lesson is clear and easy to follow	Educational technology used is interesting and easy to use	The assessment given with duration range of 2-5 mins is appropriate and adequate

Strongly Agree	53	46	35	41	43	38
Agree	39	41	55	46	45	49
Not Sure	3	11	4	11	9	11
Disagree	0	1	0	0	3	1
Strongly Disagree	5	1	5	3	0	1

CONCLUSION

The educational innovation of MOOC RC Design represents a significant step toward transforming civil engineering education in Malaysia by offering a flexible, accessible and interactive learning environment. Through a structured design and delivery model, this course successfully integrated essential topics in reinforced concrete design with modern digital tools such as video lectures, gamified assessments, virtual site visits and design software. An extensive survey involving 74 civil engineering undergraduates provided valuable insights into learner satisfaction and the overall effectiveness of the innovation. Feedback from respondents indicate a high level of satisfaction across all evaluated aspects, including course structure, instructional clarity, content relevance and platform usability. The participants appreciated the flexibility of MOOC RC Design and its ability to support deeper understanding through guided assessments and interactive activities. Statistical analysis further confirmed strong internal reliability and a consistent positive response across diverse learner backgrounds. This study highlights the potential of MOOCs to deliver technical engineering subjects effectively and equitably, especially in contexts with limited access to traditional classroom resources. These findings are significant for institutions and policymakers aiming to scale up digital education for engineering programs. Moreover, the RC Design innovation could be adapted for other disciplines, promoting innovation in teaching while supporting national goals for digital learning, educational transformation and SDG4.

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PENGUASAAN BIOLOGI SPM MELALUI VIDEO PEMBELAJARAN KOMPREHENSIF

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ABSTRAK

Pengajaran Biologi peringkat SPM memerlukan pendekatan yang kreatif dan inklusif, terutamanya bagi pelajar yang tidak mempunyai akses kepada sumber sokongan seperti tuisyen. Inovasi ini memperkenalkan satu pendekatan pembelajaran menerusi siri video dalam talian dwibahasa dan peta konsep komprehensif yang menepati sukatan pelajaran Kurikulum Standard Sekolah Menengah (KSSM). Inisiatif ini telah menghasilkan lebih 100 video, merangkumi kesemua 15 bab Tingkatan 4 dan 13 bab Tingkatan 5, disertakan peta minda terperinci dan strategi menjawab Kertas 1, 2, dan 3. Keberkesanan terbukti melalui capaiannya di saluran Youtube dengan lebih 2.5 juta tontonan dan 271,100 jam tontonan, menjadikannya salah satu sumber rujukan utama pelajar dan guru di seluruh negara.

Kata kunci: Biologi, SPM, Video dwibahasa, Peta konsep, Pendidikan terbuka.

PENGENALAN

Subjek Biologi merupakan satu komponen penting dalam pendidikan sains di peringkat menengah kerana ia membantu pelajar memahami hubungan antara organisma hidup dan persekitaran, serta asas biokimia yang menyokong kehidupan (Liu & Lee, 2013). Namun, kandungan Biologi yang kompleks dan abstrak seringkali menjadi cabaran utama kepada pelajar dan guru dalam proses pengajaran dan pembelajaran (Orazkul et al., 2022). Sehubungan itu, pendekatan yang bersifat visual, berstruktur, dan berfokus kepada pemahaman konsep seperti penggunaan peta konsep menjadi satu alternatif yang amat berkesan (Nunez et al., 2012). Penggunaan peta konsep dalam Biologi bukan sahaja memudahkan pengaitan antara topik baharu dan lama, tetapi juga menggalakkan pelajar membina kefahaman secara hierarki dan berkesinambungan (Orazkul et al., 2022).

Kurikulum Biologi SPM menuntut pelajar untuk menguasai bukan sahaja teori dan konsep, tetapi juga nilai dan kemahiran saintifik. Dalam konteks ini, peta konsep boleh membantu menyusun kandungan kompleks kepada unit-unit kecil yang mudah dihadap, berdasarkan peringkat aras kognitif dari pemahaman asas hingga ke penilaian kritikal. Strategi ini turut digunakan secara meluas dalam pendidikan sains kerana kemampuannya untuk meningkatkan penguasaan konsep dan menjadi alat pentaksiran. Peta konsep juga berperanan sebagai kerangka pembelajaran yang sistematik, memperlihatkan perkaitan antara subtopik serta membantu pelajar merancang dan menstrukturkan pembelajaran mereka (Davies, 2011; Hidayati et al., 2020).

Krisis pandemik COVID-19 telah mempercepatkan keperluan transformasi pedagogi di Malaysia apabila semua sekolah ditutup dan sesi pembelajaran terpaksa dijalankan secara dalam talian. Menyedari cabaran yang dihadapi oleh pelajar, terutamanya mereka yang tidak mempunyai akses kepada tuisyen atau bahan tambahan, satu inovasi pendidikan telah dibangunkan dalam bentuk video pembelajaran komprehensif dwibahasa yang menyokong pengajaran melalui peta konsep, merangkumi keseluruhan silibus Biologi Tingkatan 4 dan 5. Usaha ini bukan sahaja memudahkan pemahaman pelajar terhadap topik-topik Biologi yang mencabar, malah membolehkan mereka mengakses sumber berkualiti secara percuma, di mana-mana dan pada bila-bila masa.

KAEDAH

Peta Konsep Dwibahasa

Peta konsep disediakan dalam Bahasa Melayu dan Bahasa Inggeris, disusun secara aliran mengikut buku teks Tingkatan 4 & 5. Perisian Notability digunakan bersama iPad Pro bagi melukis dan menyusun cabang-cabang konsep dengan teliti. Setiap peta konsep menghubungkan subtopik secara sistematik, memudahkan pemahaman dan pengulangan.

Penghasilan Video Pembelajaran

Setiap peta konsep diterangkan secara terperinci melalui video. Lebih 100 video dihasilkan sendiri tanpa bantuan produksi luar. Setiap video disusun berdasarkan urutan sukatan pelajaran dan dijelaskan dalam dua bahasa. Topik-topik utama turut mengandungi perbincangan soalan SPM, panduan eksperimen, dan peta minda animasi.

Saluran YouTube Pendidikan

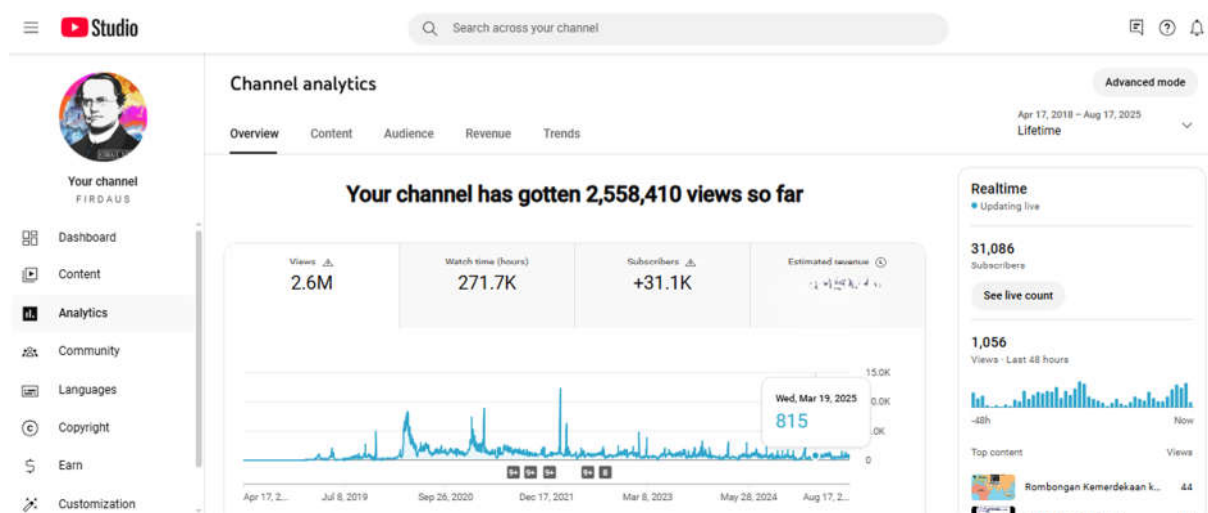
Kesemua video dimuat naik ke saluran YouTube peribadi yang kini mencecah lebih 2.5 juta tontonan dan 268,100 jam tontonan. Data diperolehi daripada YouTube pada bahagian Gambaran Keseluruhan (Overview), Analitik Saluran (Channel Analytics) di YouTube Studio. Video digunakan secara aktif oleh guru untuk PdP, pelajar untuk ulang kaji, dan tutor sebagai alat bantu mengajar.

DAPATAN DAN KESAN

Dapatan kajian ini diperoleh berdasarkan data capaian penonton, jumlah masa tontonan, serta maklum balas pengguna yang dikumpul melalui YouTube Studio dan aplikasi pesanan. Analisis ini memberi gambaran menyeluruh tentang tahap penerimaan, keberkesanan, dan impak bahan video Biologi yang dihasilkan.

Statistik Penggunaan

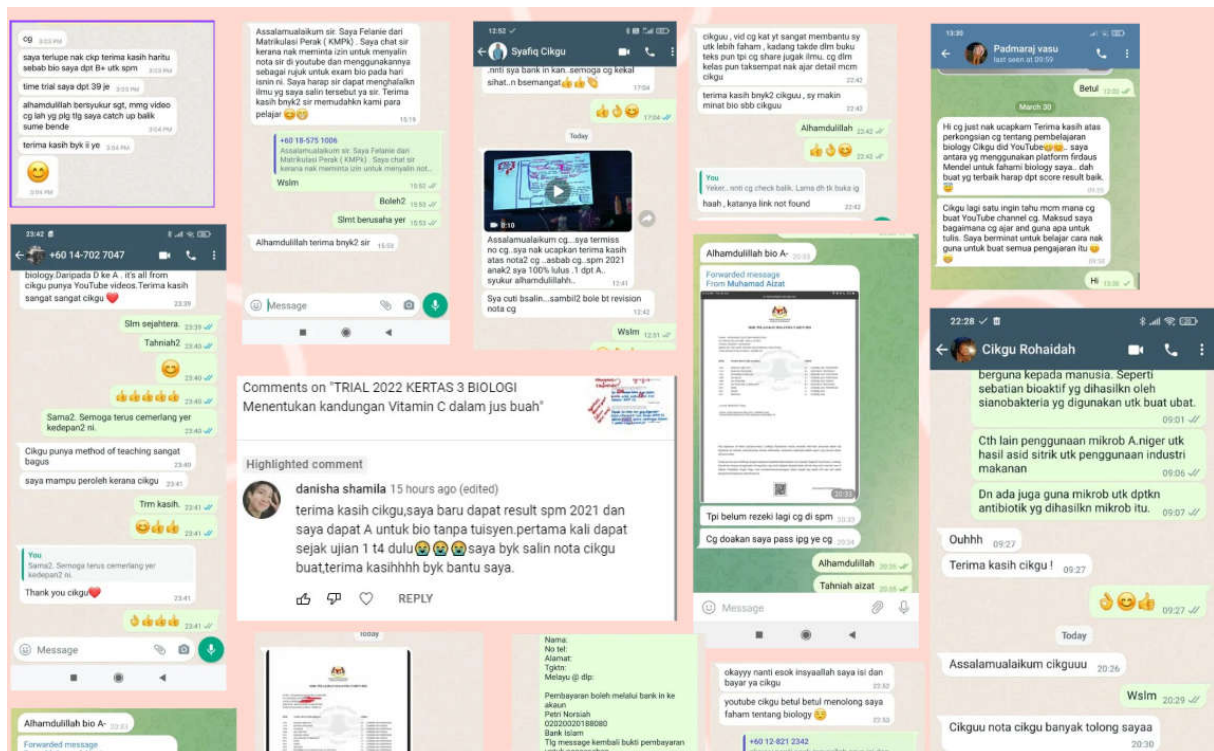
Setakat tahun 2025, data capaian menunjukkan jumlah jam tontonan ialah 271,700 jam dan jumlah tontonan melebihi 2.5 juta. Ini boleh dilihat pada Figur 1.



Figur 1.: Jumlah tontonan dan jam tontonan

Maklum Balas Pengguna

Ribuan komen positif diterima menerusi YouTube dan aplikasi pesanan. Ramai pelajar menyatakan bahawa mereka mengulang tonton kerana gaya penyampaian yang jelas, visual menarik, dan strategi menjawab SPM yang tepat. Guru juga memanfaatkan video dalam PdP harian. Figur 2 menunjukkan sebahagian dari maklumbalas mengenai video yang telah dihasilkan.



Figur 2.: Sebahagian dari maklumbalas mengenai video Biologi yang telah dihasilkan.

KESIMPULAN

Inisiatif ini membuktikan bahawa pendidikan berkualiti boleh diakses oleh semua, asalkan disampaikan dengan niat yang ikhlas dan pendekatan yang berkesan. Kombinasi peta konsep dwibahasa dan video digital mampu merapatkan jurang pendidikan serta memberi peluang adil kepada pelajar seluruh negara untuk menguasai Biologi SPM. Inovasi ini bukan sekadar satu projek digital tetapi merupakan sumbangan peribadi untuk pendidikan Malaysia.

PENGHARGAAN

Terima kasih kepada para pelajar, guru, dan komuniti pendidikan yang menyokong inisiatif ini.

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PICTO-PAIR DUEL: CHINESE CHARACTER BATTLE

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ABSTRACT

Mandarin is a popular third language in universities, but learners often struggle due to time constraints and the complexity of Chinese characters. Many students underperform, and some lose motivation. While various learning apps exist, not all meet learners' needs. To address this, Chinese character Battle (CCB) was developed to enhance mastery and motivation in learning Chinese characters. This study conducted at UiTM Sarawak, Mukah campus, involved Foundation Mandarin (Level II) students. An e-survey was distributed via WhatsApp to assess learners' perceptions of CCB's effectiveness after a trial period. Results showed that most learners found CCB helpful in improving their Chinese character recognition, reading, and comprehension. Pre and post test analyses confirmed progress in these areas. Given its positive impact, CCB is recommended as a teaching and learning tool for Chinese characters. Its engaging approach helps overcome traditional challenges, making Mandarin learning more accessible and motivating for students.

Keywords: *Learning Chinese character, Card game, Students' perception, Learning performance, Picto-pair duel*

INTRODUCTION

Learning a third language is a necessity in today's world. Therefore, various third languages have been offered at universities with the aim of producing competitive graduates. Mandarin is one of the third languages offered and has received a good response from the students. According to the Student Information Management System (SIMS) of Universiti Teknologi MARA, the number of student registrations in the Mandarin Language course increased in 2025 compared to the number of student registrations in 2024. Students who enroll in the Mandarin course are required to master Mandarin in terms of listening, speaking, reading, and writing (including writing Chinese characters). However, the

students' performance in the Mandarin course is unsatisfactory (Ch'ng, Ting, Chuah, 2018).

The lack of time exposure in teaching Chinese characters has caused students to be less proficient in writing Chinese characters. Furthermore, the Chinese writing system, which is vastly different from the alphabetical writing systems (such as English, Malay, and Spanish), also adds to the difficulty level in mastering Chinese character writing among students. According to a study conducted by Ch'ng, Ting, and Chuah (2018), non-native Chinese students recorded a very high frequency of errors in writing Chinese characters. A study by Jen and Xu (2000) reported that 91% of students decided not to continue learning Mandarin at a higher level due to the difficulty of learning Chinese characters. Such a situation needs to be addressed before the problem continues to persist.

The challenge of the Industrial Revolution 4.0, which emphasises the use of technology in teaching and learning (T&L), has driven the development and use of various applications as teaching and learning aids. Various Chinese character applications have been developed and can be obtained through the Google Play Store or Apple App Store, for example, Chinese Writer, Art of Chinese characters, CCcard-Chinese character card, zzHanzi Learn & Write Chinese, and so on. Although the applications can be used anywhere and at any time, their usage must meet certain conditions. For example, users need to have gadgets such as laptops, tablets, or smartphones when using the application. Users also need to have a stable internet connection to facilitate the use of the application. However, these requirements are difficult to meet for every user, especially those with heavy burdens or those located in remote areas where internet connectivity is hard to achieve. Therefore, board games and card games that do not require gadgets or internet connectivity have been widely produced as teaching aids. Picto-pair duel: Chinese Character Battle (CCB) is a card game that has been developed as an aid in learning Chinese characters. Various information related to Chinese characters has been provided to enhance students' knowledge of Chinese characters.

According to Shen (2005) and Allen (2008), recognising Chinese characters is the first step in learning Chinese characters. Therefore, CCB prioritises the step of "recognising Chinese characters" with the creation of pictographic Chinese characters. A study on students' overall perception of the use of CCB and the effectiveness of CCB in recognising Chinese characters was conducted by Ting and Lam (2021). This study is a review of the effectiveness of CCB in activities related to recognising and reading Chinese characters, as well as examining students' perceptions of the effectiveness of CCB in learning Chinese characters.

METHODS

This study was conducted at Universiti Teknologi MARA, Sarawak Branch, Mukah Campus. A total of 125 students enrolled in the Foundation Mandarin course (Level II) were selected as subjects for this study. The age of the subjects is in the range of 18-22 years. The number of subjects who are female (73.6%) is greater than males (26.4%). The use of instruments such as e-questionnaires has been generated through Google Forms for the purpose of data collection. The e-questionnaire consists of two sections, namely respondent information (Section A) and perception of the effectiveness of CCB

(Section B). Section B contains six questions regarding students' perceptions of the use of CCB in learning Chinese characters. The level of agreement of CCB users has been detailed through a five-point Likert scale, namely 1= Strongly Disagree, 2= Disagree, 3= Unsure, 4= Agree, and 5= Strongly Agree. The e-questionnaire has been shared in the WhatsApp group of students involved in this study. The Chinese character test question paper was prepared in the pre-test and post-test to evaluate the effectiveness of CCB as a tool for learning Chinese characters. A total of 55 Chinese characters were selected for this study. The Chinese characters selected in this study are the Chinese characters that were learned by the subjects during their enrollment in the Foundation Mandarin course (Level I), with the addition of several Chinese characters that exist in the syllabus of the Foundation Mandarin course (Level II). The data collected from the e-questionnaire forms and the Chinese character test results were analysed using the Statistical Package for Social Science (SPSS) software.

RESULTS AND DISCUSSION

Table 1 shows the frequency and percentage of students' perceptions regarding the effectiveness of using CCB in learning Chinese characters. The analysis of the collected data shows that majority of students agreed that the use of CCB benefits them in learning Chinese characters. Statement 1 (CCB meets my needs in learning Chinese characters) shows a high percentage of agreement with the total of 109 (44 agree, 65 strongly agree). The frequency of 29 agree and 71 strongly agree indicates that students agree with statement 2 (CCB helps me recognise Chinese characters easily). Additionally, the data also shows that majority of students agree that CCB enables them to understand the meaning of Chinese characters easily (25 agree, 74 strongly agree). 98 students (30 agree, 68 strongly agree) agree that CCB helps them become more confident when reading Chinese characters. The findings of this study also indicate that CCB enables students to recognise the origins of Chinese characters, with 28 agreeing and 71 strongly agreeing as recorded in Table 1.

Table 1.: Users' perception towards the usability of Chinese character card game

No	Statements	Strongly disagree (%)	Disagree (%)	Unsure (%)	Agree (%)	Strongly Agree (%)
1	CCB meets my needs in learning Chinese characters.	5 (4.0)	11 (8.8)	0 (0)	44 (35.2)	65 (52.0)
2	CCB helps me recognise Chinese characters easily.	3 (2.4)	12 (9.6)	10 (8.0)	29 (23.2)	71 (56.8)
3	CCB enables me to understand the meaning of Chinese characters easily.	2 (1.6)	14 (11.2)	10 (8.0)	25 (20.0)	74 (59.2)
4	CCB helps me become more confident when reading Chinese characters.	2 (1.6)	13 (10.4)	12 (9.6)	30 (24.0)	68 (54.4)
5	CCB enables me to recognise the origins of Chinese characters.	5 (4.0)	10 (8.0)	11 (8.8)	28 (22.4)	71 (56.8)

A pre-test and post-test on "Recognise and Read Chinese Characters" and "Understand the Meaning of Chinese Characters" were conducted in this study to test the effectiveness of using CCB in learning Chinese characters. Figure 1 shows the comparison of pre-test and post-test performance on "Recognise and Read Chinese Characters," while Figure 2 shows the comparison of pre-test and post-test performance on "Understand the Meaning of Chinese Characters" among students after using CCB during Chinese character learning. Based on Figure 1, it was found that the number of students who passed the pre-test on "Recognise and Read Chinese Characters" was 47 (37.6%), but the number of students who passed the post-test showed a significant increase to 107 (85.6%). Conversely, the number of student failures in the post-test decreased (18, 14.4%) compared to the pre-test (78, 62.4%). These findings prove that CCB is very effective in helping students recognise and read Chinese characters.

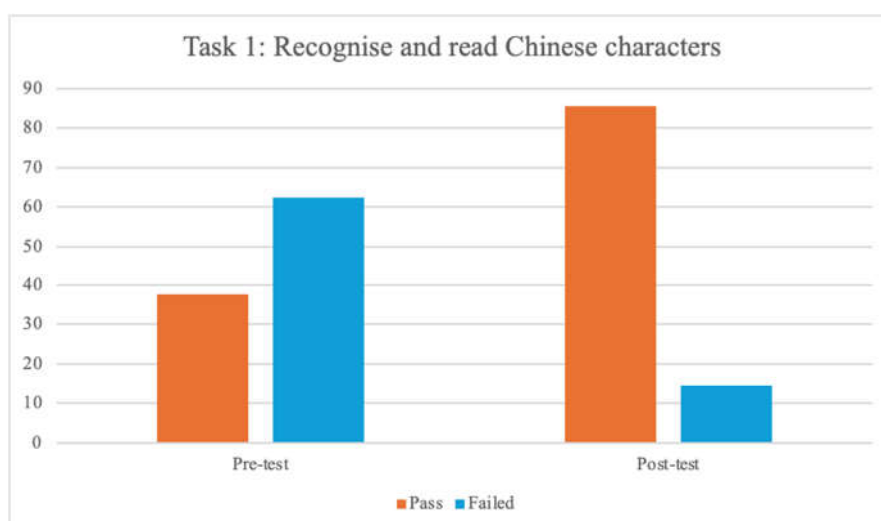


Figure 1.: Users' performance in recognising and read Chinese characters

Based on Figure 2, the number of students passing the post-test "Understanding the Meaning of Chinese Characters" increased from 89 (71.2%) to 104 (83.2%). The number of students failing the post-test decreased from 36 (28.8%) to 21 (16.8%). Although the number of students passing the post-test showed a slight increase, it cannot be denied that CCB is very effective in helping students understand the meaning of Chinese characters and CCB is very suitable to be used as a teaching and learning aid.

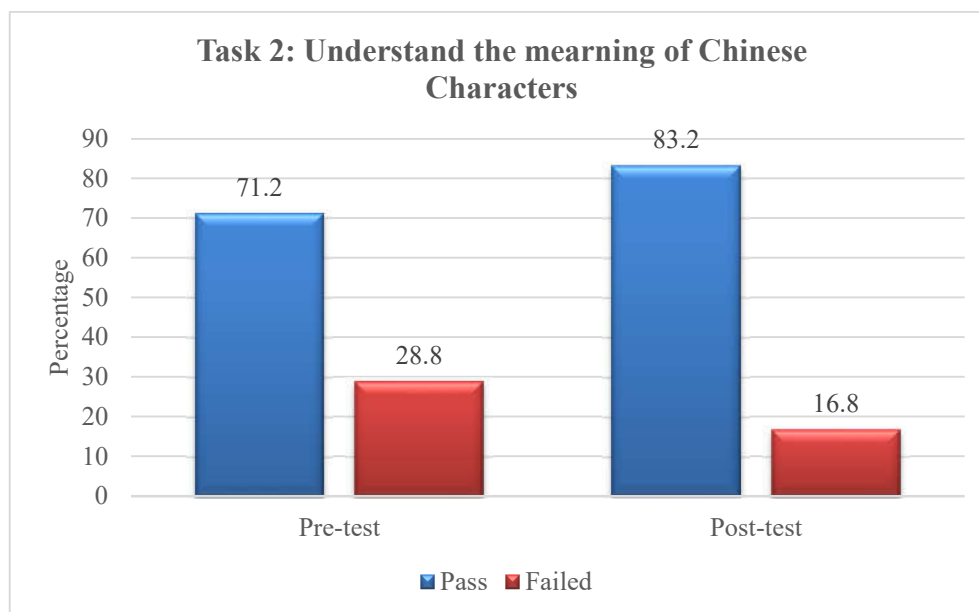


Figure 2.: Users’ performance in knowing the meaning of Chinese characters

CONCLUSION

In conclusion, the percentage and frequency of students who agreed and strongly agreed with all statements have shown that students have a positive attitude towards the use of CCB as an aid in learning Chinese characters. These findings were also supported by the post-test conducted after the use of CCB. The significant improvement in student performance in the post-test has proven that CCB is a highly effective teaching and learning tool for students in recognising, reading, and understanding the meaning of Chinese characters. The use of playing cards in learning Chinese characters can create a more enjoyable and happier atmosphere for learning Chinese characters. Student involvement in learning Chinese characters also increases through CCB games, thereby strengthening the relationship between students and Mandarin teachers. In addition, the use of CCB also increases students' motivation in learning Chinese characters compared to traditional techniques that emphasise repetitive rote memorisation. Therefore, the CCB intervention in Chinese character teaching and learning sessions can be considered by Mandarin teachers.

This study also created several limitations that need to be addressed in the future. Due to time constraints, CCB could only be played five times. Post-test delays also need to be implemented to evaluate the effectiveness of using CCB over a longer period. Student involvement in this study only includes students who are currently enrolled in the Foundation Mandarin course (Level II). Therefore, it is hoped that students who enroll in the Foundation Mandarin Course (Level I) will also be invited to participate in the next study. In addition, CCB was developed to assist non-native Chinese students and

native Chinese students who have just started learning Chinese characters. In this regard, the study sample is not limited to non-native Chinese students. A study on the effectiveness of CCB usage among native Chinese students also needs to be conducted.

ACKNOWLEDGEMENTS

We would like to express our gratitude to anonymous reviewers for their useful suggestions. We also would like to thank participants from Universiti Teknologi MARA, Sarawak Branch, Mukah campus who have contributed to the completion of this study.

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RED HERRINGS: AN INTERACTIVE MURDER MYSTERY GAME

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ABSTRACT

In this highly competitive world, critical thinking and problem-solving skills provide fundamental skills to be successful. Though traditional learning methods such as reading offer a great tool to enhance these skills further, implementing gamification in education, especially in the 21st century, has proven to not only develop these soft skills but also enhance an individual's creativity simultaneously. Hence, this project was created to explore how mystery-solving games contribute to critical thinking and problem-solving development. This project aims to design a mystery-solving game that challenges the players' analytical and theoretical skills while also encouraging reading in a more engaging way. The game was developed with puzzles requiring logical deduction and pattern recognition. A feedback survey was conducted to assess players' engagement and cognitive improvements. The findings proved that players demonstrated improved problem-solving skills after finishing the gameplay. Feedback suggests that interactive storytelling and created scenarios enhance learning outcomes. This study supports the use of gamified learning for critical thinking and problem-solving enhancement and suggests further exploration into educational game design.

Keywords: *critical thinking skills, problem-solving skills, gamification, mystery-solving games, educational game design*

INTRODUCTION

In this ever-changing world, critical thinking and problem-solving are crucial soft skills that one must obtain to survive in today's reality. With the rise of technology, the content displayed on social media brings more harm rather than good. Chen and Xiao (2022) found that social media addiction harms a student's mental repertoire and capacity, resulting in students losing focus in class. Due to social media, young adults nowadays do not have the brain cells to analyse situations critically and think outside of the box. Critical thinking is a domain-general thinking skill that is fundamentally used no matter what path or profession an individual pursues (Writers of UoPeople, 2024). Therefore, this project aims to sharpen critical thinking skills among young adults with a passion for mysteries.

‘Red Herrings’ is an interactive murder mystery game that challenges the players to solve the cases and scenarios by analysing clues and enhancing critical thinking and problem-solving skills while providing enjoyable and interactive gameplay. The game allows players to play the role of a detective, and they are obligated to solve the murder of Yasmine Mohamad, who is a first-year medical degree student. The three main suspects are Jasmine Mohamad, Haiqal Zariq, and Sofia Armin, who are all closely related to the victim. In the game, the players are provided with articles, police reports, victim case files, text message screenshots, and diary entries – all of which are intricately designed to give the realistic feel of a detective when handling real-life cases. This game is targeted at players over the age of 16, as the clues are written at a higher proficiency level. As the world is rapidly evolving, education must be adapted in creative ways. Hence, gamification in education is highlighted in this project. By combining gamification and education, individuals get to sharpen their critical thinking and problem-solving skills further, enabling them to create more innovative solutions to the complex problems that the digitalised era is providing nowadays. The primary purpose of ‘Red Herrings’ is to offer young adults an alternative tool to enhance their critical thinking and problem-solving skills in an interactive and immersive gameplay and promote reading in a more compelling way that encourages analytical skills. Therefore, this project intends to design a game that enhances critical thinking and problem-solving skills, creates scenarios that challenge communication skills, and promotes thoughtful analysis through games. This project holds entrepreneurial potential for expansion due to its gamification features that help enhance critical thinking and problem-solving skills. It can gain profit by conducting physical game sales in retail bookstores or e-commerce apps such as Shopee and Lazada, selling it at the estimated price of RM65. ‘Red Herrings’ also collaborated with other students by conducting a mini event where we showcased our innovations, giving us the opportunity to increase engagement among the potential buyers while also obtaining feedback.

METHODOLOGY

Three stages of development were conducted when creating this project. The first stage includes extensive drafting and planning on the game’s content. The second stage is developing the product based on the outline. The third stage is feedback collection and data analysis. The detailed explanation of each stage is as follows:

Content drafting

Since no pre-survey was conducted for this project, the first stage of developing ‘Red Herrings’ involved designing the game’s narrative structure and combining it with the critical thinking elements, such as analysing, evaluating, and creating (Ahuja, 2024), which are central to the gameplay. The focus was on creating a compelling storyline that would challenge players to think critically and solve problems. This process included creating detailed characters, suspenseful plot twists, and ambiguous plot holes that spur players to use logic and reasoning.

In developing the storyline, each plot element was taken into thorough consideration to ensure every sentence would contribute to fostering critical thinking, ensuring that the players’ choices

impacted the storyline and led to multiple outcomes. The content drafting of the game was constant, as continuous testing was involved to ensure that the game challenged critical thinking seamlessly.

Development Process

The next stage of creating 'Red Herrings' is the development stage, in which it was executed as a single-phase process, with the initial version of the game functioning as both the prototype and the final product. Firstly, the designs for the visual components of the game were drafted. For this project, each clue had different ways of creation. Clues, such as the Questioning Transcripts, were created using Google Documents, as the interface is foolproof and organised. Canva and Gemini AI were used to develop and inspire visual clues in the game fully, such as police logos and letterhead, victim and suspect files, victim and suspect pictures, diary entries, and text message screenshots, because of their convenient features. Extensive research on realistic components such as police reports and suspect files was done to ensure the players undergo an authentic detective-like experience.

The material creation of the game focused on creating scenarios in each clue, where players are compelled to analyse and critically connect the dots between each narrative provided in the game. Each clue was written and created ambiguously so as not to give out too much information and to allow the players to use their critical thinking and problem-solving skills to find the murderer.

After proofreading and editing the finalised clues, the refined game was sent out for printing. The production took only a day to complete. High-quality paper materials were used during the printing process to provide a professional and durable-looking appearance, ensuring that it is fitting to be played multiple times with many players. Then, the finalised product was ready for testing. Game testimony included young adults ranging from the ages of 16 to 21. After engaging in gameplay, participants were asked to fill in the feedback form to provide their insights on the game's ability to achieve its objectives and areas for improvement for the project.

This project began with pitching ideas to the appointed supervisor during consultation. Once the project is approved, research on game mechanics begins, including rules, processes, and game elements. After that, the outline of the game's plot is drafted for a week. In weeks 3 and 4, the game concept is designed. Four weeks are spent developing the clues, ensuring they are intricate and flow smoothly. During the clue development, the visual creation of the game is also made to attract more focus to the game. The game was then proofread and edited in weeks 9 and 10, ensuring correct grammar and structure. After printing, fellow students test and play the game during weeks 12 and 13. A feedback form is handed out to the players to fill out after the gameplay.

Data Analysis

A quantitative and qualitative method was employed to collect data for the feedback survey. Twenty-five respondents, aged 16 to 21-year-old young adults, completed a set of questionnaires to evaluate their personal experience carrying out the game and their judgement on its effectiveness,

usability, and design. The feedback collected was analysed through frequency counts while also adopting thematic analysis to identify the strengths and effectiveness of the game.

RESULTS AND DISCUSSION

Effectiveness in Improving Critical Thinking and Problem-Solving Skills

Respondents were required to answer whether the game improved their critical thinking and problem-solving skills. 14 out of 25 agreed that it was satisfactory in enhancing their critical thinking and problem-solving skills. In contrast, eight stated that it was excellent. 4 out of 25 decided that it was fair, and three stated that ‘Red Herrings’ improved their critical thinking and problem-solving skills

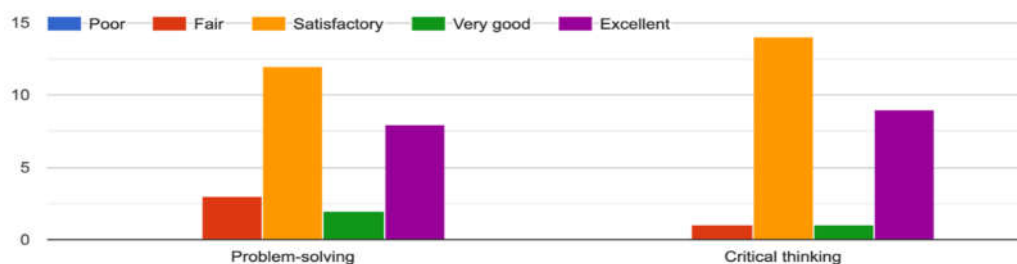


Figure 1.: Bar chart illustrating the effectiveness of the game

Opinion Whether More Games Like This Should Be Produced

The result indicates that respondents agree that games like Red Herrings should be produced more. When asked for reasoning, many emphasised how these games require them to analyse clues and make informed decisions, enhancing their critical thinking and problem-solving skills effectively in a more engaging way. Others noted that the ambiguity of the clues allowed them to become more detail-oriented when playing the game, which affected their decision-making and allowed them to create out-of-the-box theories when discussing the case.

Areas for Improvement

The findings underline several suggestions from participants to improve the game. While 16 stated that there should be no improvements on the game, 5 recommended that more visual aids should be added to the game to help the players find the murderer easier. Additionally, 3 respondents requested that there should be more plot twists in the game to enhance the engagement and suspense of the gameplay. Furthermore, another 2 respondents suggested creating better packaging for the game

display. While the game was a success in achieving its intended objectives, these suggestions will help further refine the project, allowing it to succeed in a wider audience.

CONCLUSION

In conclusion, this project explores how interactive games enhance critical thinking and problem-solving skills by engaging players with immersive gameplay. The findings highlight the educational potential of such games by examining the interactive visual elements that challenge players to analyse clues and draw conclusions. These insights suggest that incorporating mystery-solving mechanics into learning environments can foster cognitive development while creating enjoyable gameplay that ensures players do not lose interest. While respondents provided practical suggestions to improve the game, such as creating more clues and designing better packaging, it has allowed this project to be refined in the future. All in all, 'Red Herrings' successfully achieved its initial goal of creating an engaging game that enhances young adults' critical thinking and problem-solving skills.

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REINFORCING SEXUAL BOUNDARIES THROUGH INTERACTIVE SOCIAL NARRATIVES: AN INNOVATIVE APPROACH FOR ASD

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ABSTRACT

Empowering individuals with Autism Spectrum Disorder (ASD) to navigate social interactions with confidence is a critical step towards independence. Many ASD individuals struggle with self-regulation, particularly in managing sexual behaviour due to challenges in communication and social cue recognition. This groundbreaking innovation introduces a social story as an interactive self-representative tool to enhance self-control and behavioural awareness. Over an eight-week study, five ASD teenagers (aged 15–18) participated in a structured intervention involving pre-tests, post-tests, and observational analysis, revealing remarkable improvements in self-care, decision-making, and behavioural management. The findings underscore the transformative potential of social stories in equipping ASD individuals with ASD with essential life skills, bridging the gap between childhood and adulthood. This innovation redefines special needs education by fostering responsible behaviour and strengthening emotional intelligence, shaping a future where ASD individuals with ASD thrive with confidence and dignity.

Keywords: special needs, social story, behavioural intervention, self-regulation, social skills

INTRODUCTION

Individuals and adolescents diagnosed with Autism Spectrum Disorder (ASD) typically experience developmental differences across three core domains: communication, social interaction, and patterns of restricted or repetitive behaviours and interests (American Psychiatric Association, 2013). These interrelated challenges can significantly influence their sexual development, often giving rise to complex concerns regarding the expression and regulation of sexual behaviour. Increasingly, the

emergence of sexuality in ASD youth has caught parents, educators, and professionals unprepared, prompting difficult questions: What constitutes normative sexual behaviour? How can we distinguish between exploratory curiosity and potentially deviant conduct? And what early indicators signal the need for intervention?

The concept of “normality” in sexual development remains fluid and subject to debate across disciplines, with scholars like Tolman and McClelland (2011) emphasizing that interpretations of what is typical or appropriate vary widely based on cultural, developmental, and contextual factors. This ambiguity adds another layer of difficulty for those guiding ASD individuals through puberty. For ASD teenagers, the manifestation of sexual behaviours often triggers heightened concern, not solely due to the behaviours themselves but because they may occur in socially inappropriate contexts or be misinterpreted by others. Parents of ASD youth frequently grapple with the dual fear of their child being misunderstood and the risk of them engaging in or being subjected to unsafe situations (Nicholas & Blakeley-Smith, 2010). While these individuals may progress through physical and sexual developmental milestones in ways similar to their neurotypical peers, their capacity for social reasoning and emotional reciprocity may lag behind or develop unevenly (Abrams, 2017).

Such asymmetrical development means that rising sexual curiosity may not be met with a corresponding growth in social awareness, leaving ASD teens vulnerable to engaging in behaviours that are viewed as inappropriate, intrusive, or even threatening in public or interpersonal settings (Travers & Tincani, 2010; Huwaidi & Daghistani, 2013). This mismatch underscores the urgent need for innovative, inclusive, and contextualized interventions that not only educate but also empower ASD individuals to navigate the complexities of sexuality with autonomy, safety, and dignity.

"Body Zone" chart

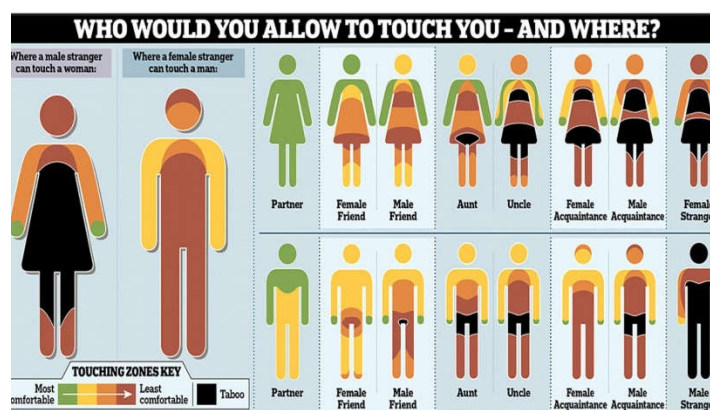


Figure 1.: General body zone chart

Abrams (2017) explained that to positively impact sexual behaviour among ASD individuals, educators and parents could use a "body zone" chart that visually identifies which body parts on a woman and man are private. For instance, educators can pictorially use 'red zone' to show private body zones for

the red signs used. However, for ASD individuals, colours are distracting (Boucher, 2009). Hence, the black and white picture is better to reduce the effect. However, Travers & Tincani (2010) suggested reducing colour usage would be a good idea. Hence, by innovating the idea of this role play, the researchers will only use three primary colours, which are green, yellow and red. If this idea is incorporated using role play technique, ASD individuals may experience it well due to their immense focal ability on the applied diorama technique.

Hence, this body zone chart is best adapted to the circle of connection and contact following the standard of the cognitive level of ASD individuals. It is best to visually personalise it by naming it "My Social Circle" and using the individual's name or sticking an ASD individual photograph in the "Me" circle to recognise it as pertinent to their lives. This social circle is essential to ASD individuals to prevent them from being harassed or lured into unwanted sexual cues. Parents and educators can portray this as a 'live' concept. The live concept refers to people who can move into and out of the circles with the corresponding rights and responsibilities these circles give them. The idea of these circles is well established in sexuality teaching, with some users using colours, names, or numbers to delineate between circles.

PRACTICE AND PROCESS

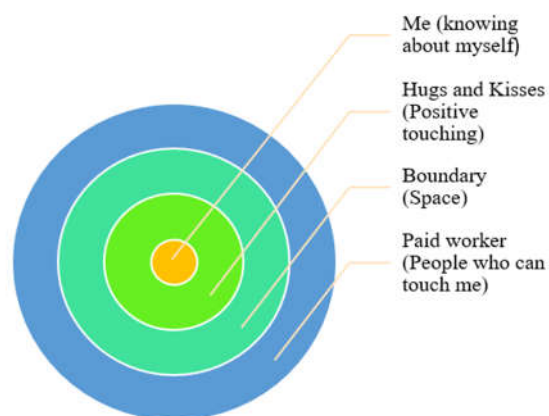


Figure 2.: Social Circle

Using role-play through doll play is designed to help people with ASD comprehend social settings. This method can educate ASD individuals on forecasting, anticipating particular events, and behaving appropriately (Gray, 2002). Social Stories provide accurate social knowledge and develop social awareness (Ozdemir, 2010). These brief, personalised stories help navigate new and often perplexing social situations. A Social Story also assists ASD individuals in gaining an appropriate grasp of social knowledge. It enhances a specific context by instructing who, what, when, where, and why of a social scenario

Upon this study, there are positive changes in sexual behaviour. It is merely because of integrating the social circle framework (Figure 2) into the role play (as shown in Figure 3). The integration

complements yet enriches communication skills with the Zone of Proximal Development (ZPD). The reason behind it is that the educators examine how a learner's performance is socially mediated (Pathan et al., 2018); hence, that is, how shared knowledge or inter-subjectivity is accomplished by bringing learners from their existing capabilities to a higher, culturally mediated level of development. Through this integration, ASD individuals will acquire all taught social competence.

CONCLUSION

The so-called improper sexual behaviour displayed by ASD individuals in the early stages is not something they yearn to do. Nevertheless, like any other human being, if someone does not know their action is right or wrong and is abruptly penalised, they will undoubtedly revolt in their emotions. The same thing will happen to those with ASD. Their emotional state revolted and erupted. Thus the situation will be invited to more uncontrollable sexual activity. Therefore, this method could assist the parents, special education educators, and clinical psychologists in tracking the history before ASD individuals fall into inappropriate sexual behaviour. In addition, retrieving the initial stage of the behaviour directing ASD individuals to fall into the sexual behaviour issue, would help the educators or even the therapist start a plan for a suitable Individual Education Program (IEP). Therefore, it is vital to overcome the issue before tackling the behaviour is more complicated.

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REVOLUTIONIZING OBE WITH CO-AIMS

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ABSTRACT

The advancement of Outcome-Based Education (OBE) in higher education calls for dynamic and sustainable systems that can effectively assess, monitor, and enhance student performance and lifelong learning outcomes. In response to this educational imperative, the College of Engineering Academic Information Management System (CO-AIMS) was developed by the Faculty of Electrical Engineering, UiTM Johor branch, Pasir Gudang campus to provide a comprehensive digital platform aligned with the goals of sustainable and innovative education. CO-AIMS integrates advanced computing technologies and utilizes the Rapid Application Development (RAD) model to address limitations in traditional tracking methods, such as fragmented data, manual reporting, and lack of real-time analytics. The system empowers academic advisors and curriculum managers to assess Program Outcome (PO) achievements at individual, course, and cohort levels through interactive dashboards, automated reports, and trend analytics. This data-driven approach not only promotes Continuous Quality Improvement (CQI) in curriculum delivery but also enhances institutional decision-making and transparency. Uniquely designed for scalability and adaptability, CO-AIMS ensures secure, cloud-based access and role-specific functions for stakeholders, supporting its implementation across faculties and campuses. Its innovation lies in transforming static assessment practices into a responsive, tech-enabled ecosystem that fosters sustainable education through empowerment, inclusivity, and lifelong learning principles. CO-AIMS is directly transforming education and advancing innovation by bridging critical gaps in academic data management and enabling a future-ready academic environment that supports both educators and learners. This initiative shows how technology can be effectively leveraged to create resilient and intelligent academic ecosystems for an empowered world.

Keywords: Outcome-Based Education (OBE), Continuous Quality Improvement (CQI), Program Outcomes (PO)

INTRODUCTION

Outcome-Based Education (OBE) has emerged as a transformative framework in the modern educational landscape, particularly in engineering programs where the focus is on aligning learning outcomes with industry-driven competencies. Unlike traditional models that emphasize content delivery, OBE centers on the measurable demonstration of knowledge, skills, and attitudes acquired by students upon program completion (Latha & Mohanamani, 2022). Within this paradigm, teaching strategies, assessment methods, and curriculum development are all tailored to ensure learners attain clearly defined Program Outcomes (POs).

As emphasized by (Pradhan, 2021), OBE encourages continuous and meaningful progress in student learning, demanding systems that can not only assess student achievement but also inform academic planning and continuous quality improvement (CQI). This is particularly critical in knowledge-based engineering education, where graduates are expected to meet rigorous accreditation standards.

(Othman et al., 2022) underscore the necessity of robust systems for tracking and evaluating PO attainment in order to uphold the integrity of OBE implementation. These systems offer valuable insights into student performance, curriculum effectiveness, and instructional impact, enabling educators to make informed adjustments that enhance the overall quality of education.

This paper introduces CO-AIMS (College of Engineering Academic Information Management System) a web-based platform developed by the Faculty of Electrical Engineering, Universiti Teknologi MARA (UiTM) Pasir Gudang. CO-AIMS is designed to support the effective implementation of OBE by providing real-time tracking, analytics, and reporting of student PO achievement.

METHODS

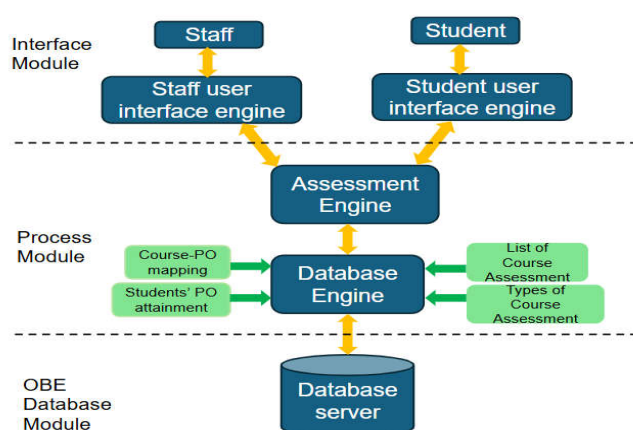


Figure 1.: Block diagram of CO-AIMS

CO-AIMS is designed with a modular architecture and developed using the Rapid Application Development (RAD) model to enable iterative prototyping and prompt user feedback. The system comprises three interconnected components: the Interface Module, the Process Module, and the OBE

Database Module as in Figure 1 above. The Interface Module offers two engines — one for staff (lecturers, advisors, and administrators) and one for students — so each group can interact with the system via dedicated dashboards: staff can input, map, and analyze data, while students can view their own PO achievement and advisory feedback. The core of the system is the Process Module, which includes an Assessment Engine linked to a Database Engine (Safiudin et al., 2020). This combination handles critical tasks such as mapping Course Outcomes (COs) to POs, calculating student PO attainment, and managing various assessment types. All processing is underpinned by the Database Module: a relational database server storing CO–PO mapping matrices, assessment records, and policy metadata. This enables real-time data validation, storage, retrieval, and reporting — essential for CQI. The modular design ensures that each component can operate independently while facilitating future integration, ensuring scalability and adaptability to evolving educational needs.

To evaluate the system's effectiveness, this system was carried out at the Faculty of Electrical Engineering, UiTM Pasir Gudang. User experience, system usability, and functional performance were observed during a full academic semester with academic staff utilizing CO-AIMS for PO tracking, report generation, and CQI processes.

RESULTS AND DISCUSSION

The implementation of CO-AIMS at the Faculty of Electrical Engineering, UiTM Pasir Gudang, showed positive outcomes in both usability and academic impact. Academic advisors reported that the system significantly reduced the time and effort required to compile, analyze, and report PO data. The automated report generation and visual dashboards enabled more efficient academic planning and streamlined audit processes.

In terms of system performance, CO-AIMS was found to be user-friendly, reliable, and adaptable for broader faculty use. It supported Continuous Quality Improvement (CQI) efforts by identifying underperforming areas and enabling evidence-based interventions. Overall, the system helped bridge the gap between teaching, assessment and outcome monitoring, making it a practical and scalable solution for sustainable OBE implementation.



Figure 2.: Features of My PA-PO Attainment with listed subjects and accumulated PO attainment

Figure 2 illustrates the 'MY PA-PO Attainment' interface, which presents a comprehensive overview of the subjects a student is currently taking in the ongoing semester. It also displays the cumulative PO attainment from semester 1 up to the present. The student's achievement for each PO is visually represented, with blue highlighting indicating that the faculty's Key Performance Indicators (KPIs) have been successfully met. The data in Figure 2 plays a vital role within the OBE framework, as it enables continuous monitoring and evaluation of a student's progress in achieving the targeted program outcomes throughout their academic journey.

Students also became more aware of their PO achievement, as advisors were able to explain performance trends using clear visual analytics. This improved the quality of academic consultations and encouraged students to take greater ownership of their learning progress. Figure 3 presents a radar chart that visually illustrates students' overall performance across all POs with each axis representing a specific PO. Higher values indicate stronger attainment, highlighting PO8 as the highest at 100%, and PO11 as the lowest at 50%. This chart is a valuable tool for quickly identifying both areas of strength and those requiring further improvement. Complementing this, a formal declaration of accuracy by both the PA and the student has been developed. It verifies that a discussion has taken place regarding the student's PO attainment and its alignment with the program's defined outcomes. This verification process ensures that the student is fully informed of their current performance and understands which areas need further development, reinforcing accountability and continuous improvement within the OBE framework.

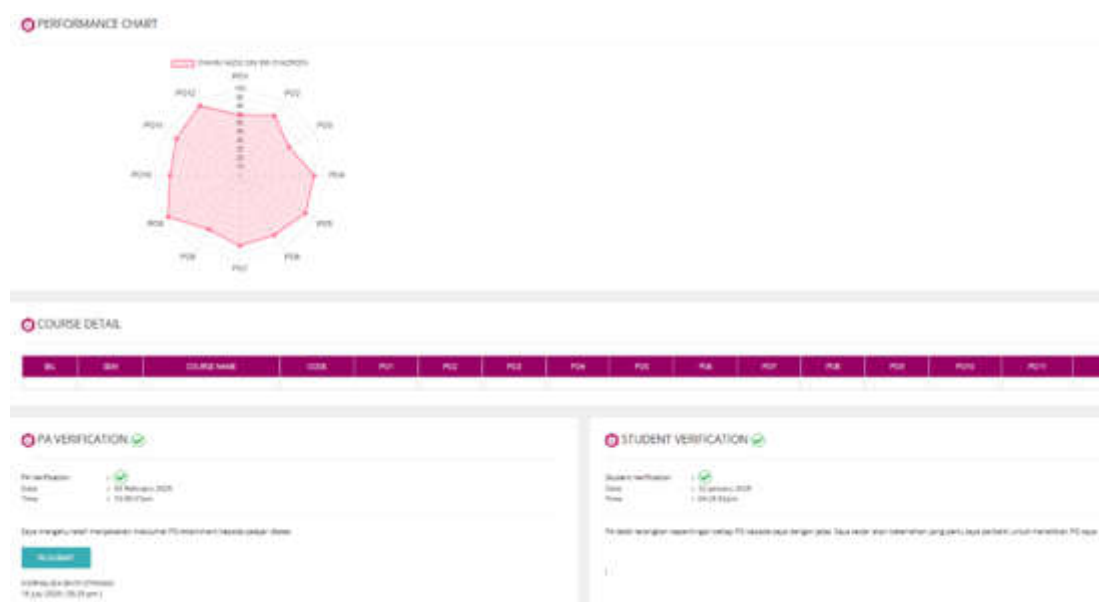


Figure 3. Features of performance chart, PA and student verification

CONCLUSION

In conclusion, the development of the CO-AIMS represents a significant leap forward in aligning higher education practices with the core principles of OBE and sustainable innovation. By addressing the shortcomings of traditional performance tracking, CO-AIMS provides a robust, data-driven platform that empowers educators, academic advisors, and curriculum managers to make informed decisions at every level of academic engagement. Its integration of advanced computing technologies and use of the Rapid Application Development (RAD) model ensures agility, scalability, and user-centered functionality, making it adaptable across faculties and campuses. The system’s interactive dashboards, automated reporting, and trend analysis tools foster transparency and facilitate CQI, directly enhancing student learning outcomes and institutional performance. Beyond its technical capabilities, CO-AIMS embodies a transformative approach to academic management that supports lifelong learning, promotes inclusivity, and prepares institutions for the demands of a future-ready education landscape. As such, CO-AIMS stands as a model for how intelligent digital systems can be strategically implemented to drive educational excellence and sustainability in higher learning environments.

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RHYTHM & RECALL: EDUBEATZ FOR COGNITIVE-FRIENDLY ECONOMICS EDUCATION

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ABSTRACT

***EduBeatz** offers an innovative approach to teaching business and economics by integrating music and rhythm to enhance memory and engagement. Traditional lecture-based methods often result in low knowledge retention, while active learning techniques, especially those using auditory and visual elements, can significantly improve learning outcomes. **EduBeatz** simplifies complex economic concepts into educational songs using familiar melodies and accessible lyrics, supporting learners with diverse cognitive needs, including short-term memory challenges and dyslexia. In this study, the researchers designed the lyrics and music by incorporating content from selected economics chapters, branding it as **EduBeatz**. To test the effectiveness of the lyrics and music, students were required to answer a questionnaire after listening to the song and lyrics. The study applies the Theory of Planned Behavior (TPB) to examine the intention to adopt music-based learning among 200 undergraduate students at Universiti Teknologi MARA (UiTM) Bandaraya Melaka. Using Partial Least Squares Structural Equation Modeling (PLS-SEM), the results show that Attitude, Subjective Norm, and Perceived Behavioural Control significantly influence students' intention, with Perceived Behavioural Control being the strongest predictor. Findings support **EduBeatz** as an effective and inclusive pedagogical tool with potential applications in classrooms, e-learning, and corporate training. By transforming theory into rhythm, **EduBeatz** makes learning more memorable, accessible, and enjoyable.*

Keywords: Music-based learning, Economics, Education innovation, Cognitive-friendly

INTRODUCTION

Economics education often relies heavily on abstract theories, complex graphs, and models, which can present significant cognitive challenges for students, particularly those with limited attention spans, short-term memory difficulties, or learning differences such as dyslexia. Traditional lecture-based teaching methods, though common, tend to result in low student engagement and poor retention of material. According to the National Training Laboratories, passive learning techniques typically yield only about 5% knowledge retention. Conversely, active learning strategies that incorporate auditory and visual stimuli have been shown to boost retention rates to as high as 80%. To address these challenges, EduBeatz was developed as an innovative, music-based educational tool that leverages rhythmic learning to enhance students' comprehension and long-term retention of key economics and business concepts.

METHOD & MATERIALS

The development and implementation of EduBeatz followed a learner-centered instructional design, structured around three key phases:

a. Concept Selection

Core economic concepts such as demand and supply were carefully selected due to their abstract nature and the common challenges students face in understanding them.

b. Lyric Development

These concepts were then transformed into simple, relatable lyrics. Special care was taken to maintain accessible terminology without compromising the accuracy of economic theories. Each song verse was crafted to align with specific learning objectives and incorporated repetition to support memory retention.

c. Melody Adaptation

Familiar and culturally relevant melodies, including nursery rhymes and popular local tunes, were adapted to accompany the lyrics. This strategy aimed to enhance emotional engagement and leverage the brain's natural affinity for rhythm and repetition, thereby facilitating easier recall.

d. Questionnaire to test the effectiveness of lyric and music

After being exposed to the lyrics and music, 200 undergraduate students participated by completing a questionnaire measuring their intention to study using music. The majority were aged between 21 and 23 years old (61.5%), with 80.5% being female. Additionally, 38% of the respondents were students from the International Business program. These students completed a questionnaire based on the Theory of Planned Behavior (TPB), measuring their intention to study using music.

FINDINGS

This study adopts the Theory of Planned Behavior (TPB) proposed by Ajzen (1991) to examine the factors influencing students' intention to use music and lyrics for learning or memorizing syllabus content. The TPB suggests that behavior is driven by three key factors: Attitude, Subjective Norm, and Perceived Behavioural Control, which collectively shape an individual's intention to perform a behavior.

In the theoretical model (see Figure 1), Attitude reflects students' positive or negative evaluation of using music in learning. It significantly influences intention ($\beta = 0.172$, $p < 0.05$), indicating that students who view music as helpful and enjoyable are more likely to use it. Subjective Norm represents social influence and was also significant ($\beta = 0.233$, $p < 0.01$), showing that encouragement from peers or educators increases students' intention to adopt music-based learning. The strongest predictor was Perceived Behavioural Control ($\beta = 0.514$, $p < 0.001$), highlighting that students' confidence and perceived ability to use music tools greatly enhance their intention.

Together, these three constructs explain 69.7% of the variance in intention, showing that the TPB framework is effective in predicting students' willingness to learn through music. This suggests that promoting positive attitudes, supportive environments, and practical access to music tools can encourage the integration of music into education.

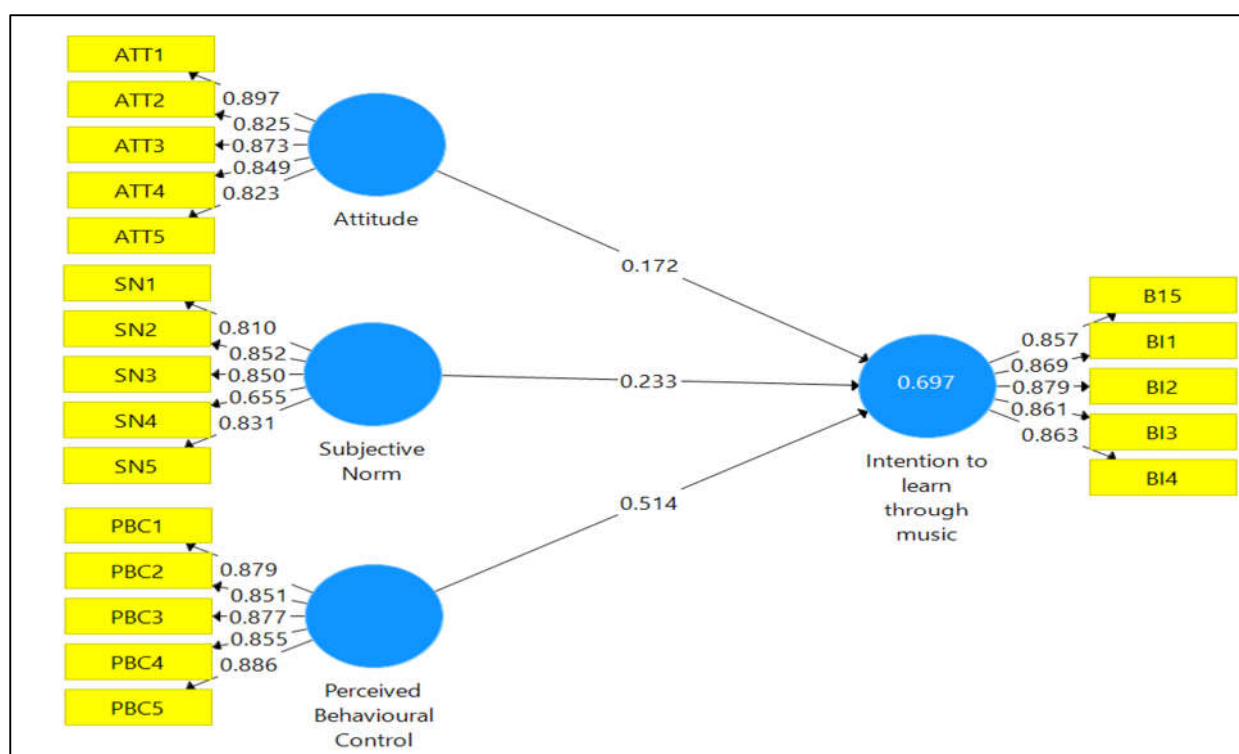


Figure 1.: Theoretical Model of the study

Measurement Model Approach

Table 1 presents the values for Cronbach's Alpha (CA), Composite Reliability (CR), and Average Variance Extracted (AVE) for the constructs of Attitude, Subjective Norm, Perceived

Behavioural Control, and Intention. Cronbach's Alpha and Composite Reliability are used to test internal consistency reliability. All constructs reported CA values above 0.86 and CR values above 0.90, which exceeds the commonly accepted threshold of 0.70. This indicates that the items for each construct consistently measure the intended concept. The AVE values range from 0.645 to 0.756, all of which are above the minimum acceptable value of 0.50. This demonstrates that more than half of the variance in the items is explained by the underlying construct, indicating good convergent validity.

Table 1.: Construct Validity and Reliability

Variables	Cronbach Alpha (CA)	Composite Reliability	Average Variance Extracted (AVE)
Attitude	0.907	0.931	0.729
Subjective Norm	0.862	0.900	0.645
Perceived Behavioural Control	0.919	0.939	0.756
Intention	0.917	0.938	0.729

Fornell-Larcker

To assess discriminant validity, the Fornell-Larcker criterion was applied. In this method, the square root of the AVE for each construct (shown on the diagonal) should be greater than the correlation values shared with other constructs (the off-diagonal values). The diagonal values such as 0.854 for Attitude, 0.866 for Intention, 0.870 for Perceived Behavioural Control, and 0.803 for Subjective Norm are all greater than the corresponding inter-construct correlations. This confirms that each construct is distinct from the others, thus establishing discriminant validity.

HTMT

Further confirmation of discriminant validity was obtained through the HTMT approach. The HTMT values for all construct pairs were below the recommended threshold of 0.90. For instance, the HTMT between Attitude and Intention was 0.738, and between Intention and Perceived Behavioural Control was 0.877. These values indicate that the constructs are empirically distinct and do not overlap excessively.

Structural Model Approach

The findings in Table 2 reveal that Attitude, Perceived Behavioural Control, and Subjective Norm significantly influence the intention to use music and lyrics in educational contexts, particularly for remembering and understanding syllabus content. Among these variables, Perceived Behavioural Control emerged as the most influential, highlighting the importance of self-efficacy and perceived ease of implementation. These results support the application of the Theory of Planned Behavior in the context of music-integrated learning and suggest practical implications for educators seeking to promote creative and engaging methods in their teaching strategies.

Table 2.: Structural Model

H	Direct Effect	β	Std. Error	t-Value	p-Value	Result
H1	Attitude > Intention	0.172	0.082	2.090	0.037	Accepted
H2	Perceived Behavioural Control > Intention	0.514	0.091	5.670	0.000	Accepted
H3	Subjective Norm > Intention	0.233	0.069	3.375	0.001	Accepted

Overall, this study demonstrates the effectiveness of integrating music and lyrics into economics education through the EduBeatz approach. Lyrics and melodies were carefully designed by the researchers based on selected economic concepts to simplify and enhance understanding. These educational songs were then presented to students, who were subsequently asked to complete a questionnaire to assess their acceptance and intention to use music as a learning tool. Using the Theory of Planned Behavior (TPB), the findings reveal that Attitude, Subjective Norm, and Perceived Behavioural Control significantly influence students' intention, with Perceived Behavioural Control emerging as the strongest predictor. The results from undergraduate students at UiTM Bandaraya Melaka suggest that music-based learning is well accepted and offers cognitive support, particularly for diverse learner needs. EduBeatz presents a creative, inclusive, and engaging teaching method that can be further explored across disciplines and educational platforms.

DISCUSSION

EduBeatz marks a transformative advancement in teaching strategies by integrating music and rhythm into economics and business education. This method aligns closely with active learning principles, which prioritize learner engagement, multisensory experiences, and emotional connections to the material. By distilling complex economic theories into structured, rhythmic songs, EduBeatz effectively tackles common challenges of traditional lecture-based approaches—namely, low retention and student disengagement. The observed and anticipated gains in comprehension and recall highlight EduBeatz's effectiveness for a diverse range of learners, including those with cognitive differences such as dyslexia and short-term memory difficulties. By pairing musical rhythm with core economic concepts, the approach leverages dual coding theory, where verbal and non-verbal cues work together to strengthen memory pathways and enhance learning outcomes. Furthermore, EduBeatz's interactive format fosters greater student participation, alleviates anxiety around challenging content, and boosts intrinsic motivation. These benefits not only improve academic achievement but also enrich the overall learning experience, making education more inclusive and enjoyable. Significantly, EduBeatz's flexible design allows for easy adaptation beyond economics, making it suitable for other academic subjects, language learning, and even corporate training—particularly within digital or e-learning platforms. As such, EduBeatz represents a scalable and innovative educational tool that meets the demands of 21st-century learning and supports cognitive-friendly teaching practices (Rosman, Ismail, & Masrek, 2021).

CONCLUSION

EduBeatz presents an innovative reimagining of business and economics education by converting complex, abstract theories into captivating, rhythm-based content. By tapping into learners' cognitive strengths especially those facing memory or learning challenges EduBeatz shows great promise in enhancing both knowledge retention and student engagement. These anticipated benefits underscore the effectiveness of music-based learning as an inclusive and impactful alternative to traditional lecture methods. Additionally, EduBeatz's versatility and broad appeal position it well for expansion across various disciplines and educational levels. It holds potential for seamless integration into digital learning environments, licensing opportunities for educational institutions, and incorporation into corporate training programs. As education continues to evolve toward learner-centered and cognitively responsive models, innovations like EduBeatz demonstrate that making learning both memorable and meaningful can lead to profound, lasting impact.

ACKNOWLEDGMENTS

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S.T.O.R.I.A. STORYTELLING AND TECHNOLOGY OUTREACH FOR REVIVING INDIGENOUS ARABIC

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ABSTRACT

S.T.O.R.I.A. (Storytelling and Technology Outreach for Reviving Indigenous Arabic) is an innovative digital learning solution designed to integrate language acquisition with cultural preservation. This project combines authentic Semai oral narratives with Arabic language instruction in an immersive audiobook format. The intervention addresses the limited availability of engaging, culturally relevant resources for non-native Arabic learners while promoting respect for indigenous heritage. A Semai folktale titled The Rules of The Jungle was selected, translated, and enriched with targeted Arabic vocabulary. Professional narration, sound design, and visual aids were developed to create a multimedia experience accessible on mobile devices. Learners participated in a four-week program involving listening sessions, interactive tasks, and reflection activities. Pre- and post-intervention assessments measured vocabulary retention, motivation, and learner perceptions. The results demonstrated significant improvements in vocabulary recall and sustained motivation to learn Arabic. Learners also reported a deeper emotional connection to the stories, which enhanced engagement and cultural awareness. These findings align with previous research highlighting the effectiveness of digital storytelling in language education. S.T.O.R.I.A. demonstrates that culturally integrated, technology-driven tools can make language learning more meaningful, inclusive, and sustainable. This model offers strong potential for adaptation to other languages and contexts, creating a valuable resource for educators and learners committed to preserving cultural identity while advancing linguistic competence.

Keywords: Digital storytelling, Arabic language learning, Semai folktales, Cultural preservation, Motivation

INTRODUCTION

In today's digitally connected world, language learning must evolve beyond rote memorization to engage learners in culturally authentic and emotionally meaningful ways. S.T.O.R.I.A. (Storytelling and Technology Outreach for Reviving Indigenous Arabic) was developed to address this challenge by blending the endangered oral heritage of Malaysia's Semai community with Arabic language acquisition in an innovative digital format. Despite the growing importance of Arabic as a global language in business, diplomacy, and education, many non-native learners continue to face significant challenges in acquiring vocabulary and developing listening skills. Traditional Arabic resources often rely on repetitive drills, outdated textbooks, and decontextualized examples that fail to reflect real-life communication (Jones & Lee, 2018). This lack of engaging and relevant materials frequently results in low motivation and poor retention of new language skills.

At the same time, Semai folktales, which represent a vital part of Malaysia's intangible cultural heritage, are at risk of disappearing as younger generations increasingly consume standardized, global media (Ali & Subri, 2020). As Ali and Subri (2020) emphasize, neglecting indigenous narratives in educational content not only contributes to the erosion of cultural identity but also limits opportunities to create more inclusive, meaningful learning experiences that validate diverse cultural perspectives. Jones and Lee (2018) have highlighted that language materials rarely provide authentic contexts that help learners internalize vocabulary and develop true communicative competence. Meanwhile, Hassan and Youssef (2019) found that digital storytelling methods significantly enhance vocabulary retention and learner engagement by integrating narrative, visual, and auditory elements.

Therefore, this study is significant because it offers evidence that an innovative, culturally integrated audiobook can serve a dual purpose: enhancing Arabic language proficiency for non-native speakers while simultaneously preserving and celebrating the Semai community's oral traditions in a way that is relevant, motivating, and respectful.

Research Objectives:

RO1: To assess the effectiveness of STORIA in improving learners' vocabulary retention over time.

RO2: To evaluate learners' satisfaction with the STORIA digital storytelling experience.

RO3: To examine the impact of STORIA on learners' motivation levels throughout the learning period.

RO4: To explore how integrating Semai folktales into Arabic language learning influences learners' awareness and appreciation of indigenous cultural heritage.

Research Questions:

RQ1: How does the use of STORIA influence vocabulary retention from pre-intervention to four weeks after implementation?

RQ2: What are learners' satisfaction levels with STORIA, and which aspects of the program contribute most to their satisfaction?

RQ3: How does learner motivation change over the four-week use of STORIA and what factors support sustained engagement?

RQ4: How does exposure to Semai folktales through STORIA affect learners' understanding and appreciation of Semai indigenous culture?

METHODS

This study employed a design-based research approach to systematically evaluate the effectiveness, learner satisfaction, motivational impact, and cultural relevance of S.T.O.R.I.A. in Arabic language learning. The methodology was structured to address each research objective and corresponding research question comprehensively.

Participant Selection

A purposive sample of non-native Arabic learners was recruited. Participants were selected based on their beginner-to-intermediate Arabic proficiency to ensure the content was appropriate and challenging. Prior to the intervention, all participants provided informed consent.

Intervention Materials

An authentic Semai folktale, *The Rules of The Jungle*, was chosen as the core content. The story was translated into Arabic and enriched with carefully selected vocabulary and sentence structures relevant to beginner and intermediate learners. Professional narration in Modern Standard Arabic was recorded and accompanied by sound design and culturally appropriate visual aids to create an immersive audiobook experience.

Procedures

The study unfolded over four stages:

1. Pre-Assessment (Baseline Data Collection):
 - Vocabulary Retention (RO1/RQ1): A pre-test consisting of targeted vocabulary items from the audiobook measured baseline retention.
 - Motivation (RO3/RQ3): A motivation questionnaire adapted from validated language learning scales assessed initial attitudes.
 - Cultural Awareness (RO4/RQ4): A brief survey measured prior knowledge of Semai culture.
2. Intervention (Audiobook Use):
 - Over four weeks, participants listened to the audiobook episodes on mobile devices.

Each episode was accompanied by comprehension questions and vocabulary reinforcement tasks.

- Interactive reflection activities encouraged learners to connect the story to their personal experiences and cultural understanding.

3. Post-Assessment:

- Vocabulary Retention (RO1/RQ1): A parallel post-test measured improvements in vocabulary knowledge.
- Motivation (RO3/RQ3): The motivation questionnaire was repeated to capture changes over time.
- Satisfaction (RO2/RQ2): A structured satisfaction survey evaluated learners' perceptions of the audiobook's usability, content quality, and engagement.
- Cultural Awareness (RO4/RQ4): A follow-up survey and open-ended reflection logs assessed changes in understanding and appreciation of Semai heritage.

4. Data Analysis:

- Quantitative Data: Pre- and post-test scores for vocabulary and motivation were compared descriptively to determine gains. Frequencies and percentages were calculated for satisfaction responses.
- Qualitative Data: Reflection logs and open-ended survey responses were analyzed thematically to identify patterns of learner experiences, emotional connection, and cultural appreciation.

Alignment to Research Objectives and Questions:

- RO1/RQ1: Effectiveness in improving vocabulary retention was measured by comparing pre- and post-intervention test scores.
- RO2/RQ2: Satisfaction levels and contributing factors were captured through structured surveys.
- RO3/RQ3: Motivation changes were evaluated with repeated measures of motivational attitudes.
- RO4/RQ4: Cultural awareness and appreciation were assessed through pre-post surveys and thematic analysis of reflections.

ETHICAL CONSIDERATIONS

All participation was voluntary, and data was anonymized. Learners could withdraw at any stage without penalty. This structured methodology ensured comprehensive data collection and analysis, directly addressing each research objective and question to evaluate the impact of S.T.O.R.I.A. on Arabic language learning and cultural preservation.

RESULTS AND DISCUSSION

Research Question 1 - How does the use of STORIA influence vocabulary retention from pre-intervention to four weeks after implementation?

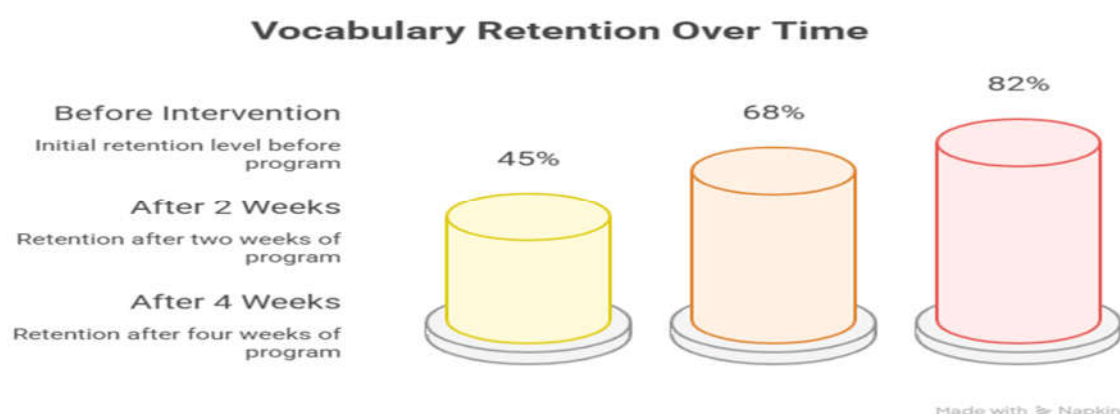


Figure 1.: Vocabulary Retention over time

The chart illustrates the progression of learners' vocabulary retention throughout their participation in the QissahConnect program.

Before Intervention:

Learners started with an initial vocabulary retention level of 45%, indicating that less than half of the target words were recalled accurately before using the program.

After 2 Weeks:

Following two weeks of engaging with QissahConnect's digital storytelling and interactive activities, vocabulary retention improved significantly to 68%. This increase shows early positive effects of the program on learners' memory and understanding of new words.

After 4 Weeks:

By the end of four weeks, retention rose further to 82%. This result demonstrates that continued exposure and repeated practice through the platform led to sustained vocabulary acquisition over time.

Overall, the findings clearly indicate that STORIA effectively enhances vocabulary retention. The consistent improvement—rising from 45% to 82%—suggests that integrating culturally relevant storytelling and multimedia learning can substantially strengthen language outcomes. These results support the value of using innovative, culturally rooted educational technology to boost learner engagement and achievement.

Research Question 2 - What are learners' satisfaction levels with STORIA and which aspects of the program contribute most to their satisfaction?

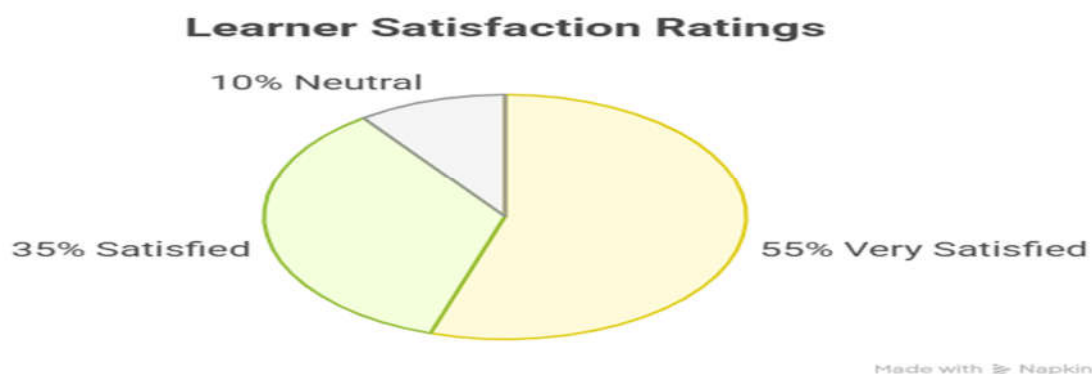


Figure 2.: Learner Satisfaction Ratings

The chart displays learners' satisfaction levels after using the STORIA program: The overall results demonstrate a strong positive reception of STORIA with 90% of learners expressing satisfaction or high satisfaction, the data suggests the platform successfully engaged participants, supported their learning, and met its educational objectives. These findings validate the program's effectiveness in delivering culturally relevant, motivating Arabic language instruction.

Research Question 3 - How does learner motivation change over the four-week use of STORIA, and what factors support sustained engagement?



Figure 3.: Motivation Level Over 4 weeks

This upward trend demonstrates that STORIA effectively maintained and boosted learners' motivation over time. The steady increase from a moderate level (6) to a very high level (9) suggests that combining cultural storytelling with interactive digital learning helped keep learners interested, invested, and eager to continue studying Arabic.

Research Question 4 - How does exposure to Semai folktales influence learners' understanding and appreciation of indigenous culture?

Table 1.: Thematic Analysis

Theme	Description	Sample Learner Quote
Theme 1: Increased Cultural Awareness	Learners reported that the stories introduced them to Semai customs and beliefs previously unknown to them, highlighting respect for nature and community values.	<i>"I never knew how important the forest is to the Semai way of life until I heard these stories."</i>
Theme 2: Personal Connection and Empathy	Participants felt a personal connection to the characters and situations, reflecting on their own cultural identity and building empathy towards Semai ancestors.	<i>"These stories made me feel closer to the people who have been here for generations."</i>
Theme 3: Motivation to Learn More	Exposure to authentic narratives sparked curiosity and motivated learners to explore indigenous heritage further, making Arabic learning feel more meaningful.	<i>"This is the first time language learning felt like learning about real people, not just words."</i>

Integrating Semai folktales into Arabic language learning enriched learners' cultural understanding, built empathy, and increased motivation. Thematic analysis showed that authentic storytelling broadened knowledge of Semai traditions, encouraged reflection on identity, and made learning more meaningful and engaging. These outcomes align closely with previous research by Hassan and Youssef (2019) and Ali and Subri (2020), which demonstrated that culturally integrated, multimedia storytelling strengthens language skills, promotes intercultural respect, and fosters positive attitudes toward learning. The findings confirm that combining heritage content with modern technology is an effective strategy to create inclusive, impactful educational experiences.

CONCLUSION

The findings of this study demonstrate that S.T.O.R.I.A. is an effective and innovative approach to Arabic language learning that successfully integrates cultural preservation with modern educational technology. Learners showed significant improvements in vocabulary retention, confirming that immersive storytelling can enhance language acquisition more effectively than traditional methods. Motivation levels increased steadily throughout the four-week intervention, indicating that the engaging audiobook format sustained learners' interest and encouraged continued participation. The

majority of participants expressed high satisfaction with the overall experience, particularly valuing the combination of professional narration, culturally rich content, and interactive reflection activities. Additionally, the study revealed that integrating Semai folktales into the curriculum not only enriched cultural awareness but also fostered empathy and appreciation for Malaysia's indigenous heritage.

ACKNOWLEDGEMENTS

We extend our heartfelt thanks to Universiti Teknologi MARA Cawangan Kedah for their support and resources throughout this study. Special gratitude goes to the Semai community for generously sharing their rich cultural heritage and stories, which form the heart of this initiative. We also acknowledge the valuable insights provided by the dedicated educators and language experts who offered constructive feedback during the design and evaluation phases.

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SHAREPAD: A COLLABORATIVE AND CUSTOMISABLE DIGITAL PLATFORM FOR TEACHING AND LEARNING

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ABSTRACT

This project introduces SHAREPAD, an innovative and interactive online teaching and learning tool developed using the PADLET platform. SHAREPAD addresses common challenges in traditional classroom settings, such as limited real-time collaboration, difficulty accessing resources, and low student engagement. SHAREPAD, which was created as a centralised, multimedia-rich learning environment, enables teachers and students to collaborate and exchange ideas and content across multiple devices and locations. It encourages students' interaction and creative expression, supporting a variety of educational philosophies with features such as real-time feedback, privacy restrictions, and adjustable layouts. Additionally, SHAREPAD has great marketing potential because subject-specific modules may be created, disseminated, and sold to teachers at all educational levels, from elementary to university, fostering a more cohesive and expansive teaching community.

Keywords: Real-time collaboration, Online platforms, Digital board, Pedagogical tool

INTRODUCTION

In recent years, the integration of technology in education has become essential for enhancing student engagement, promoting collaborative learning, and improving access to resources. Traditional pedagogical practices often limit students' ability to access learning materials in real-time, collaborate actively with peers, and express creativity using varied formats (Brown, 2021). Asynchronous communication, one-directional information delivery, and reliance on static teaching resources frequently disengage learners, especially in digitally native generations (Prensky, 2001). To address these challenges, online educational platforms have emerged as powerful tools that reshape the teaching and learning landscape. Among them is SHAREPAD, a digital platform developed using PADLET technology, designed to centralise learning materials, enable real-time

collaboration, and support multimedia content creation in educational contexts.

SHAREPAD functions as an interactive digital board that empowers educators to design flexible and student-centred learning spaces. It is not only beneficial for students but also facilitates professional collaboration among teachers and lecturers. The platform enables educators to curate, organise, and disseminate a wide range of learning resources, including texts, images, videos, audio, and external links, catering to diverse learning styles. In Malaysia's higher education context, particularly in English Language Teaching (ELT), SHAREPAD has the potential to transform conventional delivery modes by supporting blended and remote learning approaches that align with 21st-century learning needs (MOE Malaysia, 2013).

This study aims to present the development and implementation of SHAREPAD as a digital pedagogical tool and to examine its usability, accessibility, collaborative features, and commercialisation potential within a higher education setting.

METHODS

Platform Development and Design

SHAREPAD was designed using PADLET, a web-based platform that supports interactive multimedia boards. The primary features leveraged include Layout Customisation, such as grid, stream, shelf, and canvas views, which can be used to create subject-specific and weekly lesson plans. The next feature is multimedia integration, which supports a variety of media types, including text, images, videos, audio, embedded content, and downloadable files. Access control is another feature of this platform, which includes password protection and invitation-based access to ensure privacy and secure content delivery. The last feature of this digital platform is its collaboration tools, which enable commenting, real-time editing, and reaction functions (e.g., likes, stars) to encourage participation and feedback.

Educators involved in this project customised boards for their respective courses, categorising content according to weekly topics and learning outcomes. They utilised SHAREPAD boards for instructional delivery, brainstorming activities, group projects, and sharing resources.

Participants

The platform was piloted with a group of 78 undergraduate students at Universiti Teknologi MARA (UiTM) across three classes over a semester (14 weeks). Three lecturers participated as content creators and facilitators. The participants represented a range of digital competencies, enabling an assessment of SHAREPAD's usability across diverse user profiles.

Data Collection

Qualitative and quantitative data were collected using a questionnaire which consists of 78 items. This Likert-scale questionnaire was used to measure perceptions of accessibility, collaboration, creativity, and ease of use. In addition, data from lecturers' reflection logs are also collected. These logs contain weekly reflections recorded by the lecturers on their instructional delivery and student engagement. Platform analytics were also carried out, in which data, such as the number of posts,

comments, and file uploads, were extracted from PADLET's built-in activity reports.

Data Analysis

Quantitative data from surveys were analysed using descriptive statistics (mean, SD). In contrast, qualitative data from reflections and open-ended responses were thematically analysed using NVivo to identify recurring themes and insights.

RESULTS AND DISCUSSION

Table 1 below summarises key findings gathered from the students' survey.

Table 1.: Summary of Key Findings

Survey Item	Mean	Standard Deviation (SD)	Agree/ Strongly Agree (%)
SHAREPAD is easy to use and navigate.	4.65	0.48	94.8%
I can access SHAREPAD conveniently from multiple devices.	4.59	0.51	92.3%
SHAREPAD helps me collaborate more effectively with my peers in real-time.	4.42	0.63	89.7%
The multimedia features (video, audio, images) enhance my learning experience.	4.56	0.54	91.0%
I feel more engaged in learning when using SHAREPAD.	4.38	0.67	87.1%
I find it helpful that all class resources are stored on one platform.	4.61	0.50	93.6%
The privacy and access control features make me feel secure.	4.47	0.60	88.5%
I would recommend using SHAREPAD for other subjects or classes.	4.50	0.58	90.4%

Usability and Accessibility

The vast majority of students (94.8%) reported that SHAREPAD is user-friendly and compatible with multiple devices (92.3%). The platform's cross-platform accessibility was confirmed by the fact that students used computers (52%), cell phones (40%), and tablets (8%). They valued asynchronous access to resources, which is consistent with previous research findings emphasising the value of adaptable learning settings (Hrastinski, 2008). According to lecturers, the ability to customise the layout made it simpler to plan classes and offer a clear progression of content. The media-rich posts,

resource folders, and weekly lesson tabs made teaching more engaging and well-organised.

Collaboration and Participation

One of SHAREPAD's strongest contributions was its real-time collaboration feature. 89.7% of the student respondents reported that SHAREPAD helps them collaborate more effectively with their peers in real-time. Students also responded that they could post simultaneously, provide feedback to peers, engage in discussions, and access all class resources on a single platform (93.6%). Analysis of activity logs revealed an average of 64 posts and over 150 comments per class board across 14 weeks. These interactions reflect active engagement and peer learning. According to Syifaulkaromah et al. (2021), peer feedback provides learners in online classes with opportunities for interaction, enabling them to articulate their thoughts and offer constructive criticism to their peers, thereby contributing to a collaborative learning environment.

Support for Creative Expression

The SHAREPAD platform has empowered students and lecturers to leverage multimedia features to generate visually engaging and interactive content. For example, students have demonstrated creativity by embedding YouTube videos, creating audio reflections, and uploading infographics alongside textual materials. Ninety-one per cent of the student respondents reported that the multimedia features (video, audio, images) enhance their learning experience. This multimodal approach facilitates differentiated instruction, addressing varying learning preferences and enhancing overall student engagement (Bruckermann et al., 2017). Creative output not only increased student motivation but also allowed lecturers to assess students' understanding through various modes of expression. As one lecturer noted, "The students' group presentations were far more dynamic than traditional PowerPoint slides. They used GIFs, voice notes, and video snippets to deliver their content."

Centralisation of Teaching and Learning Materials

All course content, assessments, and student submissions were stored on a single board, enabling efficient access and management. Ninety-three point six per cent of respondents found SHAREPAD helpful, as all class resources are stored on a single platform. This centralisation reduced the need for multiple platforms (e.g., LMS, email, cloud storage) and allowed lecturers to track students' progress more effectively. Students also expressed appreciation for having all their resources in one place, echoing findings from Mtebe & Raisamo (2014) about the importance of centralised digital repositories in e-learning environments.

Privacy and Security

The option to set password protection and restrict access by email invitation was vital in ensuring content security and privacy. This was especially important when students uploaded personal reflections, voice recordings, and assessment tasks. Eighty-eight point five per cent of the students responded that the privacy and access control features make them feel secure. This feature supports ethical digital practices, especially in educational settings where data protection is crucial (Selwyn, 2012).

COMMERCIALISATION POTENTIAL

Beyond classroom use, SHAREPAD showed potential for module commercialisation. Educators could create and publish subject-specific boards that can be shared with or sold to other institutions or individual educators. Given the growing market for teacher-created digital content (EdTech Digest, 2020), this represents a sustainable model for professional development and income generation. Modules developed for specific courses (e.g., English for Academic Purposes, Grammar for ESL, Public Speaking, etc) can be adapted for different educational levels and teaching contexts. This scalability positions SHAREPAD as a valuable asset not only for personal use but also for broader educational ecosystems.

CONCLUSION

SHAREPAD has proven to be an effective and versatile tool for modern teaching and learning. Its strengths lie in its user-friendly interface, multimedia support, real-time collaboration features, and capacity for centralising educational content. Feedback from students and lecturers indicates increased engagement, improved content delivery, and enhanced creative expression. The ability to customise boards and control access further enhances its appeal in diverse teaching environments.

Moreover, the platform's potential for module commercialisation opens opportunities for educators to share their expertise beyond the classroom, fostering a culture of open educational resources (OER) and educational entrepreneurship. As education continues to evolve toward digital and blended models, tools like SHAREPAD will be critical in supporting innovation, inclusivity, and scalability in teaching practices.

Future research may explore the impact of SHAREPAD on students' learning outcomes, as well as its integration with formal Learning Management Systems (LMS). Nonetheless, this study provides a strong foundation for understanding SHAREPAD's role as a transformative tool in 21st-century education.

ACKNOWLEDGMENT

We want to express our sincere gratitude to all those who contributed to the development of this paper. Special thanks to the team behind SHAREPAD for their innovation and dedication in creating a robust digital collaboration tool. Their work has significantly inspired and supported the insights shared in this publication.

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SHIFTING THE TRADITIONAL: STUDENT FEEDBACK ON FLIPPED CLASSROOM APPROACH IN LEARNING A STATISTICS COURSE

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ABSTRACT

The contemporary digital era poses a challenge to the national education system, encompassing higher education. Students have developed digital competencies following the COVID-19 pandemic. Educational approach has evolved beyond traditional approaches, necessitating diversity through strategies such as flipped classrooms and blended learning. A flipped classroom (FC) is a way of teaching that flips the usual order of activities for learning. Outside of class, students often learn new things through readings or videos. During class, they use their time to connect with each other through problem-solving, discussions, and group projects. This approach seeks to enhance classroom engagement and concentrate on the application of information. This study aims to examine students' feedback on the implementation of flipped classroom (FC) approach in the Statistics course. This pilot study included 111 selected students from FSKM, FSG, and FP as respondents. A set of questionnaires was provided to them. 71% of the respondents are female, while 29% are male. Consequently, over 90% of students concurred that flipped classroom (FC) is beneficial in the teaching and learning process, enhances comprehension, augments concentration, and immediately elevates their performance in statistics courses. Most respondents perceive FC as facile, straightforward, and user-friendly. Consequently, the versatility of FC across various educational levels enhances economic potential and serves as an alternative approach for fostering diversified learning environments.

Keywords: *Flipped Classroom, Students' Feedback, Statistics Course*

INTRODUCTION

Currently, technological advancements compel educational institutions to develop and execute new pedagogical models in the design and implementation of teaching and learning activities (Colomo-Magana et al., 2021; Li, 2018; Wenming & Erwen, 2018). To tackle these problems and improve student involvement, changes in teaching methodologies and classroom environments have been investigated (Abramson, 2010; Marantz et al., 1991; Mustafa & Yilmaz, 1996). The flipped classroom (FC) technique is a promising strategy in which students engage with course information and assignments prior to class, hence facilitating active learning and collaboration during class time (Hew & Lo, 2018). FC is one of the innovative approaches used in modern education. This model has shifted the role of the classroom from a learning space to an interactive discussion arena. The application of the FC can provide learning encouragement to students, especially to improve the ability of self-regulated learning by students. With this, students' ability for proactive participation is seen (Trisnayanti & Wijayanto, 2025). Nevertheless, the role of the teacher is very important in teaching and utilizing digital media (Yusuf, 2025). Teaching a statistics course is not an easy task due to difficulty on understand the statistical concepts and process of statistical analysis. Statistics course consist of activities that are used to gather data, summarize, or show data, analyze data using certain methods, and make sense of the results of the analysis (Sugiyono, 2016). The Flipped Classroom model can improve student learning outcomes and self-esteem because it encourages more contact between students and teachers, maximizes student accountability, makes class time more effective, and allows students to learn on their own in exploring online learning resources to encourage motivation and interest in completing as many projects as possible (Fedistia & Musdi, 2020). Figure 1 illustrates the differences approaches on FC and traditional. Therefore, this study is conducted to examines the implications of the flipped classroom method on students' feedback and their satisfaction with the learning experience on selected topic in statistics courses.

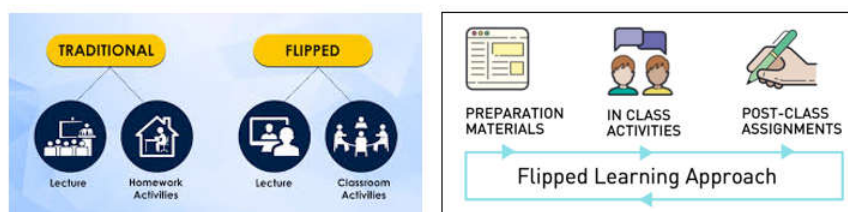


Figure 1.: Flipped Classroom and Traditional Approach

METHODOLOGY

This study begins with providing the students with video on Statistics course a week before the in-class session. The students are assigned to work in group for a tutorial assignment based on the selected topic. Then the discussion session conducted in-class with two ways of communication between the lecturer and students. After that, a set of questionnaires on the feedback of students towards the implementation of the flipped classroom are distributed after the completion of class activities. The feedback of students is assessed on usefulness of flipped classroom and the benefit of using the flipped classroom. This study focused on statistics courses which are taught to students from the Faculty of Computer and

Mathematical Sciences (FSKM), the Faculty of Applied Sciences (FSG), and the Faculty of Accountancy (FP). Figure 2 depicts subtopics shared with all the students prior to the actual class. In class, the lecturer may vary the activities that involve students.



Figure 2.: Process of Implementing the Flipped Classroom

RESULTS AND DISCUSSION

Table 1 presents a descriptive analysis of the background of respondents based on gender, faculty, technology skill, and internet coverage.

Table 1.: Descriptive Analysis on Demographic

Variables	Category	Number of Respondent	Percentage (%)
Gender	Male	32	28.83
	Female	79	71.17
Faculty	FSKM	53	47.75
	FSG	41	36.94
	FP	17	15.31
Technology Skill	High	59	53.15
	Moderate	52	46.85
	Poor	0	0
Internet Coverage	Excellent	21	18.92
	Fair	80	72.07
	Poor	10	9.01

Most respondents are female (71.17%), while males represent only 28.83%. Regarding faculty distribution, the largest proportion of respondents are from the Faculty of Computer and Mathematical Sciences (FSKM), accounting for 47.75%, followed by the Faculty of Applied Sciences (FSG) at 36.94%, and the Faculty of Accountancy (FP) with 15.31%. In terms of technology skill levels, over half of the respondents (53.15%) rate their skills as high, while 46.85% identify as having moderate skills. Notably, no respondents reported having poor technology skills, indicating a relatively tech-savvy sample population. On the factor of internet coverage, most respondents (72.07%) report having fair internet access, while 18.92% describe their coverage as excellent. Only a small percentage (9.01%) experience poor internet coverage. Therefore, the data indicate a predominantly female group of respondents with strong representation from FSKM and generally good technology proficiency. However, internet quality varies, with the majority experiencing only fair connectivity, which may impact their digital experiences and performance. This background information provides important context for interpreting further findings in the study.

Table 2 presents a summary of students' feedback on the flipped classroom approach, categorized into two main areas: Usefulness of Flipped Classroom and Benefit of Flipped Classroom. The data reflect students' agreement levels across 10 statements in the usefulness of FC and 10 statements in the Benefit of FC, with response options ranging from "Strongly Agree" to "Strongly Disagree".

Table 2.: Summary on Students' Feedback of Flipped Classroom

Usefulness of Flipped Classroom	Strongly Agree	Agree	Disagree	Strongly Disagree
Flipped classroom are useful in teaching and learning process	38	71	2	0
The use of flipped classroom would improve learning performance	34	68	8	1
Learning will be more productive with the use of flipped classroom	40	61	8	2
Using flipped classroom will save time	43	58	10	0
Flipped classroom when judiciously adopted gives successful and effective learning	30	74	7	0
It has increased my reasoning ability	34	69	7	1
Flipped classroom enhances student participation in the course content	37	63	11	0
The use of flipped classroom enhances interaction with peers and lecturers	38	61	9	3

Flipped classroom improves exposure to relevant educational media	44	59	8	0
Using flipped classroom arouses interest for learning	39	66	6	0
Benefit Of Flipped Classroom	Strongly Agree	Agree	Disagree	Strongly Disagree
Flipped classroom are easy to use for learning	32	69	10	0
Flipped classroom are simple to use for learning	36	71	4	0
Flipped classroom are user friendly	38	67	6	0
I learned to use flipped classroom quickly for learning	31	73	7	0
I quickly remember how to use flipped classroom for learning	32	69	10	0
Flipped classroom make my work faster	28	66	17	0
I became more skillful with using flipped classroom for learning	31	66	14	0
My interaction with other students using flipped classroom is understandable	37	64	8	2
I can use flipped classroom for learning without any written instructions	25	67	17	2
I recover from mistakes quickly when I use flipped classroom for learning	31	71	7	2

Students generally perceive the flipped classroom as highly useful in enhancing the teaching and learning process. For example, 38 students "strongly agree" and 71 "agree" that flipped classrooms are useful in teaching and learning, indicating over 90% positive feedback. Similarly, 34 students "strongly agree" and 68 "agree" that this approach improves learning performance. The highest level of strong agreement (43 students) is observed in the statement "Using flipped classroom will save time," followed closely by productivity and reasoning ability enhancements. Notably, the flipped classroom is also seen to boost participation, peer interaction, and interest in learning, with combined agreement levels (strongly agree + agree) consistently above 90% for all statements in this section. Very few students expressed disagreement, and none strongly disagreed for most items. In terms of usability and perceived benefits, feedback remains largely positive. For instance, 32 students "strongly agree" and 69

"agree" that flipped classrooms are easy to use for learning. Simplicity, user-friendliness, and quick learning of how to use the system also received high agreement rates. Statements like "I quickly remember how to use flipped classroom for learning" and "I became more skilful with using flipped classroom for learning" both had a combined agreement rate of 94%, showing effective adaptation. Additionally, students reported that flipped classrooms make work faster (28 strongly agree, 66 agree) and that they could use the platform without prior instructions. Only a small minority disagreed or strongly disagreed, generally not exceeding 3 or 4 students per item. As a result, the descriptive statistics show overwhelmingly positive student perceptions of the flipped classroom in terms of both its utility in educational outcomes and its ease of use. The high frequencies of "strongly agree" and "agree" responses across all items underscore the effectiveness of the flipped classroom model in improving engagement, learning efficiency, and student satisfaction. Low disagreement levels further reinforce this, suggesting minimal resistance or challenges in adopting the model. This feedback supports broader implementation of flipped classroom methodologies in diverse learning environments.

CONCLUSION

The findings from both tables offer valuable insights into the student demographic and their perceptions of the flipped classroom model. Most of the respondents are female and primarily from the Faculty of Computer and Mathematical Sciences, with most reporting moderate to high technological skills. Although internet access is generally fair, this variability in connectivity may affect the consistency of their digital learning experience. Nevertheless, the overall technology skill of the participants provides a solid foundation for adopting digital learning methods like the flipped classroom. Overwhelmingly positive feedback on the usefulness and benefits of the flipped classroom approach. Students widely agree that it enhances learning effectiveness, increases productivity, improves reasoning, and supports better interaction with peers and instructors. The approach is also seen as time-saving, user-friendly, and easy to learn. High levels of agreement across all evaluated aspects, which were combined with minimal disagreement and suggest strong student acceptance and satisfaction. Collectively, the data highlight that a largely capable and well-prepared student population is positively responding to flipped classroom methods. These insights support the continued and possibly expanded use of flipped classroom strategies in higher education settings, particularly where technological readiness among students is already high, ensuring more effective and engaging learning experiences.

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SKETCHSCAPE: TRANSFORMING 2D LANDSCAPE SKETCHES INTO IMMERSIVE 3D PAPER ART

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ABSTRACT

In landscape architecture education, 2D sketches serve as vital tools for conceptualizing spatial ideas. However, they often fall short in communicating depth, elevation, and the immersive qualities of landscape design. SketchScape is a creative pedagogical initiative that transforms traditional 2D landscape sketches into tangible 3D paper sculptures, bridging the gap between static representations and spatial comprehension. This project draws exclusively from A Student's Guide to Landscape Architecture, a textbook authored and illustrated by lecturers within the same academic programme. By converting these familiar teaching materials into layered, cut-paper models, SketchScape reinforces a shared visual language while introducing an innovative medium that enhances both engagement and understanding. The transformation process involves four stages: sketch selection, digital vectorization, 3D modelling, and paper engineering. Vectorized sketches are modelled in CAD software to simulate terrain and elevation, then fabricated using paper cutting and manual assembly techniques. Tested among 98 students in the Landscape Architecture Programme, the models allowed learners to interact with spatial forms in a hands-on and creative way. Results show that this method significantly improves spatial awareness and design literacy. Students reported stronger engagement, better understanding of topographic relationships, and increased motivation to explore design variations. SketchScape successfully integrates traditional drawing methods with modern fabrication techniques, offering a compelling educational tool that makes landscape architecture more accessible, interactive, and creatively rich. This approach reaffirms the importance of multisensory, interdisciplinary learning and underscores the potential of merging artistic processes with architectural education.

Keywords: 3D art, Landscape Architecture, Landscape Ecology, Sustainable Learning

INTRODUCTION

In landscape architecture education, hand-drawn sketches remain fundamental for exploring spatial concepts, design thinking, and visual storytelling. However, traditional 2D sketches often struggle to convey spatial depth, elevation, and physical relationships within the designed environment. As educational needs evolve, there is growing demand for more immersive, interactive, and creative tools that aid both understanding and communication. *SketchScape* is an innovative teaching and visualization project that reinterprets flat landscape drawings as layered, three-dimensional paper sculptures. The project draws exclusively from *A Student's Guide to Landscape Architecture*—a textbook written and illustrated by the lecturers from the same academic programme. These original sketches form a shared visual language used in classroom instruction. By transforming these familiar images into 3D paper art, *SketchScape* bridges traditional methods with tactile, engaging experiences, offering a new dimension to how landscape architecture is learned and taught.

METHODS

This study employed a structured, four-stage pipeline to transform two-dimensional instructional sketches into three-dimensional paper sculptures, refined through collaborative exploration with 98 Landscape Architecture students.

Sketch Selection

All source material was drawn from *A Student's Guide to Landscape Architecture*, a textbook illustrated by programme faculty and already integral to studio instruction. Illustrations were selected to represent diverse formal typologies—including terraced landscapes, garden layouts, open-space systems, and topographic contour plans—ensuring pedagogical consistency while enriching student engagement with familiar teaching content.

Digital Conversion

Selected sketches were digitized via high-resolution scanning and processed in Adobe Illustrator. Through vectorization, distinct design elements (e.g., terrain contours, plant masses, and architectural features) were isolated into discrete, manipulable layers, thereby preparing the sketches for subsequent three-dimensional modelling.

3D Modelling

In SketchUp, students extruded vector-derived layers to construct vertical models that emphasized spatial hierarchy and form. Key techniques included elevation mapping from contour data, segmentation of layers by functional or compositional features, and light-and-shadow simulations for visual feedback. Digital models were iteratively reviewed to ensure both structural feasibility and aesthetic coherence.

Paper Engineering

The finalized digital models were exported as 2D vector outlines compatible with laser-cutting equipment. Fabrication employed 200 gsm cardstock, with assembly undertaken through scoring, folding, and stacking. This hands-on phase introduced students to principles of paper engineering and manual prototyping, enabling them to realize tactile, three-dimensional representations of landscape drawings.

RESULTS AND DISCUSSION

This section examines how engaging 98 landscape architecture students in the *SketchScape* project enhanced their spatial cognition, reinforced pedagogical continuity, and fostered creative learning through tactile prototyping. Drawing upon interdisciplinary research in architectural education and material experimentation, the analysis situates our findings within broader pedagogical frameworks that underscore the value of physical modeling in design studios.

Enhanced Spatial Cognition

Participants reported a significant improvement in spatial perception, demonstrating a refined awareness of depth, layering, and sectional relationships following engagement with paper models. This aligns with established benefits of tactile prototyping, which supports rapid iteration and spatial understanding by transforming abstract forms into physical constructs.

Pedagogical Alignment and Innovation

Because all models originated from A Student's Guide to Landscape Architecture, students-maintained continuity with core instructional material, reinforcing a shared visual pedagogy. The project simultaneously introduced novel applications of material exploration and creative interpretation, validating traditional sketches as catalysts for experiential learning.

Facilitated Creative and Interactive Learning

The tactile nature of paper sculptures fostered active engagement and experimentation. Students probed compositions, reinterpreted established designs, and iteratively refined spatial storytelling—practices recognized in hands-on prototyping methodologies for promoting creative insight and collaborative ideation.

Positive Student Feedback

Survey results from 98 participants revealed strong pedagogical outcomes: 92% acknowledged enhanced spatial thinking; 88% valued the creative, hands-on format and requested further curricular integration; 78% reported increased confidence in interpreting topographic drawings.

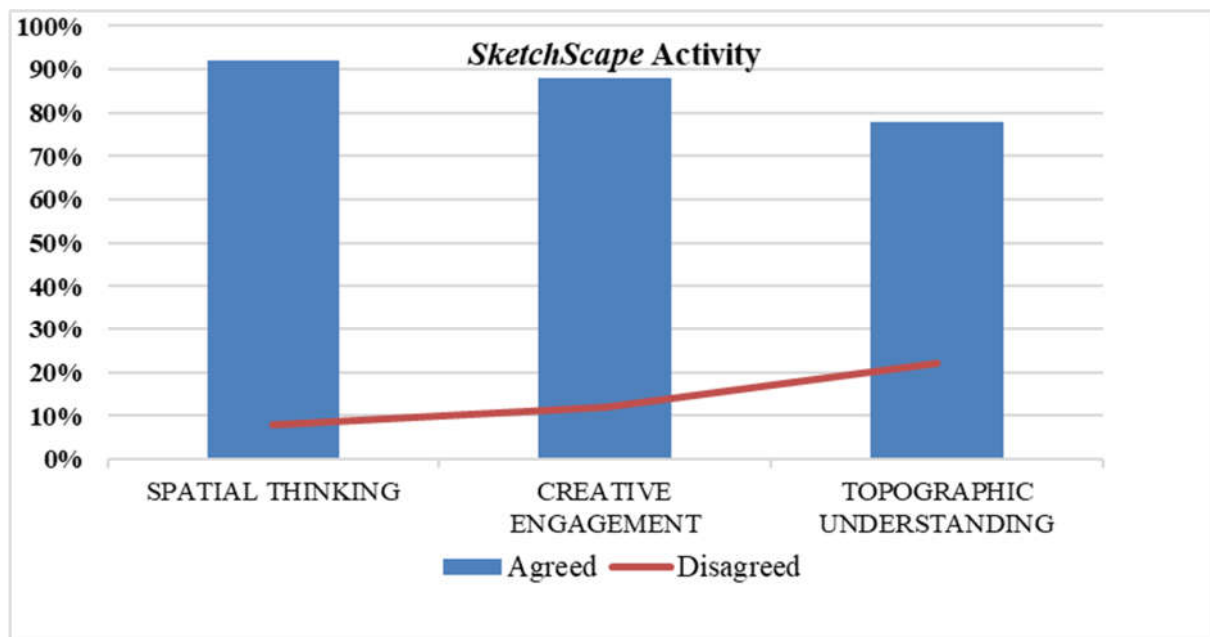


Figure 1.: *SketchScape* activity results gained from 98 students participating in the project.

Students notably expressed enthusiasm for incorporating analogous methods into design reviews and studio presentations, underscoring the long-term value of this pedagogical innovation in landscape architecture education.

ACKNOWLEDGEMENTS

The authors thank the programme team behind *A Student’s Guide to Landscape Architecture Book* for granting permission to reinterpret their original sketches. Special thanks to the 98 landscape architecture students who participated with enthusiasm, creativity, and critical insight.

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SMARTCALC GUIDE: ADVANCING MATHEMATICAL FLUENCY THROUGH DIGITAL CALCULATOR INTEGRATION

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ABSTRACT

Scientific calculators have become a compulsory partner for students in studying mathematical concepts. These devices enable students to visualize, compute, and explore basic and multiple equations as well as formulas in a user-friendly manner. However, many students often find it challenging to utilize the full potential of these calculators. Hence, the SMARTCALC GUIDE is introduced to them to improve their mathematical fluency in using scientific calculators. The research was conducted among 125 students from different academic programs as well as mathematics courses at UiTM Kampus Kuala Pilah, assessing improvements in scientific calculator efficiency as well as competence by taking a pre-test and post-test. Out of 125 participants, 80% students have agreed that SMARTCALC GUIDE improved their scientific calculator knowledge compared to before. Descriptive statistics revealed a major increase in the mean scores from the pre-test ($M = 2.23$, $SD = 2.05$) to the post-test ($M = 6.52$, $SD = 2.38$), indicating marked improvement. About 76.8% students agreed that this GUIDE has increase their confidence level in using scientific calculator. A majority (86.4%) of the participants agreed that using a scientific calculator significantly helped them solve mathematical problems more quickly. These findings show that SMARTCALC helped students not only understand the concepts of mathematics more efficiently but also boosted their confidence in applying these tools in other future courses. Thus, by enhancing students' proficiency with scientific calculators, the SMARTCALC GUIDE has significantly improved their mathematical fluency, deepened their understanding, and strengthened their problem-solving abilities.

Keywords: *Scientific Calculator, Mathematics Fluency, Problem Solving*

INTRODUCTION

Technology integration in mathematics education has revealed increasing potential to support students' achievement, confidence, and problem-solving capabilities. Scientific and graphing calculators are cognitive aids that improve comprehension of abstract mathematical concepts and lessen computing load when used properly. Recent studies highlight that calculator-based instruction can significantly improve learning outcomes, especially when aligned with guided teaching strategies (Angco et al., 2023; Kandemir & Demirbağ-Keskin, 2019). Moreover, calculators can act as substances for improving students' problem-solving accuracy, speed, and attitudes toward mathematics.

Beyond technological tools, psychological factors such as learning motivation, self-confidence, and self-regulated learning strategies also play crucial roles in students' academic success. El-Adl and Alkharusi (2020) found that students who employed self-regulated learning strategies and had higher intrinsic motivation demonstrated stronger achievement in mathematics. Similarly, Wahyuni et al. (2024) emphasized the influence of math anxiety and self-confidence on problem-solving skills, underscoring the need to support affective as well as cognitive domains in mathematics education. The intersection of digital tools and motivational factors is further reinforced by studies on e-learning environments. Yaniawati et al. (2020) revealed that the integration of e-learning within resource-based learning significantly improved students' creative thinking abilities and self-confidence in mathematics. These findings suggest that both technical assistance and emotional readiness might enhance students' mathematical experiences, especially in problem-solving scenarios.

Indeed, the invention of scientific calculators have helped many students, including those in UiTM Cawangan Negeri Sembilan (UiTMCNS) Kampus Kuala Pilah, to solve mathematical problems in various courses. However, through the observations carried out during classes, it has been revealed that most of them only use the basic operations. Furthermore, they are also not familiar with most of the advanced functions, which can be useful to assist them in solving mathematical problems. Although their purchased scientific calculators come with an operation guide booklet, nonetheless, it only comes with basic functions without much explanation. This shows that it is essential to have proper guidance on scientific calculators to reduce the confusion, frequent errors, and low participation of students during problem-solving activities. Thus, SMARTCALC GUIDE was introduced.

The main advantage of SMARTCALC GUIDE is that it has step by step instructions on how to insert the numbers or equations correctly. Moreover, games are also included for students to practice while observing their own competency and understanding of problem solving using their scientific calculators. Therefore, in this study, we will explore how our SMARTCALC GUIDE can improve the students' speed and accuracy in using scientific calculators to solve mathematical problems. Additionally, the impact of SMARTCALC GUIDE on the students' confidence and competence will also be evaluated. It is expected that our GUIDE will have positive effect on both objectives.

METHODOLOGY

This study consists of three phases: (i) the construction and development of the SMARTCALC GUIDE, (ii) data collection for the SMARTCALC GUIDE evaluation, and (iii) data analysis of the SMARTCALC GUIDE. The content of the developed material is based on topics covered in several mathematics courses where the use of scientific calculators is most required for diploma students. These topics include arithmetic operations, number systems, algebraic expressions, linear and quadratic functions, systems of equations, logarithms, indices, and trigonometric functions.

To evaluate the material, a workshop using the SMARTCALC GUIDE as instructional material was conducted. A total of 125 students enrolled in various academic programs and mathematics courses at UiTMCNS Kampus Kuala Pilah participated in this study. The study adopted a quasi-experimental pre-test and post-test single-group design to assess the effectiveness of our guide.

The workshop began with an overview of the layout of scientific calculators, along with information about the different models and brands commonly found in Malaysia. Students were guided through the keypad with clear explanations of the functions and modes of each button. To ensure students' efficiency and competence in using scientific calculators, hands-on practice with guided examples was incorporated. This approach allowed for the correction of common mistakes and misconceptions, while providing guidelines for effective calculator use.

Pre- and post-assessments were administered to evaluate the effectiveness of the SMARTCALC GUIDE. The pre-test was given before the workshop to measure the students' initial competency in using scientific calculators, and the post-test was conducted immediately afterward to assess any improvements in their skills. The assessments consisted of ten mathematics questions related to their syllabus, focusing on areas where scientific calculators are most required.

Additionally, a survey was conducted to gather the participants' feedback. The questionnaire was designed to determine the students' perceptions of the SMARTCALC GUIDE, using a five-point Likert scale to measure their agreement or disagreement. The data obtained were quantitatively analyzed using SPSS software. Participants' demographics were summarized using frequency and percentage. A descriptive analysis, including mean and standard deviation (SD), was employed to assess the students' perceptions and the differences in assessment scores. To evaluate the differences in the mean scores between the pre-test and post-test, a paired sample t-test was conducted.

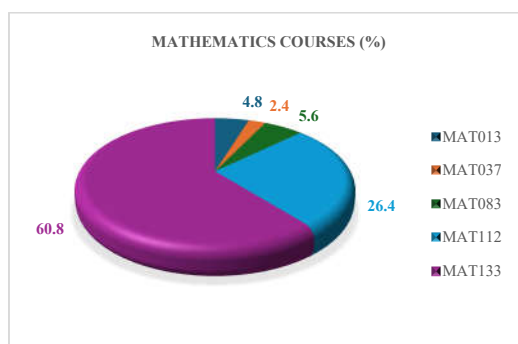
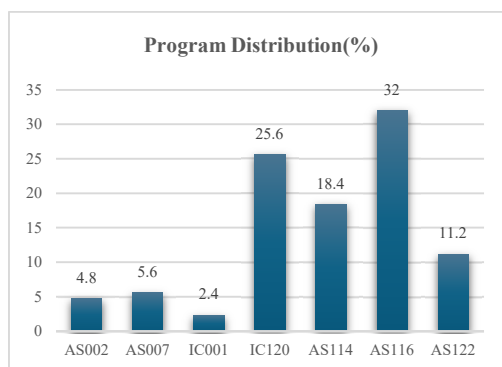
RESULT AND DISCUSSION

A total of 125 students participated in this study at UiTMCNS Kampus Kuala Pilah. The students were drawn from both pre-diploma and diploma programs across various fields of study and enrolled in different mathematics courses as part of their curriculum.

Figures and tables provided in this study further illustrate these distributions. Table 1 summarize the frequency of students who participated in this study by academic level and programme. The bar chart (Figure 1) and pie chart (Figure 2) highlight the proportional representation of students in each programme and mathematics courses.

Table 1.: a) Frequency and Percentage Graphs of Students' Programmes and Course Background (n=125)

Level	Program	Students	Total
Pre-diploma	AS002	6	16 (12.8%)
	AS007	7	
	IC001	3	
	IC120	32	
Diploma	AS114	23	109 (87.2%)
	AS116	40	
	AS122	14	



Of the 125 students, 16 students (12.8%) were from pre-diploma programmes comprising AS002, AS007, and IC001, while the remaining 109 students (87.2%) were from diploma programmes comprising IC120, AS114, AS116, and AS122. In terms of mathematics course enrolment, students were distributed across five courses. A total of 6 students (4.8%) were enrolled in MAT013, 7 students (5.6%) in MAT083, 3 students (243%) in MAT037, 33 students (26.4%) in MAT112, and 76 students (60.8%) in MAT133. MAT133 recorded the highest enrolment, accounting for over half of the total number of students, while MAT037 had the lowest enrolment.

In this study, students' feedback was also collected, and the outcome of the SMARTCALC GUIDE survey is presented in Table 2.

Table 2.: Descriptive Frequency Statistics of Students’ Feedback on SMARTCALC GUIDE

5-point rating scales	Frequency	Percent (%)
After attending the workshop, my understanding of how to use a scientific calculator has improved.		
Strongly Disagree	0	0
Disagree	1	0.8
Neutral	24	19.2
Agree	51	40.8
Strongly Agree	49	39.2
After attending this workshop, I feel more confident in my answers when using the scientific calculator.		
Strongly Disagree	0	0
Disagree	1	0.8
Neutral	28	22.4
Agree	52	41.6
Strongly Agree	44	35.2
I believe that the scientific calculator helps me solve mathematical problems more quickly.		
Strongly Disagree	0	0
Disagree	3	2.4
Neutral	14	11.2
Agree	43	34.4
Strongly Agree	65	52.0

A total of 80% agreed that their understanding of scientific calculators had improved after attending the workshop on SMARTCALC GUIDE (Table 2). This shows that the explanation that was given during the workshop has increased their knowledge and understanding on the mathematical functions on their scientific calculator. In terms of confidence levels, most of them agreed at 76.8% that SMARTCALC GUIDE has enhanced their confidence in solving mathematical problems. This result is similar with findings of Raduan et al. (2021). Thus, by having proper guidance, especially on inserting the numbers or equations in the scientific calculator correctly, students are less likely to make mistakes in obtaining the final answer for their calculations.

Table 2 also shows that 86.4% students agreed that SMARTCALC GUIDE has sped up their mathematical calculations. By applying the correct equation and syntax in their scientific calculator, it has expedited the time taken to solve the mathematical problems given. Prior to this, most of the students will insert the values or solve a long equation one-by-one, which causes them to spend longer times in solving a question. However, through SMARTCALC GUIDE, the numbers or variables can be inserted as a single equation in their scientific calculator, subsequently decreasing the time needed to solve a mathematical problem. In manual calculation of simultaneous equations, such as finding the value of the variables, the common mistakes that students likely make is the writing of wrong symbols of negative and positive. This usually occurs either during expansion of brackets or moving the variable

from left to right. Thus, by mastering the techniques to enter the whole equation in their scientific calculator, these common mistakes can be reduced.

The pre-and-post effect of the SMARTCALC GUIDE on the students' speed, precision as well as confidence and competence were also carried out. It was found out that the output in the mean scores of pre-test and post-test is different. The values for the pre-test mean score is 2.23 and the post-test mean score is 6.52 indicates the mean score increases from 2.23 (pre) to 6.52 (post). However, there is slightly more variability in post-test scores, with a standard deviation of 2.381, but small value of standard error for both assessments indicates high reliability of the sample mean estimates. It can also be observed that there is significant difference in means between pre-test and post-test score ($p\text{-value} = 0.000 < 0.05$). Due to the means of the two tests and the direction of the t -value, we can conclude that there was a statistically significant improvement in performance after using SMARTCALC GUIDE from 2.23 ± 2.05 to 6.52 ± 2.38 (mean $\pm$ sd); an improvement of 4.288 ± 2.593 . This finding is similar to the findings of Sugla et al. (2024) where their post-test results show significant improvement. Cohen's d is for comparing the means between two groups. Here, we obtained Cohen's $d = -1.654$ which implies a very strong effect of the GUIDE. This suggests that the workshop had a significant and meaningful impact on student performance in solving problems by using scientific calculators.

CONCLUSION

The outcomes show that SMARTCALC GUIDE has successfully improved students' speed and accuracy in solving mathematical problems using scientific calculators. Furthermore, after being introduced to the SMARTCALC GUIDE, students' confidence and competence have increased. This is because, through SMARTCALC GUIDE, they are exposed to various features in their scientific calculators and will be able to use them more effectively and confidently for solving mathematical problems compared to before. In conclusion, fostering students' proficiency with scientific calculators has significantly enhanced their mathematical fluency, deepened their understanding, and strengthened their problem-solving capabilities. These skills are important not only for academic success at the university level but also for future professional development. The impact of scientific calculator literacy will further empower students to adapt confidently to increasingly complex mathematical and technological challenges in this modern era.

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SPEAKSPRINT: ENHANCING ENGLISH SPEAKING SKILLS THROUGH SPEED INTERVIEW PRACTICE

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ABSTRACT

This innovation introduces SpeakSprint, a dynamic, low-stakes speaking activity inspired by the speed dating format to boost students' confidence and communicative competence in English. Designed for undergraduates in the LSP301 General English course at Universiti Sains Malaysia (USM), this approach prepares learners for simulated job interviews, a key course assessment through rapid, structured peer interactions. Grounded in Communicative Language Teaching (CLT), SpeakSprint transforms classrooms into interactive spaces where students engage in rotating five-minute interviews using authentic prompts such as personal introductions and behavioural questions. Conducted over three weeks, each session incorporates scaffolded support, including vocabulary banks, peer feedback checklists, and self-assessment via Google Forms to foster learner autonomy and reflective practice. To address anxiety in high-stakes speaking situations, the activity draws on Krashen's Affective Filter Hypothesis, creating a supportive environment that prioritises fluency and experimentation over grammatical perfection. Engaging with multiple peers and unpredictable scenarios, students develop adaptability and confidence through repeated practice. Preliminary results show promising outcomes: 85% of participants reported increased readiness for real-life interviews. In alignment with SDG 4 (Quality Education) and SDG 8 (Decent Work and Economic Growth), SpeakSprint equips learners with transferable employability skills such as communication, collaboration, and self-efficacy. The innovation demonstrates how gamified interaction and student-centred design can bridge classroom learning with career preparedness in a meaningful and motivating way.

Keywords: speed interview, innovative pedagogy, low-anxiety, CPT, learner autonomy

INTRODUCTION

In the current landscape of higher education, communicative competence in English has become a vital skill for employability, particularly in multilingual societies like Malaysia. For many undergraduates, the ability to speak confidently and effectively in professional settings such as job interviews remains a significant hurdle. Despite exposure to English language instruction, many learners continue to struggle with speaking performance due to anxiety, limited authentic practice, and a lack of feedback-rich environments (Tan et al., 2019; Yusof & Saadon, 2021). This gap is especially evident in language-for-specific-purpose (LSP) courses, where assessment formats often include simulated job interviews but rarely provide scaffolded opportunities to prepare in low-stakes settings.

To address this issue, this study introduces SpeakSprint, an innovative pedagogical activity that adapts the structure and pace of “speed dating” into a series of rapid, structured peer interviews. The aim is to provide students with repeated, scaffolded opportunities to rehearse job interview responses, improve fluency, and build confidence through peer interaction. This method aligns with Communicative Language Teaching (CLT) principles, emphasising real-life communication, learner autonomy, and meaningful interaction (Richards & Rodgers, 2014). It also incorporates insights from Krashen’s Affective Filter Hypothesis, which posits that learners acquire language more effectively in low-anxiety, motivating environments (Krashen, 1982).

The SpeakSprint model was implemented in the LSP301 General English course at Universiti Sains Malaysia (USM), a course designed to equip undergraduates with workplace-related English language skills. Within this context, the innovation serves two main purposes: (1) to simulate authentic job interview experiences through repeated, structured peer interaction, and (2) to reduce speaking anxiety through gamified, non-evaluative practice sessions. While job interviews are commonly simulated in language classrooms, SpeakSprint introduces a new approach by leveraging the fast-paced, rotating structure of speed dating to ensure maximum participation, immediate application, and iterative practice (Thornbury, 2005).

The initiative also aligns with global educational objectives. By integrating communicative, digital, and collaborative learning strategies, SpeakSprint aligns with Sustainable Development Goal 4 (Quality Education) and SDG 8 (Decent Work and Economic Growth), both of which emphasise the importance of equipping learners with relevant skills for employability and lifelong learning (UNESCO, 2017). It enhances students’ employability by fostering transferable skills such as adaptability, critical thinking, and oral communication—competencies essential for the 21st-century workplaces (Trilling & Fadel, 2009).

This paper explores the use of an innovative approach through the SpeakSprint activity, focusing on its pedagogical design, classroom implementation, and methodological framework. Preliminary feedback and engagement trends will be explored in subsequent sections. The findings are expected to contribute to ongoing discussions in language pedagogy and innovation in higher education, particularly regarding how authentic, low-stakes speaking activities can better prepare learners for real-world communication tasks.

METHODS

This study was implemented in the LSP301 General English 2 course at Universiti Sains Malaysia (USM), a compulsory and exit-level English course for all undergraduates. The participants consisted of thirty students, both local and international, from various academic disciplines. Their English proficiency levels ranged from B1 to C1 according to the Common European Framework of Reference for Languages (CEFR), representing a mixed-proficiency cohort with diverse linguistic backgrounds.

The SpeakSprint activity was conducted over three consecutive one-hour sessions and was modelled on the speed dating format. In each session, students engaged in rapid, five-minute peer interviews, rotating to a new partner with each round. The prompts increased in complexity over the three weeks: the first focused on self-introductions, the second on behavioural questions, and the final session on situational and field-specific scenarios. The primary aim was to provide authentic, repeated speaking opportunities in a low-stakes, engaging format that simulated real-life job interview conditions.

To scaffold learning and support reflection, students used Padlet after each session to record peer and self-evaluation scores based on fluency, clarity, and confidence. This visual, interactive platform allowed students to monitor their performance progression and engage with feedback in real-time. To measure affective and performance-related outcomes, Google Forms were administered before and after the intervention. These surveys collected quantitative data on three key variables: students' self-reported levels of speaking anxiety, confidence, and communicative proficiency. The pre-survey established a baseline, while the post-survey captured changes following the three-week activity.

The instructional approach was informed by Communicative Language Teaching (CLT), which advocates for authentic interaction and learner-centred tasks, and by Krashen's Affective Filter Hypothesis, which emphasises the importance of reducing anxiety in language learning contexts. The gamified structure and repeated practice were intentionally designed to lower affective barriers and increase learners' willingness to speak.

Data from the post-activity Google Form survey were analysed using descriptive statistics to identify trends in student-reported gains. Peer and self-assessment scores collected through Padlet served as supplementary tools for reflection and classroom-based formative assessment, though they were not included in the statistical analysis. The analysis focused on the quantitative outcomes of the post-survey, which are presented in detail in the following section to evaluate the effectiveness of the SpeakSprint intervention.

RESULTS AND DISCUSSION

The post-activity survey results provide strong support for the effectiveness of the SpeakSprint intervention in improving students' communicative preparedness and confidence in English-speaking tasks related to job and internship interviews. Quantitative data reveal that 75% of students reported feeling more prepared for such high-stakes interactions, indicating that the repeated, peer-led practice

simulated interview settings effectively. This finding aligns with the principles of Communicative Language Teaching (CLT), which emphasises real-world tasks, meaningful interaction, and learner engagement in authentic communication contexts (Richards & Rodgers, 2014).

Moreover, 69% of students reported increased speaking confidence, while 65.1% indicated lower levels of anxiety during the activity. These affective outcomes are consistent with Krashen's Affective Filter Hypothesis (1982), which posits that emotional states like anxiety can hinder language acquisition. By providing structured but low-stakes, gamified speaking sessions, SpeakSprint created a psychologically safe space where students could experiment, take risks, and improve through repetition, key conditions for lowering the affective filter and promoting fluency (Thornbury, 2005).

In addition to affective gains, cognitive improvements were also reported. 62.1% of students agreed that the reflection and feedback tools, particularly Padlet and peer scoring checklists, helped enhance their speaking performance. This is in line with studies emphasising the importance of formative assessment and peer feedback in developing oral skills (Yusof & Saadon, 2021). By externalising their awareness of strengths and areas for improvement, learners developed metacognitive strategies that contributed to self-regulation and autonomy.

Furthermore, 65.5% of participants noted improved ability to structure responses using examples, drawing directly from peer feedback and repeated practice. This supports Tan et al. (2019), who identified a lack of strategic language use and poor response organisation as common challenges among Malaysian ESL learners. The structure of SpeakSprint, which included iterative rounds with varied prompts, allowed students to refine their answers, test different strategies, and receive immediate feedback, thereby promoting both linguistic competence and interview readiness.

These findings also reinforce the argument that repeated speaking practice in a supportive environment promotes both fluency and communicative competence, particularly when combined with learner reflection and scaffolded feedback (Richards & Rodgers, 2014; Thornbury, 2005). The layered approach of SpeakSprint, interaction, repetition, and reflection, appears to have holistically addressed both the cognitive and affective dimensions of language learning.

Taken together, the results demonstrate that SpeakSprint successfully operationalised a CLT-based model in a way that supported both student performance and psychological readiness for real-world communication. The positive reception among students and the measurable affective gains support its potential for broader application across other English for Specific Purposes (ESP) contexts. The innovation not only aligns with national and global calls for more employability-focused language instruction (UNESCO, 2017; Trilling & Fadel, 2009) but also addresses persistent gaps in low-anxiety speaking practice in Malaysian ESL classrooms.

CONCLUSION

This study introduced SpeakSprint, a low-stakes, high-engagement speaking innovation designed to enhance undergraduates' oral communication skills for job and internship interviews. Grounded in

Communicative Language Teaching (CLT) and supported by Krashen's Affective Filter Hypothesis, the activity addressed both the cognitive and affective challenges faced by ESL learners in high-stakes speaking scenarios. Conducted over three weeks, the intervention used a speed dating-inspired structure, scaffolded peer interaction, and reflective tools to foster learner autonomy, build confidence, and reduce speaking anxiety.

Findings from the post-activity survey revealed strong positive outcomes, with 75% of participants reporting increased readiness for interviews and over 65% noting gains in confidence, structured responses, and reduced anxiety. The integration of digital tools such as Padlet and Google Forms for peer feedback and self-assessment further enriched the learning experience, enabling students to engage in metacognitive reflection and track their progress over time.

The success of SpeakSprint highlights several pedagogical implications. First, incorporating repeated speaking opportunities in a non-evaluative, gamified format can significantly enhance fluency and reduce affective barriers to performance. Second, simple digital tools can be leveraged to support real-time feedback and reflection, increasing learner engagement and ownership of progress. Finally, the activity's flexible, low-cost design allows it to be easily adapted to various English for Specific Purposes (ESP) and English as a Second Language (ESL) contexts, including interview training, presentation preparation, and other professional communication modules.

In alignment with Sustainable Development Goal 4 (Quality Education) and Goal 8 (Decent Work and Economic Growth), SpeakSprint equips learners with transferable skills such as adaptability, communication, and collaboration—key competencies for the 21st-century workforce. As educational institutions continue to seek effective, scalable solutions for employability-focused language instruction, innovations like SpeakSprint offer practical, research-informed pathways for enhancing learner readiness and confidence in real-world communication tasks.

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STA BOOST: AN INNOVATIVE DIGITAL SOLUTION TO ENHANCE STUDENT ENGAGEMENT IN INTRODUCTION TO STATISTICS

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ABSTRACT

STA Boost is a digital learning tool designed to enhance student engagement and understanding in the Introduction to Statistics course. Designed using a no-code platform, the app provides structured, topic-based notes and a range of interactive learning games that support both classroom use and self-directed study. This innovation addresses common challenges in statistics education, such as difficulty in understanding abstract concepts, low motivation, and limited access to engaging learning materials. Selected topics from the syllabus are presented in a simplified format, accompanied by interactive single-player and multiplayer games that reinforce learning through quizzes, puzzles, and timed challenges. These features help students actively recall and apply statistical concepts in a fun and meaningful way. STA Boost is accessible on multiple devices through a simple shareable link, with no installation required. It was developed entirely using free digital tools, making it a cost-effective and scalable solution for educational institutions. Feedback from 67 students revealed highly positive responses, with common descriptors including "enjoyable," "educational," and "interactive," indicating strong engagement and satisfaction. By promoting digital literacy, active learning, and flexible access, STA Boost aligns with the goals of 21st-century education. It provides a practical solution to enhance the teaching and learning of introductory statistics.

Keywords: Digital learning, Gamified education, Statistics education, Student Engagement, No-code platform

INTRODUCTION

The teaching and learning of statistics at the tertiary level present persistent challenges. Students often struggle with the abstract nature of statistical concepts, which require higher-order reasoning and the application of quantitative techniques (Boitshwarelo & Jayasinghe, 2024). Traditional lecture-based

instruction frequently fails to sustain engagement, accommodate diverse learning preferences, or support independent learning (Al-Haddad et al., 2024; Lee, 2007). Lecturers, in turn, face difficulties in maintaining attention, encouraging interaction, and adapting pedagogical methods to support statistical literacy (Hassad, 2009; Nunes, 2016).

To address these issues, this project introduced STA Boost, a mobile-accessible application that integrates structured instructional content with interactive and gamified learning tools. STA Boost was designed to improve students' understanding of foundational statistical concepts, increase engagement, and promote flexibility in learning. The platform features structured notes, scenario-based exam questions, calculator tutorials, and game modules that cover key topics, including statistical terms, measurement scales, sampling techniques, and data collection methods. STA Boost was developed using the Glide Apps platform. Game activities are hosted on external tools such as Wordwall, Genially, Educaplay, Blooket, and Kahoot, and are accessible through a unified interface.

METHODOLOGY

The development of STA Boost followed a structured and user-focused approach to support teaching and learning for the Introduction to Statistics course. The process involved four main phases: planning, development, implementation, and evaluation. During the planning phase, the Introduction to Statistics course syllabus was reviewed to identify key learning outcomes and commonly challenging topics. Based on student learning needs and lecturer input, a selection of topics was chosen for inclusion in the initial version of STA Boost. These selected topics were considered foundational and essential for building students' understanding of basic statistical concepts.

In the development phase, STA Boost was created using Glide Apps, a no-code platform accessible across mobile phones, tablets, and laptops. The chosen content was organized into clear, topic-based sections to help students easily navigate and review each concept. Each section included concise notes and explanations, paired with interactive activities and games developed using a variety of educational tools. These features were embedded within the app for seamless access and engagement.

The implementation phase involved using STA Boost in actual classroom sessions. Lecturers introduced the platform during lessons, while students were encouraged to explore and interact with the content both during and outside of class. For evaluation, feedback was collected from 67 students using Mentimeter. They were asked to describe their experience with STA Boost in three words. The responses were analyzed and visualized in a word cloud to identify recurring themes and evaluate the platform's impact on student engagement and learning motivation. Figure 1 shows the user interface of STA Boost.



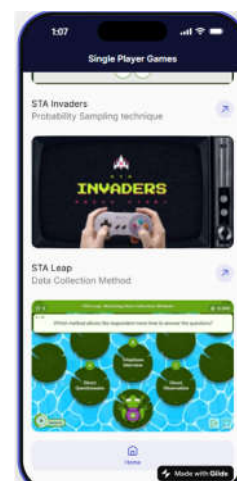
(a)



(b)



(c)



(d)

Figure 1.: User Interface of STA Boost

As illustrated in Figure 1, the STA Boost application guides students through a structured digital interface to support the learning of statistics. The welcome screen (a) introduces the platform, while the main menu (b) offers access to learning modes and essential tools. The topic selection page (c) presents categorized statistical concepts and revision materials. The game interface (d) showcases interactive activities designed to reinforce learning through gamified assessments, progressively building students' understanding of key statistical topics.

RESULTS AND DISCUSSION

The qualitative feedback provided by students was synthesized to identify key themes regarding their experience with the STA Boost platform. Prominent descriptors were extracted to capture students' perceptions related to engagement, interactivity, and usability. Responses were collected and visually represented through a word cloud as shown in Figure 2.



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Figure 2.: Mentimeter Results

Figure 2 illustrates the words most frequently provided by respondents to describe their experience with STA Boost. The larger the word, the more frequently students mentioned it. Among the most frequently mentioned words were "enjoyable," "educational," and "fun," indicating that students found STA Boost to be beneficial and engaging. Other notable words included "interactive," "informative," "interesting," and "clear," reflecting the platform's effectiveness in providing an enjoyable and stimulating learning environment.

These findings suggest that STA Boost successfully fosters an engaging learning environment, making it a valuable educational tool. The overwhelmingly positive student feedback underscores the platform's effectiveness in enhancing student engagement and promoting learning outcomes that align with the objectives of 21st-century education. Continuous improvements and regular feedback will further enhance STA Boost's positive impact on students' learning experiences.

CONCLUSION

The implementation of STA Boost in the Introduction to Statistics course demonstrates significant potential in enhancing students' engagement, motivation, and overall learning experience. By integrating structured educational content with interactive games, STA Boost successfully addresses

common challenges faced by students, including difficulty understanding abstract concepts and low classroom participation.

Student feedback strongly supports the effectiveness of STA Boost, highlighting key benefits such as being enjoyable, educational, fun, and interactive. This feedback suggests that the innovative digital approach of STA Boost has a positive impact on students' perceptions and mastery of statistics, aligning closely with the goals of 21st-century education by promoting digital literacy, creativity, and active learning.

Moving forward, continuous evaluation and refinement based on user feedback will further strengthen STA Boost as an impactful educational innovation. It is recommended that future studies investigate broader implementation across various courses and institutions, examining the long-term effects on student performance and engagement. Ultimately, STA Boost exemplifies how thoughtfully designed digital innovations can significantly enrich the educational landscape, making learning accessible, effective, and enjoyable for all students.

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TABTECH

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ABSTRACT

In today's digital era, students are increasingly disengaged from educational tools like textbooks, creating a need for more interactive and personalized learning experiences. TabTech is a technology-enhanced educational assistant that combines a smart tablet with an ergonomically designed table to support both teaching and learning. Aimed at primary and secondary students, TabTech offers an intuitive platform where learners can complete interactive quizzes, access multimedia lessons, and receive instant, personalized feedback. Students sit at an ergonomic table with an integrated tablet, logging in with personal credentials to access a customized learning environment. The system adapts content difficulty based on each student's progress and includes accessibility features such as adjustable screen settings to support vision difficulties or specific learning preferences. It also restricts access to distracting or inappropriate content, helping students maintain focus safely. The combined table-and-tablet setup promotes better posture, reduces eye strain, and supports visual learners through rich, interactive content. For teachers, TabTech provides a real-time dashboard accessible on various devices to assign lessons and quizzes tailored to their curriculum, monitor student progress and engagement, and analyze detailed performance data to identify students needing additional support or enrichment. The platform helps maintain classroom focus through content controls and allows teachers to generate reports for tracking academic outcomes and facilitating communication with students, parents, and administrators. Designed for classrooms and blended learning environments, TabTech offers flexibility and accessibility. Based on research on similar educational technologies, TabTech is expected to enhance engagement, improve focus, and contribute to better academic outcomes by fostering active learning and providing valuable insights for teachers.

Keywords: *Interactive quizzes, Intuitive platforms, Interactive content*

INTRODUCTION

PROJECT BACKGROUND

In Malaysia, the education system is centrally shaped by the Ministry of Education, which designs the national curriculum, prescribes subjects, and administers examinations such as the Sijil Pelajaran Malaysia (SPM). This system seeks to provide a balanced education that develops knowledge in science, mathematics, languages, and other core areas while fostering unity in a diverse society. Although examinations remain an important benchmark of achievement, there has been a gradual shift toward more interactive and student-centered teaching methods, such as project-based learning and the use of digital tools.

Despite these efforts, many students remain disengaged with learning resources, particularly textbooks, which are often perceived as less stimulating in today's digital-driven era. Learners are increasingly accustomed to interactive technologies in their daily lives, creating a disconnect between classroom practices and their preferred modes of engagement. This gap poses challenges for teachers, who must not only deliver curriculum content but also motivate students, accommodate different learning needs, and maintain classroom focus.

To bridge this gap, TabTech was conceptualized as a technology-enhanced educational assistant that integrates an ergonomically designed table with a smart tablet. TabTech offers students an engaging, personalized learning environment where interactive lessons, quizzes, and multimedia resources are tailored to individual progress. At the same time, it provides teachers with powerful tools to assign tasks, monitor performance in real time, and generate insights to guide academic support. By combining ergonomic design, digital interactivity, and adaptive learning, TabTech addresses both student disengagement and teaching challenges, ultimately supporting Malaysia's vision for a more innovative and inclusive education system.

PROBLEM STATEMENT

Many teachers face challenges in effectively meeting the diverse learning needs of students due to large class sizes, limited resources, and varying learning styles. As a result, students, particularly those struggling academically, often do not receive the individualized attention or support they need, leading to disengagement, low motivation, and poor performance. This creates a cycle of frustration for both teachers and students, hindering the overall effectiveness of the learning process. To address this issue, it is essential to explore solutions that provide teachers with better resources, professional development opportunities, and tools for differentiated instruction, while also offering students the support they need to succeed.

SIGNIFICANCE OF STUDY

The study of teaching and learning is essential for advancing the quality and effectiveness of education. It enables educators to continuously refine their teaching methods, design curricula that meet the needs

of diverse learners, and adopt approaches that foster deeper understanding rather than surface-level memorization. By drawing on evidence-based strategies, teachers can cultivate critical thinking, creativity, and problem-solving skills-competencies that are vital for student's personal development and lifelong learning. In addition, studying teaching and learning strengthens student engagement by making lessons more interactive, relevant, and inclusive. It equips educators with the knowledge to assess learning more accurately, respond to emerging challenges, and integrate innovative practices, including the use of technology, to enhance accessibility and adaptability. Beyond the classroom, these insights contribute to systemic improvements in education, helping institutions create environments that are equitable, future-oriented, and responsive to societal needs. Ultimately, the significance of studying teaching and learning lies in its ability to drive both individual growth and educational transformation, ensuring a more inclusive and effective learning experience for all.

DISCUSSION

In an era where traditional learning tools like textbooks often fail to captivate students' attention, TabTech emerges as a promising solution by merging ergonomics, personalized digital learning, and classroom management. Its hybrid designs a smart tablet embedded into an ergonomically designed table directly addresses both the physical and cognitive needs of students, particularly in primary and secondary education settings. One of the major benefits of TabTech is its interactive and multimedia rich platform, which aligns with how modern students consume information. Unlike static textbooks, TabTech allows students to engage with videos, animations, and gamified quizzes, promoting active rather than passive learning. This approach not only improves focus but also helps accommodate various learning styles, particularly for visual and kinesthetic learners. The platform's ability to adapt content difficulty.

CONCLUSION

In an era where digital distractions often compete with meaningful learning, TabTech offers a powerful solution that seamlessly blends technology with pedagogy to reimagine the classroom experience. By uniting an ergonomically designed table with an adaptive tablet platform, TabTech not only supports student health and focus but also delivers a highly personalized and interactive learning journey. Its ability to adjust content difficulty, provide instant feedback, and ensure accessibility for diverse learning needs makes it an inclusive tool that empowers every learner to reach their full potential. For teachers, TabTech serves as a dynamic partner in instruction offering real time performance insights, streamlined lesson delivery, and the ability to determine both struggling students and high achievers in need of enrichment. Beyond improving individual outcomes, the platform fosters stronger connections between educators, students, and parents through transparent progress tracking and communication tools. By prioritizing engagement, safety, and accessibility, TabTech goes beyond being just another educational gadget. It is a holistic learning ecosystem designed to strengthen focus, enhance academic achievement, and prepare students for the demands of the digital age. With its advanced design for both conventional

and blended learning environments, TabTech has the potential to transform classrooms into interactive, data driven spaces where curiosity thrives, teachers are empowered, and education is truly personalized.

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TEACHING FOR TOMORROW: TRANSFORMING ASSESSMENT FOR SUSTAINABILITY

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ABSTRACT

Teaching and learning (T&L) assessment is critical to aligning higher education with the growing demands of sustainability and professional relevance. In professional programs such as accounting, traditional assessments often emphasize technical proficiency while neglecting broader competencies such as ethical reasoning, systems thinking, and critical reflection. This study explores the transformation of T&L assessment through the lens of Education for Sustainability (EfS), aiming to empower learners with the competencies required for a sustainable future. A three-phase structured model - Design, Delivery, and Evaluation was adopted to realign T&L assessment transformation. Using a qualitative case study approach, the project involved six lecturers, five facilitators, and 108 students enrolled in a foundation-level accounting program. Data were collected through document analysis, interviews, and classroom observations. The findings reveal a shift from content-based to competency-driven assessment, emphasizing real-world application, interdisciplinary thinking, and participatory learning. Students found the new assessment approach more relevant and engaging, while lecturers noted improved alignment with sustainability and professional values. The study underscores the importance of institutional support, continuous feedback, and educator capacity building in embedding EfS principles effectively. The study contributes to SDG 4 by fostering quality education and preparing graduates to lead sustainable change in their professions and communities.

Keywords: Teaching and Learning assessment, Sustainability, Higher education, Accounting program

INTRODUCTION

Higher education institutions (HEIs) are under increasing pressure to transform their teaching and learning (T&L) practices in response to global sustainability challenges. Education for Sustainability (EfS) emphasizes the need for curricula that cultivate not only disciplinary knowledge but also attitudes,

values, and competencies aligned with the United Nations Sustainable Development Goal 4 (SDG 4) on quality education. However, meaningful transformation remains limited in many HEIs, particularly in professional programs such as accounting, where assessment practices continue to prioritize technical proficiency over broader, sustainability-oriented capabilities.

Recent literature highlights that traditional assessment methods were dominated by summative testing and rote learning, which do not adequately foster competencies such as ethical reasoning, systems thinking, and critical reflection, all of which are essential for graduates navigating complex sustainability challenges (Tran & Herzig, 2023). In contrast, integrating authentic, case-based, and problem-based assessments has shown promise in enhancing engagement and cultivating sustainability mindsets. For instance, studies in environmental education have demonstrated how formative assessment embedded within real-world learning scenarios can foster student ownership and critical action.

Accounting education plays a vital role in shaping future professionals' capability in making informed, ethical, and sustainable decisions. Yet, many programs retain siloed content and lack integrated assessment systems that embed sustainability and professionalism as core outcomes. Addressing this gap requires a holistic, values-based pedagogical shift—one that is supported by faculty commitment, top management leadership, and stakeholder collaboration (Powell & McGuigan, 2024).

Education for Sustainability (EfS) offers a transformative framework to guide such change. Rooted in competencies such as systems thinking, ethical decision-making, and participatory learning (David, 2025; Wamsler, 2020), EfS provides a foundation for redesigning T&L assessment practices toward more authentic, learner-centered approaches. In this context, assessment becomes a tool not only for measuring performance but also for empowering learners to engage with real-world complexity and contribute to societal well-being.

This study aims to transform assessment practices in a foundation-level accounting program by adopting an EfS-informed, three-phase model: Design, Delivery, and Evaluation. The project explores how deliberately structured assessment transformation grounded in stakeholder perspectives and faculty innovation can embed authenticity, civic responsibility, and professional relevance within accounting education.

METHODOLOGY

This study employed a qualitative case study approach to explore the transformation of T&L assessment practices in a foundation-level accounting program, guided by the principles of Education for Sustainability (EfS). The intervention focused on revising learning outcomes and assessment tasks to embed sustainability competencies such as systems thinking, ethical reasoning, and real-world application. The transformation process and its brief explanation were conceptualized using a three-stage model as illustrated in Figure 1 below.

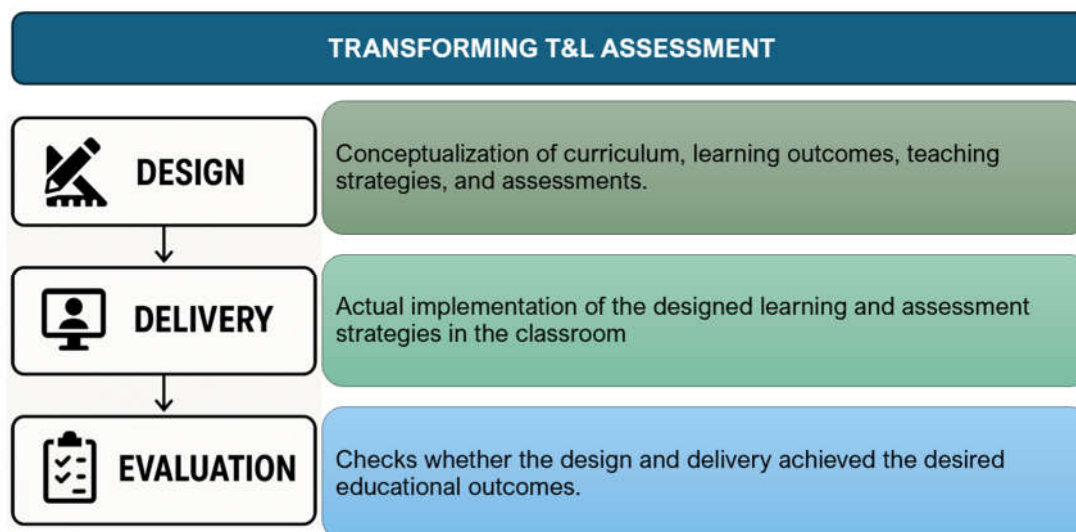


Figure 1.: Three stages of the T&L assessment transformation process

Data collection methods included document analysis of redesigned course materials and rubrics, semi-structured interviews with lecturers and facilitators, and classroom observations during the delivery phase. To evaluate the impact, three different sets of structured questionnaires were developed and administered to each group (students, lecturers, and facilitators) to capture their perspectives on the quality and effectiveness of the transformed T&L experiences. The student questionnaire assessed perceived relevance, engagement, and the extent to which sustainability and professional values were embedded in learning and assessments. The lecturer questionnaire explored changes in assessment design, instructional strategies, and challenges encountered during implementation. The external facilitator questionnaire, targeted at academic peers, provides an external validation of the learning outcomes concerning sustainability and professional standards.

Data were analyzed thematically to identify patterns related to engagement, relevance, and alignment with EfS principles. Triangulation across multiple data sources enhanced the validity of findings, while researcher reflexivity ensured interpretive rigor. This methodology allowed for an in-depth understanding of how assessment innovation can promote sustainability-aligned competencies in professional education contexts.

RESULTS AND DISCUSSION

The transformation of T&L assessment in this study demonstrates a deliberate and structured shift toward more sustainable and future-oriented education practices. Grounded in the three-stage processes, the intervention aimed to align assessment strategies with the core competencies of Education for

Sustainability (EfS), such as systems thinking, ethical reasoning, and problem-solving. The components involved in the transformation process are summarized in Table 1 below.

In the design stage, the learning outcomes and assessment tasks were redefined for three key subjects: Financial Accounting, Business & Technology, and Management Accounting. A collaborative process was undertaken by six lecturers and five external facilitators, who co-designed new assessment formats aimed at aligning content with sustainability competencies such as ethical reasoning, problem-solving, and systems thinking. Learning outcomes were revised to encourage deeper conceptual understanding and application to real-world contexts, while assessment tasks were shifted toward project-based assignments, case analyses, and reflective components. These changes align with EfS principles, emphasizing learning for sustainability rather than merely about content (Lozano et al., 2019).

Among the five facilitators, three were teaching lecturers who had been appointed as subject matter experts. Their experience extended beyond the foundation level, as they had also taught the relevant subjects at higher levels. This enabled them to better understand the roles and responsibilities of teaching lecturers in guiding learners. The remaining two facilitators were independent experts specializing in pedagogy. Their observations of the teaching lecturers provided valuable opportunities for reflection on teaching practices, ensuring alignment with current professional and pedagogical standards. The collaboration and openness of the lecturers signaled a positive shift in mindset, fostering a more reflective and student-centred teaching approach. This transformation was not only intended to strengthen learners' understanding but also to advance the adoption of transformative and interactive pedagogies.

Table 1.: Component involved and its description

Component	Description
Program level	Foundation Stage - Professional Accounting Program
Subjects	Three - Financial Accounting, Business & Technology, Management Accounting
Participants	Six classrooms (108 students) Six teaching lecturers Five external subject matter experts/facilitators
Assessment Intervention	Redesign of learning outcomes and assessment tasks
Evaluation Tools	Three structured questionnaires (Students, Lecturers, Facilitators)

The new assessments were tested across six classrooms involving 108 students. Lecturers facilitated the delivery using more interactive and participatory pedagogies. Methods included group-based problem-solving, simulations, and sustainability-themed business cases. Students were encouraged to explore cross-functional impacts (e.g., how accounting decisions affect social and environmental outcomes), promoting systems thinking. The use of formative feedback and scaffolded guidance reflected EfS's emphasis on iterative, reflective learning (Kandiko Howson & Kingsbury, 2023). Delivery was also enriched by external facilitators who provided industry and sustainability insights, bridging academic theory and practice.

The evaluation served to measure learning outcomes and reflected on the transformation effectiveness. Three structured questionnaires were tailored to students, lecturers, and facilitators. The positive feedback from both students and educators points to increased awareness, deeper critical thinking, and a broader understanding of sustainability concepts. Importantly, evaluation data also illuminated the ongoing need for professional development, institutional support, and a culture of reflection to sustain transformation efforts.

CONCLUSION

This study set out to transform teaching and learning (T&L) assessment within a foundation-level accounting program by aligning it with the principles of Education for Sustainability (EfS). Through a structured three-phase model, the intervention proved that assessment could serve as a powerful tool not only to measure learning outcomes but also to cultivate sustainability-related competencies such as systems thinking, ethical reasoning, and real-world problem-solving (Lozano et al., 2019; Wamsler, 2020).

The collaborative redesign of assessment tasks, supported by active pedagogies and industry engagement, led to more meaningful learning experiences and improved alignment with both professional standards and societal expectations (Azaiki & Shotte, 2020; Tran & Herzig, 2023). Feedback from students, lecturers, and facilitators confirmed increased engagement, relevance, and critical awareness among learners. These findings affirm the potential of EfS-informed assessment to contribute meaningfully to SDG 4: Quality Education and to prepare graduates for the demands of a rapidly evolving, sustainability-conscious world.

This study contributes to the growing body of knowledge on sustainability education by providing a practical, replicable model for assessment transformation. It also supports the call for integrating SDG 4 into the heart of educational design and practice. It underscores the need to reconceptualize assessment not merely as a grading mechanism, but as a strategic tool for nurturing competent, ethical, and sustainability-conscious graduates prepared to contribute meaningfully to society and their professions.

Future research should explore the long-term impact of such assessment transformations on graduate employability, ethical decision-making, and civic responsibility. Comparative studies across disciplines and institutional contexts could yield broader insights into the scalability and adaptability of EfS-based

assessment models. Additionally, longitudinal research may help track how sustainability-integrated assessment influences lifelong learning and professional practice.

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THE PEEL PATHWAY: A LEARNING INNOVATION FOR SMARTER LEARNING AND BETTER GRADES

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ABSTRACT

Transitioning from school to university education poses substantial challenges for students, particularly those diploma and undergraduate learners. One key difficulty is the lack of critical explanatory skills, specifically the ability to express thought and explain ideas clearly, convincingly, and analytically. This deficiency often contributes to poor individual performance in coursework, poor subject performance, and an overall decline in program achievement. Conversely, the ability to communicate ideas effectively is a strong determinant of academic success. To address this issue, the PEEI approach, a student-centered framework was introduced and implemented. PEEI stands for Point, Elaboration, Example, and Impact. This four-step method is designed to guide students in organizing and expressing their thoughts more effectively. This approach serves as a practical tool for guiding students to identify their key point, elaborate on it, support it with relevant examples, and discuss its implications. Students are guided to apply the PEEI framework during tutorial sessions. Feedback indicates that most students find the PEEI approach beneficial in refining their ability to present ideas more effectively. Moreover, lecturers can utilize this approach to improve course outcomes and use it as effective teaching strategies in higher education. PEEI proves to be a simple yet powerful method for enhancing students' articulation skills in higher education learning environments.

Keywords: PEEI approach, explanatory skills, academic performance

INTRODUCTION

Explanatory skills and writing proficiency are crucial for academic excellence, particularly in final examinations and final written assessments where students are encouraged to communicate their understanding clearly, systematically, logically and creatively. High explanatory skills empower learners to organize their ideas, articulate key points, and support their arguments with relevant

examples and reasoning. Learners’ continued reliance on educators’ input has been shown to hinder the development of essential writing techniques (Cheng, 2016), as well as their capacity for effective communication and higher-order thinking (Palpanadan et al., 2019). Saravanan et al. (2021) highlight that learners’ focus more on linguistic accuracy such as grammar, spelling, and vocabulary over the actual content of their writing. In learning to write explanatory texts, students often face obstacles like low motivation, fragmented idea development, and lack of coherence. Their struggles are particularly evident in composing introductory statements, maintaining logical sequencing, and explaining phenomena effectively (Perdana et al., 2022). Ability to maintain logical flow, cohesive structure, and seamless transitions remains a persistent challenge for learners and hinder writing quality among learners (Zakaria., & Sulaiman, 2024). Strengthening students’ explanatory skills not only enhances academic attainment but also builds lifelong communication competencies. Due to that PEEI approach is introduced to educate and train learners on effective technique of explaining their point.

METHODS

This study adopted a practical application approach, utilizing the PEEI method (Point, Elaborate, Example, Impact) as the foundational teaching strategy. The PEEI approach was implemented as a classroom-based teaching method throughout the semester to enhance students' explanatory skills. To evaluate the effectiveness of this approach, a simple online quantitative survey was conducted at the end of the semester involving 64 second-semester students enrolled for the Human Resource Management in the Public Sector course. The survey consisted of closed-ended questions using nominal data, where students were asked to indicate their agreement or disagreement with a series of statements related to the PEEI approach. The responses were analyzed using descriptive statistics, focusing on learners’ views regarding the user-friendliness of the PEEI approach, adequacy of training, enhancement of their explanatory abilities, confidence in idea articulation, support in developing coherent arguments, and overall satisfaction with the method. Picture 1.0 illustrates the PEEI approach template, which is designed to train and motivate learners in developing and strengthening their explanatory skills through structured practice.



Picture 1.: PEEI approach template

RESULTS AND DISCUSSION

Based on the feedback collected through the survey, the majority of learners responded positively to the implementation of the PEEI approach. Most students indicated that they were able to understand and apply the method effectively during both tutorial sessions and their final examination. Table 1 shows the result of a survey conducted on PEEI approach.

Table 1.: Learners response on the PEEI approach

Questions	Agree (%)	Disagree (%)
The PEEI approach is straightforward and easy to grasp.	98.4	1.6
I have been trained to use the PEEI method during tutorial sessions.	96.9	3.1
Using the PEEI approach helps me to improve my skill in explaining my point effectively.	98.4	1.6
I confidently applied the PEEI method during my final assessment.	85.9	14.1
I love using the PEEI approach	100	0

CONCLUSION

The success of the PEEI approach in improving learners' abilities to explain their point confidently highlights its potential as an effective instructional tool. This approach is not only helping students to achieve better academic performance but also gaining pivotal skills such as critical thinking, structured reasoning, logical progression of thoughts and systematic flow of ideas. It is hoped that these skills will continue to support learners in their future academic pursuits and professional careers. This approach anticipated will continue to empower learners, preparing them not just for exam purposes but also for lifelong learning.

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THE POTENTIAL FLOW INTERACTIVE TEACHING TOOL (PFITT)

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ABSTRACT

Potential flow theory is a fundamental concept in fluid mechanics but is often challenging for students to visualize due to its mathematical complexity and reliance on ideal assumptions. To address this educational barrier, the Potential Flow Interactive Teaching Tool (PFITT) was developed as a web-based, interactive simulation platform that helps learners explore and understand the behavior of ideal flows. Built using Python and Streamlit, PFITT allows users to manipulate parameters of elementary flows such as uniform flow, source, sink, vortex, and doublet, as well as simulate their superpositions. The tool dynamically generates streamlines, stream function (ψ), and potential function (ϕ) plots based on user inputs, reinforcing key concepts such as flow symmetry, stagnation points, and scalar field orthogonality. The accuracy of PFITT was verified through case studies and compared against analytical solutions, showing strong agreement with theoretical expectations. With its clean user interface, real-time outputs, and browser-based accessibility, PFITT serves as a practical and scalable educational tool for enhancing conceptual understanding in fluid mechanics courses. Future enhancements may include extended flow scenarios, result exporting features, and integration with online learning platforms.

Keywords: Fluid mechanics, Potential flow, Stream function, Python, Streamlit

INTRODUCTION

Potential flow theory forms a critical component in the study of fluid mechanics, especially for analyzing ideal flows under the assumptions of inviscid, incompressible, and irrotational conditions. These assumptions lead to Laplace's equation, which governs both the stream function and the velocity potential, forming the basis for modeling various elementary flow cases such as uniform flow, source,

sink, vortex, and doublet (White, 2016; Munson et al., 2013). Despite its fundamental importance, many students find it difficult to grasp the physical meaning behind these mathematical formulations, particularly when superpositions of multiple flow elements are introduced. Traditional instruction methods often rely on lectures and textbook examples, which can limit students' spatial and conceptual understanding of flow behavior. As a result, the need for more intuitive and visual approaches has grown in engineering education, especially for complex topics like potential flow (Kumar, Jain, & Pathak, 2021). To respond to this challenge, the Potential Flow Interactive Teaching Tool (PFITT) was developed as an educational simulation platform using Python and Streamlit. PFITT allows users to manipulate flow parameters and observe real-time changes in streamline patterns, velocity fields, and potential functions through a web-based interface. Studies have shown that incorporating interactive simulations can significantly enhance student engagement and improve conceptual understanding in engineering subjects. These tools serve as bridges between abstract theory and practical visualization, thereby promoting deeper learning (Shaikh & Khoja, 2012). PFITT aligns with this approach by enabling both predefined and custom scenarios for elementary and combined flows, allowing students to intuitively analyze flow interactions and phenomena such as stagnation points, streamline curvature, and the orthogonality of ψ and ϕ contours. PFITT is especially useful for courses such as MEC442, where students are first introduced to potential flow theory. The tool provides an accessible, platform-independent solution that complements traditional instruction methods and removes the need for commercial simulation software or physical laboratory setups. Its implementation supports independent exploration, facilitates active learning, and aligns with modern pedagogical trends in engineering education (Bower & Sturman, 2015).

METHODS

The development of the Potential Flow Interactive Teaching Tool (PFITT) followed a structured, iterative methodology that integrates interactive frontend design with mathematically rigorous backend computations to enhance student comprehension of ideal fluid flow. Built using Python as the core programming language and Streamlit as the web-based application framework, PFITT offers a real-time visualization platform that simulates elementary potential flows and their combinations. This technology stack was selected for its rapid development capability, browser-based deployment, and ease of access across devices, eliminating the need for local software installation. The graphical user interface (GUI) of PFITT was designed to be both intuitive and pedagogically effective. It features clean layout sections for predefined flow case selection, custom parameter inputs, optional visualization toggles, and an expandable theory guide. The predefined case dropdown includes classic flow patterns such as uniform flow, source, sink, vortex, and doublet, as well as common superpositions like Rankine half-body and flow around a cylinder. For each case, users can adjust the flow parameters, such as strength and location through labeled number input fields. Upon activating the simulation, the app dynamically computes velocity components, stream function (ψ), and velocity potential function (ϕ), and displays the resulting flow field as streamlines with color-coded velocity magnitude. The computational logic behind PFITT is rooted in the analytical expressions of potential flow theory. All flow types adhere to Laplace's equation, ensuring the incompressibility and irrotationality conditions are satisfied. The governing equations used for velocity fields and scalar functions are embedded in the

backend using NumPy operations, with safeguards to prevent numerical instability near singularities. For example, the source and sink velocity components are derived using the radial distance formula:

$$u = \frac{m}{2\pi} \frac{x}{r^2}, \quad v = \frac{m}{2\pi} \frac{y}{r^2}, \quad \psi = \frac{m}{2\pi} \theta, \quad \phi = \frac{m}{2\pi} \ln r \quad (1)$$

Similar expressions are applied for vortex and doublet flows, with coordinate transformations that account for the user-defined element positions. These expressions are superposed to produce total flow fields that represent more complex physical situations. To ensure robust performance, a minimum threshold is set for radial distances to prevent division by zero or log singularities during computation. The overall workflow of PFITT follows a linear sequence: flow case selection, input validation, backend computation, and layered output rendering. Outputs include streamline plots of the velocity field, stream function contours, potential function contours, and an optional overlay of ψ and ϕ . Each plot is accompanied by descriptive text to aid student understanding and to support self-paced learning. Figure 1 illustrates this workflow visually. To ensure computational integrity, input validation checks and default value fallbacks are implemented throughout the system. A built-in warning message is triggered when all inputs are zero, thus preventing meaningless simulations and guiding users to enter valid parameters. These mechanisms enhance both usability and pedagogical value.

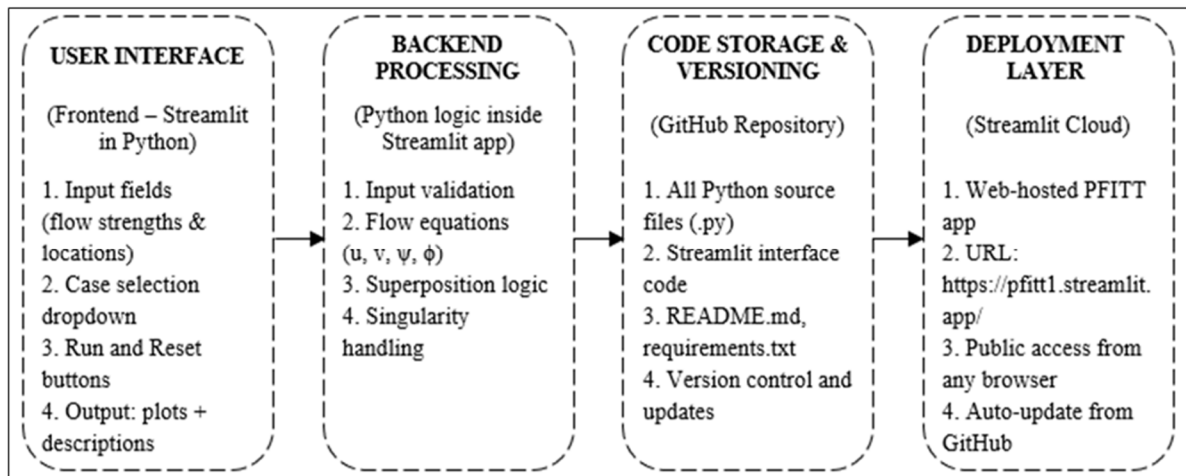


Figure 1.: PFITT System Workflow

The technology stack used in PFITT is summarized in Table 1. Each component contributes to the system’s responsiveness, accuracy, and accessibility. Streamlit handles the frontend development, while NumPy supports the backend flow computations. Visualization is conducted using Matplotlib, and the source code is hosted on GitHub for version control and scalability. Public deployment is achieved through Streamlit Cloud, allowing users to run the application on any internet-enabled device without installation requirements. This combination of technologies ensures PFITT remains lightweight, robust, and adaptable for use in academic settings and beyond.

Table 1.: Technology Stack Used in the Development of PFITT

Component	Technology Used	Description
Frontend	Streamlit (Python)	GUI interface, dropdowns, buttons, user inputs
Backend	Python with NumPy	Flow computation, Laplace-based velocity fields
Visualization	Matplotlib	Streamlines, ψ and ϕ contour plots
Code Hosting	GitHub	Source code repository and version control
App Deployment	Streamlit Cloud	Public access to PFITT via browser-based link

RESULTS AND DISCUSSION

The user interface of the Potential Flow Interactive Teaching Tool (PFITT) was designed to provide an accessible and interactive learning environment for fluid mechanics students. As illustrated in Figure 2, the front page introduces the tool with a clean layout, guiding users to select predefined flow cases or input custom values. Upon entering the simulation, the main interface presents numerical input fields for each flow element (e.g., source strength, vortex location), checkboxes for optional scalar field visualizations, and an output area that dynamically renders streamlines, stream functions (ψ), and potential functions (ϕ). This intuitive layout ensures that users, even without coding experience, can simulate potential flows and observe results immediately.

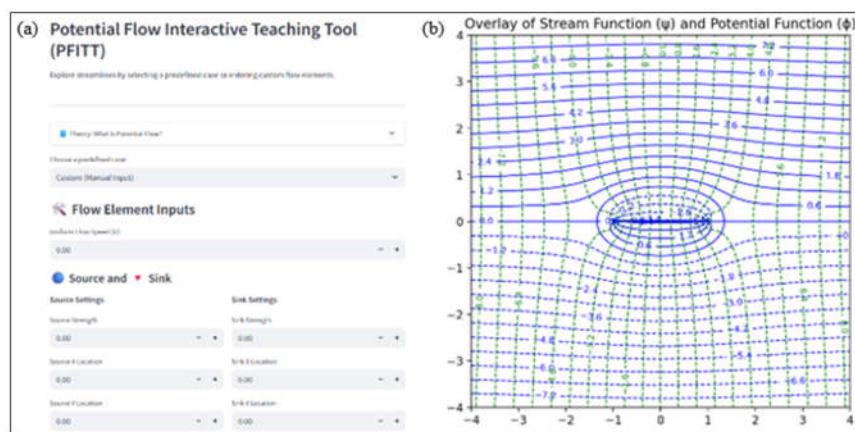


Figure 2.: PFITT User Interface: (a) Before Execution, (b) After Execution

To evaluate the correctness of PFITT's computational engine, two benchmark simulations were performed and compared with analytical solutions based on potential flow theory. The first case

simulated a source flow at the origin with a strength of 5.0 units. The second case involved a uniform flow with a velocity of 2.0 units combined with a doublet, which theoretically represents flow around a cylinder. For each case, key characteristics such as flow symmetry, stagnation points, and streamline patterns were compared visually and numerically to standard textbook solutions. The streamline results in both cases closely matched theoretical expectations. For the source case, radial streamlines and circular, equipotential lines were observed, as predicted by the logarithmic potential and angular stream function equations. For the uniform + doublet case, the resulting streamline pattern exhibited a symmetric closed streamline contour around the origin, consistent with classic flow around a circular cylinder. These results are summarized in Table 2, which compares PFITT visual outcomes with expected textbook behavior.

Table 2.: Comparison of the Result of PFITT with the Theoretical Calculation

Case Study	Expected Flow Behavior	Observed in PFITT	Match
Case 1: Source Only	Radial streamlines, circular ψ and ϕ contours	Radial and circular contours correctly plotted	Yes
Case 2: Uniform + Doublet	Closed streamline loop, symmetric cylinder-like pattern	Symmetric loop observed, with stagnation points	Yes

CONCLUSION

The Potential Flow Interactive Teaching Tool (PFITT) is a practical and user-centered educational platform designed to support the understanding of ideal flow behavior in fluid mechanics. By allowing users to manipulate flow element parameters such as velocity, strength, and location, and instantly visualize resulting streamline patterns, stream functions (ψ), and potential functions (ϕ), PFITT bridges the gap between theoretical instruction and experiential learning. Its simulation results, validated through comparison with textbook flow behavior, confirm its reliability and accuracy in illustrating core principles of potential flow. From an educational perspective, PFITT addresses long-standing challenges in teaching abstract concepts such as flow superposition, irrotationality, and scalar field orthogonality. Its clean, guided interface and dynamic outputs provide learners with immediate visual feedback, enabling them to explore the influence of individual and combined flow elements in an intuitive manner. This reinforces foundational topics such as Laplace’s equation, stagnation points, and flow around bodies without the need for high-cost physical experiments or commercial software. Developed using Python and Streamlit, PFITT is accessible through any web browser without installation, making it highly adaptable for classroom use, remote learning, and self-paced study. Its lightweight architecture and modular codebase also enable collaborative development, version control, and customization through open-source distribution. These features position PFITT as a scalable and flexible teaching tool, well-suited for integration into undergraduate courses like MEC442 or other fluid dynamics modules. The broader impact of PFITT lies in its ability to translate mathematical models into interactive visual learning experiences. By embedding the analytical expressions for potential flows into a responsive simulation environment, the tool highlights the pedagogical value of real-time computation and graphical interpretation. Future enhancements may include the ability to export plots, overlay multiple flow cases, and analyze velocity or pressure distributions. Additional integrations with learning management systems or embedded quizzes could further support formal instruction and

assessment. As engineering education increasingly shifts toward digital and experiential platforms, PFITT exemplifies how simulation-based tools can demystify theoretical concepts and promote deeper engagement. With continued refinement, PFITT has the potential to evolve into a comprehensive instructional resource for fluid mechanics, supporting both fundamental understanding and advanced exploration of flow phenomena.

ACKNOWLEDGEMENTS

The authors would like to thank everyone who supported the development of the Potential Flow Interactive Teaching Tool (PFITT). Appreciation is extended to those who provided feedback, encouragement, and technical assistance throughout the project. Their support contributed to the successful creation of PFITT as a practical and accessible educational tool for fluid mechanics learning.

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THE USE OF CLASSPOINT FOR STUDENT ENGAGEMENT IN LEARNING COMPUTER AND INFORMATION PROCESSING

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ABSTRACT

Computer and Information Processing is a servicing type of subject for Diploma in Office Management and Technology students. This subject involves two hours of lecture and two hours of laboratory per week. Nine chapters need to be covered during the lecture within 14 weeks. All the chapters involve lots of theoretical concepts and terms that are quite dry compared to the laboratory session. It is challenging to ensure engagement and participation of students in class, especially for Generation Z, who are known to have very short attention span. Therefore, ClassPoint platform is used to make the class livelier and more exciting during the teaching and learning process. ClassPoint is a learning platform that can be integrated with PowerPoint, with various interactive activities. Among the attractive features of ClassPoint is the accumulation of stars awarded by the instructor according to their participation or achievement. Through observation by instructors, the students would pay more attention when ClassPoint activity is conducted and are eager to get involved compared to conventional lectures. The students' perceptions are obtained through a questionnaire survey, and the findings are analyzed for future action and improvement.

Keywords: Classpoint, Student, Engagement, Learning, Computer

INTRODUCTION

Educational technology has evolved rapidly with the integration of various tools in the education sector at all levels. The goal is to make the teaching and learning process more interactive and engaging, which subsequently helps the students understand the lesson better. This is especially crucial for Gen Z students who have shorter attention spans compared to millennials (Thakur, 2025). One of the emerging tools is ClassPoint, an interactive tool that can be integrated into Microsoft PowerPoint. Gamification

is a core component of ClassPoint’s design. The inclusion of features such as points, badges, star levels, and leaderboards has been shown to positively influence learner motivation and participation (Dixit, Nirgude & Yalagi, 2018). Studies on gamified educational platforms have confirmed that these elements promote sustained attention and deeper cognitive engagement (Saleh & Mohamed, 2025).

METHODS

ClassPoint activities are implemented during the lecture session for each chapter. Among the ClassPoint features used are Short Answer, Word Cloud, Multiple Choice, and Slide Drawing. To gauge the students’ perceptions about the effect of Class Point on the aspect of engagement and participation, an online survey was given. 26 students enrolled in the Computer and Information Processing subject in Universiti Teknologi MARA Terengganu Branch during March – August 2025 semester responded, and the results are shown in the next section.

RESULTS AND DISCUSSION

The survey results are shown in Figure 1, Figure 2, Figure 3, Figure 4, and Figure 5 below.

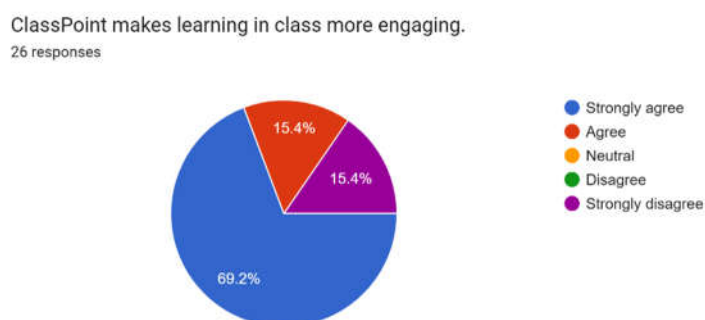


Figure 1.: Responses to “ClassPoint makes learning in class more engaging.”

The interactive features (e.g., quizzes, polls, annotations) of ClassPoint keep me actively involved during lessons.
26 responses

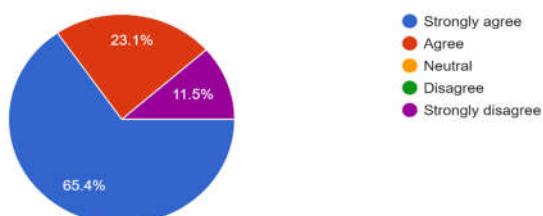


Figure 2.: Responses to “The interactive features keep me actively involved during lessons.”

I am more likely to participate in class activities when ClassPoint is used.
26 responses

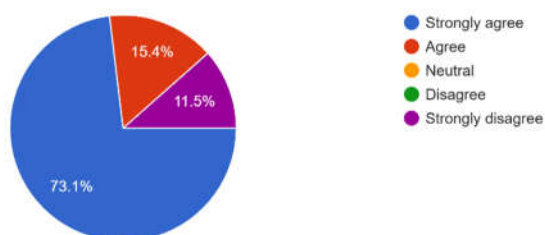


Figure 3.: Responses to “I am more likely to participate in when ClassPoint is used.”

ClassPoint helps me focus better during lessons.
26 responses

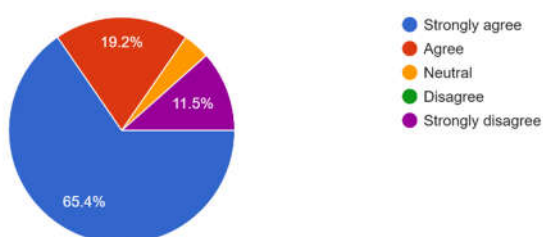


Figure 4.: Responses to “ClassPoint helps me focus better during lessons.”

I feel more motivated to learn when my lecturer uses ClassPoint.

26 responses

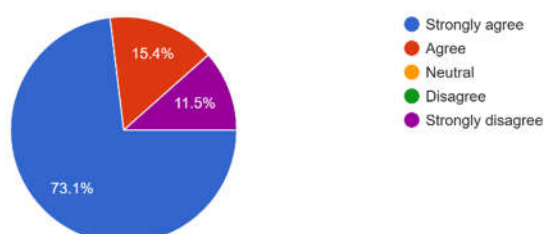


Figure 5.: Responses to “I feel more motivated to learn when my lecturer uses ClassPoint.”

For all survey questions, more than 65% of students strongly agree that ClassPoint has impacted them positively in terms of engagement and participation.

CONCLUSION

The usage of the ClassPoint tool for enhancing engagement in the Computer and Information Processing subject lecture session has successfully achieved the objective, as demonstrated by the views obtained from the survey questionnaire. To encourage and appreciate their participation, the winners, determined by the number of stars accumulated, are given special prizes. The students have also suggested that ClassPoint be integrated into the teaching and learning process of other subjects. The students’ feedback will be implemented in the ClassPoint implementation for next semester. The implementation activities can be documented in a proper teaching manual. Basic ClassPoint workshop can also be conducted among the lecturers to spread its benefits.

ACKNOWLEDGEMENTS

Huge thank you to UiTM Terengganu students who enrolled in the Computer and Information Processing subject during the March-August 2025 semester for participating in this study.

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THREADING *MEMORYSCAPES*: MENTAL MAPPING AND CULTURAL STORYTELLING THROUGH STRING, SPACE & PLACE

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ABSTRACT

This teaching innovation transforms the exploration and understanding of cultural landscapes by creatively integrating mental mapping, tactile storytelling, and place-based learning. Conducted with landscape architecture students in various heritage towns and kampongs in Perak, the project blends cognitive mapping with physical expression using maps, archival images, and string to create interactive "memoryscapes". Students are challenged to translate their personal perceptions, local narratives, and community memories into spatial forms, resulting in layered installations that visualise both the physical and mental geographies of a place. They externalise internalised knowledge by threading strings between locations, stories, and symbolic references, effectively making the invisible visible. This approach encourages critical reflection on how cultural identity, memory, and space are mentally and emotionally mapped. Offering a multisensory learning experience that combines fieldwork, ethnographic inquiry, and visual communication, this methodology allows students to co-create meaning in collaboration with the local context. Mental mapping serves as both a process and a product, fostering empathy, cultural sensitivity, and spatial awareness. The use of analogue tools and embodied practices deepens engagement and bridges theory with experience, while promoting creativity, collaboration, and critical thinking. This method redefines mapping as an act of cultural storytelling, where students document not only what is seen but also what is felt, remembered, and imagined. It presents a scalable, low-tech, high-impact model for teaching cultural landscapes in an immersive, reflective, and deeply human-centred way.

Keywords: Cultural Mapping, Place-Based Learning, Spatial Thinking, Mental Mapping

INTRODUCTION

Understanding cultural landscapes goes beyond analysing physical elements, as it requires engaging with memory, identity, and emotional connections to place. Traditional mapping techniques often fail to capture the layered, subjective experiences embedded in a community's collective memory. In response, the "Threading Memoryscapes" offers a creative, embodied pedagogy that integrates mental mapping, tactile materials, and cultural storytelling. Designed for landscape architecture students, this method fosters a deeper comprehension of heritage, a sense of place, and spatial narratives. Through this innovation, students explore the emotional and symbolic geographies of heritage towns and kampongs in Perak, transforming intangible memories into visible, interactive installations. By reimagining mapping as a form of storytelling and co-creation, the project aligns with current pedagogical shifts toward participatory, place-based, and interdisciplinary learning.

METHODS

The teaching innovation unfolded in four iterative phases, implemented during community-based studio projects with landscape architecture students in selected towns and kampongs in Perak (e.g., Tronoh, Pusing, Parit and Teluk Intan):

i) Mental Mapping & Field Immersion

Students conducted field visits and interviews with residents, focusing on gathering personal stories, spatial memories, and cultural meanings associated with places. They were instructed to sketch mental maps based on both their own impressions and those shared by the locals, emphasising what is felt rather than only what is seen.

ii) Archival Research & Contextual Mapping

Using historical photographs, oral histories, and old maps, students cross-referenced present-day spatial experiences with archival layers. These materials became part of their interpretive base for identifying memory nodes and cultural landmarks.

iii) Threading the Memoryscape

In the studio, students created three-dimensional memory maps using string, pins, labels, photographs, and transparent layers. Strings were used to connect locations, emotions, historical events, and symbolic narratives, producing multisensory installations that reflected the intertwined nature of memory and space.

iv) Presentations, Reflections & Community Dialogue

The final installations were exhibited and discussed with community members. Students reflected on their learning in written narratives and peer critiques, deepening awareness of cultural sensitivity and spatial empathy.

RESULTS AND DISCUSSION

The *Threading Memoryscapes* project revealed several pedagogical and experiential insights supported by both student feedback and observational data. With 26 landscape architecture students participating

in various heritage towns in Perak, survey results and reflective responses affirmed the impact of this tactile, place-based learning approach.

i) Enhanced Cultural Sensitivity and Empathy

Students demonstrated an improved capacity to listen, observe, and interpret the lived realities of others. Through field visits and informal conversations with residents, they developed a deeper appreciation for intangible heritage, personal memory, and the emotional layering of space.

- 88% of students (23 out of 26) strongly agreed that fieldwork and community interaction deepened their empathy and cultural understanding.
- One student reflected: “Listening to kampong residents and mapping their stories made me see the place in a new light—not just buildings and roads, but memories and emotions.”

This aspect of the project fostered a more human-centred learning experience, reinforcing the role of emotional intelligence in spatial design.

ii) Spatial Thinking Beyond Physical Form

By engaging in mental mapping and tactile expression, students expanded their understanding of space to include symbolism, emotional significance, and memory. The translation of oral histories and internalised perceptions into thread-based spatial compositions allowed students to think critically about what constitutes meaningful space.

- 92% of students (24 out of 26) agreed that the project improved their ability to reflect critically on spatial relationships and symbolism.
- 96% (25 out of 26) acknowledged that the activity helped them understand the cultural and emotional layers of a landscape.

Through this, students began to question and move beyond conventional top-down design strategies toward more inclusive and narrative-driven approaches.

iii) Multisensory and Collaborative Learning

The use of string, pins, layered transparencies, and analogue mapping tools made learning tactile, visual, and collaborative. The act of threading relationships between spaces, people, and memories became both a method and a metaphor for understanding non-linear place connections.

- 100% of participants (26 of 26) stated that the method encouraged creative thinking in how they represent memory and meaning.
- 90% (23 of 26) said they prefer learning approaches involving hands-on or tactile elements.

In peer interviews, students noted that the physical act of connecting places with strings “helped make the abstract concrete”.

Collaboration was organically embedded in the process as students co-created installations and co-interpreted memories in group dialogue.

iv) Community Engagement and Reflective Practice

Engagement with the local context was essential. Students interacted with residents in informal interviews, often revisiting sites to clarify stories and confirm spatial references. These encounters not

only grounded their mapping in lived experience but also fostered mutual respect between learners and community members.

- 85% of students (22 out of 26) expressed increased confidence in engaging with local narratives and heritage in their future design work.
- Installations presented in informal exhibitions prompted local feedback, with some community members commenting that they were “surprised and moved” by how students had interpreted and valued their memories.

This reflective and dialogic element positioned students not just as designers but as active cultural interpreters and facilitators.

In summary, the project successfully combined qualitative storytelling, spatial reasoning, and embodied making, with clear evidence from student responses indicating high levels of engagement, empathy, and spatial literacy. The participatory nature of the activity also fostered personal ownership of learning, bridging the gap between studio knowledge and real-world cultural understanding.

CONCLUSION

"Threading Memoryscapes" redefines mapping as a culturally immersive and emotionally resonant practice. It empowers students to explore landscapes not just as designers but as storytellers and listeners. By integrating ethnography, artistic expression, and spatial inquiry, this low-tech, high-impact method nurtures empathy, cultural understanding, and creative thinking, which reflect the key competencies for future landscape architects. It also offers a replicable framework adaptable across disciplines and community settings.

ACKNOWLEDGEMENTS

The project team acknowledges the invaluable participation of residents from Tronoh, Pusing, Parit and Teluk Intan, whose stories and memories enriched this initiative. Special thanks to the landscape architecture students who approached the process with openness, curiosity, and care. Appreciation is also extended to the faculty's colleagues and local authorities who support field access and community engagement.

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TIKTOK'S ROLE IN BOOSTING MOTIVATION TO LEARN ARABIC AMONG MALAYSIAN UNIVERSITY STUDENTS

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ABSTRACT

This study investigates the impact of using the TikTok platform as a supplementary educational tool for enhancing motivation among university students in learning Arabic as a foreign language. The research responds to the increasing integration of social media in students' daily lives, particularly TikTok's popularity among users aged 18–24, and explores how its features—short videos, interactivity, and entertainment—can be harnessed for pedagogical purposes.

Keywords: *TikTok, Arabic language learning, student motivation, digital pedagogy, social media in education*

INTRODUCTION

Arabic is often perceived by learners as difficult and less engaging, leading to low motivation levels. Traditional teaching methods struggle to retain students' attention in an era dominated by fast-paced digital content. Given TikTok's popularity and ability to personalize content through algorithms, it holds potential for modern language education—especially for increasing exposure to vocabulary, pronunciation, and sentence structures in an enjoyable way. This study therefore aims to measure the frequency of TikTok usage among Malaysian university students, assess students' perceptions of TikTok content compared to traditional methods in learning Arabic and identify motivational factors and as well as preferred content types that enhance interest in Arabic via TikTok.

METHODS

A **quantitative research design** was used, with data collected through an online questionnaire distributed via WhatsApp and Telegram over 7 days. A total of 56 students from universities in Malaysia and abroad (UIAM, UPSI, USIM, Al-Azhar, UiTM) participated. The sample included Arabic language majors and students from other disciplines using Arabic as a medium of instruction.

RESULTS AND DISCUSSION

The results show that 75% of respondents had used TikTok to learn Arabic, with the most motivating content being daily vocabulary videos (82.1%), followed by challenges and interactive scenes. This type of content is not only motivating but also entertaining. Dinia et al. (2024) similarly found that translating viral songs into Arabic emerged as the most motivating form of content for learners, as it enhanced vocabulary retention and recall. As a result, this enjoyable exposure encourages consistent engagement with the language, immediately addressing the study's objective of identifying key motivational factors. Besides, the students highlighted that TikTok's informal environment reduced anxiety and increased self-confidence. This is because for some individuals, the thought of attending class while still struggling with the language can create pressure and reinforce the perception that the language is difficult. However, frequent exposure to short videos and the opportunity to experience and construct learning anonymously through TikTok able to allow them to learn without fear of making mistakes or being judged. Kidwell et al. (2023) similarly noted that interaction with speakers of similar linguistic backgrounds increases confidence by providing a supportive atmosphere. For example, TikTok's algorithm always presents users to live streams where the Arabic speaker hosts or Native speaker and invites conversation. Therefore, viewers are drawn in and feel more comfortable engaging in the learning process. This definitely relates with social engagement features (e.g., likes, comments) that able to enhance learners' sense of belonging and motivation. When the algorithm matches users with content that aligns with their interests, and they see meaningful comments from others with similar goals, it fosters a like-minded learning community that inspires further language acquisition. Nevertheless, the platform was not perceived as a replacement for formal education but rather as a complementary learning tool. Formal education with experienced teachers remains essential for providing systematic guidance and ensuring deep understanding. As the saying goes, when building a house, the first priority is not the furniture or decorations (TikTok), but the essential materials needed to construct the foundation. Zulkifli et al. (2022) further observed that TikTok can serve as a creative assessment platform to support project-based learning in the language arts. This allows students to develop their potential creatively, exchange ideas without face-to-face interaction, and draw inspiration from both local and international peers. This is aligned with this current era, where trends spread globally such as dance challenges and how fortunate it would be if similar viral trends were used for educational purposes. Lastly, the suggestions for improvement include increasing Arabic educational content, enhancing searchability, and encouraging collaboration with educators to produce more targets to make learning more effective and sustainable.

CONCLUSION

TikTok proves to be an effective motivational supplement for learning Arabic among university students when used purposefully. Its engaging content, short video format, and social interactivity help foster sustained interest, especially in vocabulary acquisition. Future efforts should focus on integrating TikTok strategically into blended learning models and guiding students on how to use it for meaningful language learning experiences.

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TRADEU: BRIDGING THEORY AND THE MARKET WITH REAL-TIME FINANCIAL LEARNING

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ABSTRACT

In Malaysia, finance education remains largely theoretical, leaving students underprepared for real-world trading and market dynamics. To address this gap, TradeU is introduced as an interactive, classroom-based platform integrated with Bursa Malaysia's tools and localized financial content. The platform enables educators to build digital classrooms where students learn trading fundamentals, analyze live market data, conduct technical analysis, and monitor real-time company news. Its novelty lies in a gamified Bursa Malaysia trading simulation with a leaderboard, promoting engagement through competition and practice. TradeU also supports assignment submission and performance tracking, creating a comprehensive teaching and learning ecosystem. Although financial literacy in Malaysia increased slightly from 60.2% to 62.9% in 2024, overall levels remain stagnant, highlighting the need for impactful solutions. Tailored for university students and finance educators, TradeU fosters investment literacy, analytical thinking, and confidence, demonstrating strong commercialization potential in academia, literacy programs, and professional development.

Keywords: Financial Literacy, Gamification, TradeU, Bursa Malaysia, Higher Education, Experiential Learning

INTRODUCTION

Finance education at the tertiary level has long emphasized theoretical knowledge over practical application, resulting in a disconnect between what students learn in classrooms and the realities of financial markets. Many graduates face challenges applying financial concepts in real-world scenarios due to limited exposure to market tools, live data, and trading environments during their studies (Rohm

et al., 2021). Despite efforts to improve, financial literacy levels remained relatively stagnant from 60.2% to 62.9% in 2024, indicating the need for more effective learning strategies (Bernama, 2025). This highlights the growing need for experiential learning approaches that enhance investment literacy, analytical skills, and decision-making confidence among students.

To address this issue, *TradeU* was developed as a digital, classroom-based platform that integrates real-time financial data and localized market content from Bursa Malaysia. Unlike platforms aimed at the public such as Bursa Marketplace, TradeU is designed specifically for university students and educators, offering features like gamified trading simulations, live technical analysis tools, and performance tracking. The platform also enables digital classroom creation, assignment submissions, and leaderboard rankings to encourage engagement and competitive learning. By merging theory with practice in an educator-led environment, TradeU supports active, applied learning and aligns with the increasing demand for digital tools in higher education (Salas-Pilco, 2020). With its localized design and educational focus, TradeU has strong potential for broader application in academic finance programs, financial literacy campaigns, and professional upskilling.

METHODS

This study used a quantitative research approach to explore students' perceptions of TradeU, a proposed mobile application for financial literacy and trading education. A total of 100 students from finance, accounting, investment, economics, and related fields participated, as they are expected to have basic knowledge of financial markets and exposure to platforms such as Bursa Malaysia.

Data were collected using an online questionnaire via Google Forms, distributed mainly through WhatsApp for wider reach. The questionnaire included close-ended questions such as multiple choice, nominal scales, rating scales, and short answers to gather opinions on TradeU's usefulness, features, and credibility.

Responses were analyzed descriptively using Google Forms' summary tools and Microsoft Excel to compute frequencies, percentages, and mean values. This provided initial insights into market receptiveness and expectations for the TradeU application, consistent with common practices in educational technology research (Creswell & Creswell, 2018; Sekaran & Bougie, 2019)

RESULTS AND DISCUSSION

A total of 105 students participated in our survey, primarily from finance and accounting majors, indicating that our app idea, TradeU, is highly relevant to students studying investment and financial markets.

The results show that 94.3% (99 students) are using learning platforms like Google Classroom, suggesting they are familiar with digital environments that would facilitate adaptation to TradeU.

Additionally, 81.9% (86 students) reported participating in the Bursa Malaysia stock market game, indicating prior exposure to stock simulation tools.

Despite this exposure, students face significant challenges. Approximately 50% cited a lack of practical experience as their main obstacle, followed by difficulties in understanding financial data (30.2%) and insufficient tools or software (17%). These findings highlight a gap between theoretical knowledge and practical application, underscoring the need for a platform that bridges this divide.

Theoretical frameworks, such as Kolb's experiential learning theory, emphasize the importance of hands-on experience in the learning process, suggesting that practical engagement can enhance understanding and retention of financial concepts (Kolb, 1984). Furthermore, research indicates that digital financial education can significantly improve students' financial cognition and behavior (Liu, 2021).

When asked about their interest in TradeU, 94.3% (100 students) expressed enthusiasm, with 57.5% "very interested" and 36.8% "interested." Only 5.7% (5 students) were not interested, indicating strong market potential for the app. Furthermore, 81.1% of students indicated they would recommend or use TradeU if available, supporting its development as an interactive educational tool.

TradeU aims to enhance financial education by integrating live market instruments, news feeds, and technical analysis within a classroom setting. This approach not only makes learning more engaging but also equips students with practical skills applicable in real-world scenarios. The integration of real-time data and tools can foster a more immersive learning experience, aligning with the growing trend of digital education in financial literacy (Agasisti, 2023).

Table 1.: Summary of Key Survey Findings

Survey Element	Results
Use of Google Classroom	99 respondents (94.3%)
Played Bursa Market Game	86 respondents (81.9%)
Main Challenges in Game	1. Lack of experience (50%) 2. Difficulty with data (30.2%) 3. Lack of tools (17%)
Total Very Interested and Interested in TradeU	100 respondents (94.3%)
Not Interested in TradeU	5 respondents (5.7%)
Would Use or Recommend TradeU	86 respondents (81.1%)

Total Respondents: 105 respondents

CONCLUSION

TradeU addresses the gap in finance education by offering a gamified, hands-on learning experience tailored for university students. By integrating real-time tools from Bursa Malaysia, the platform enables students to engage directly with market data, improving financial literacy and building confidence in trading decisions.

Beyond traditional classroom methods, TradeU incorporates live market instruments, news feeds, and technical analysis features, creating an immersive experience aligned with modern digital education trends (Agasisti, 2023). This practical approach helps bridge the disconnect between theory and practice, a longstanding challenge in financial education (Yaacob et al., 2024).

Survey results highlight strong student interest, with 94% expressing willingness to use TradeU and 81% indicating they would recommend or adopt the platform. These findings underscore TradeU's potential to transform financial education by delivering an interactive, application-focused learning experience.

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VARKonstruct: INNOVATING SUSTAINABLE EDUCATION IN CONSTRUCTION TECHNOLOGY THROUGH ADAPTIVE E-LEARNING

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ABSTRACT

The construction sector is quickly evolving through technological integration in education; yet, conventional methods frequently overlook diverse learning preferences, resulting in inconsistent educational outcomes. 'VARKonstruct: Innovating Sustainable Education in Construction Technology through Adaptive E-Learning' tackles this issue by incorporating the VARK learning styles model (Visual, Auditory, Reading/Writing, Kinesthetic) with customized e-learning tools to promote a more inclusive and engaging educational atmosphere. The approach utilizes immersive simulations, interactive laboratories, and multimedia resources to deliver a tailored educational experience that corresponds with each student's primary learning preference. This adaptive method fits personal learning preferences and mitigates educational inequities by democratizing access to varied learning resources. Preliminary results suggest that VARKonstruct significantly improves understanding and retention by enabling learners to interact with intricate construction concepts via their preferred learning modality, therefore cultivating more proficient and motivated workers prepared to address industry requirements. Moreover, the project emphasizes the significance of sustainable education through the use of digital platforms that reduce resource consumption while enhancing learning effectiveness. It is advisable to implement data-driven learning analytics to enhance personalized learning pathways and evaluate student progress, while also broadening VARKonstruct's application to additional STEM fields to foster sustainable educational practices that empower both educators and learners.

Keywords: Learning Styles, Adaptive E-learning, Digital Pedagogy, Construction Technology, Sustainable Education

INTRODUCTION

The swift evolution of the construction sector, propelled by the Fourth Industrial Revolution and the advent of Education 4.0, demands a reassessment of conventional educational frameworks (Mubarak & Selimin, 2023). Although technology has infiltrated construction activities, the educational delivery in construction programs frequently remains unchanged, adhering to traditional, uniform methodologies. These methods neglect the varied cognitive and sensory learning preferences of students, thereby restricting their ability to comprehend intricate construction concepts successfully (Bondie et al., 2019; Gupta, 2018).

In reaction to this educational deficiency, the VARKonstruct Model was created to enhance construction education via personalized technological learning. Based on the VARK learning styles theory—Visual, Auditory, Reading/Writing, and Kinesthetic—the model offers a framework for the integration of adaptive e-learning aids with classroom technologies. The objective is to cultivate an inclusive, dynamic, and efficient learning environment that accommodates individual preferences while addressing the construction industry's need for qualified and adaptable personnel.

The innovation of VARKonstruct is in its integration of immersive digital technologies, including virtual simulations and multimedia content, with a tailored instructional design. VARKonstruct enhances student engagement, improves idea retention, and fosters deeper comprehension by customizing learning experiences. Furthermore, it tackles overarching sustainability objectives by diminishing the necessity for physical resources and facilitating fair access to high-quality education. This study delineates the conceptual underpinnings, methodological framework, implementation tactics, and preliminary findings related to the VARKonstruct Model, as well as a discourse on its ramifications, commercialization possibilities, and societal advantages.

METHODS

Conceptual Framework

The VARKonstruct Model is based on the VARK learning theory (Visual, Auditory, Reading/Writing, Kinesthetic), which emphasizes that individuals assimilate and process information in distinct ways. Acknowledging this variability is essential in construction education, where intricate spatial, material, and procedural information must be communicated in ways that align with diverse cognitive preferences.

Empirical Design and Data Collection

This study utilized a quantitative research approach with stratified random sampling to guarantee representative feedback from construction technology students. A total of 43 students were surveyed across two diploma-level construction classrooms; following data validation and cleaning, 37 valid replies were preserved for analysis. A structured VARK-based questionnaire was utilized to ascertain each student's predominant learning choice. The measure addressed aspects of learning preferences

across many modalities (visual, aural, read/write, and kinesthetic), encompassing the preferred method of content delivery (synchronous or asynchronous). The survey findings were examined by descriptive statistics in SPSS to ascertain the distribution of learning styles and preferred delivery methods. These findings directly influenced the organization of VARKonstruk’s modular learning concept.

RESULTS AND DISCUSSION

Demographic Profiles

The respondents were 68% female and 32% male students, aged 20 to 22, all in their final year of diploma studies. The gender and age distribution illustrates the standard demographic within Malaysia's built environment diploma programs.

Learning Mode Preferences

Among the participants, 95% indicated a preference for synchronous learning, appreciating real-time engagement with instructors and peers. Merely 5% favored asynchronous modes solely. Although asynchronous methods allow flexibility, students reported that synchronous modes provided instant clarification and social interaction, both essential in technical education. These observations underscore the necessity for VARKonstruk to incorporate hybrid content delivery, guaranteeing that real-time engagement coexists with adaptable, on-demand modules tailored to individual learning schedules.

Distribution of Learning Styles

The findings on dominant learning styles among the 37 students were as follows (Figure 1):

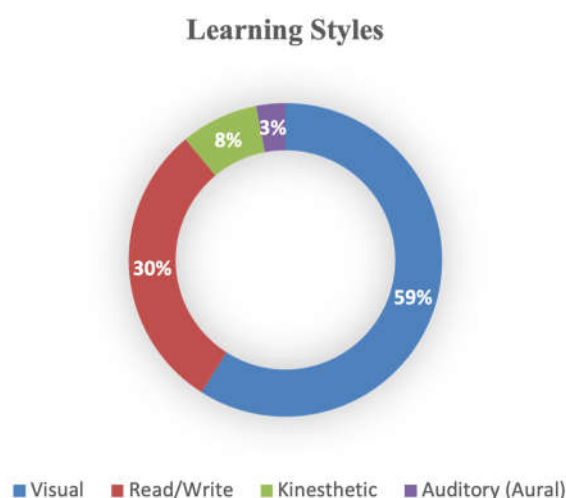


Figure 1.: Learning styles distribution among the students

The results indicate that visual learners predominate within the construction technology cohort, consistent with the visually demanding characteristics of construction drawings, site planning, and modeling tasks. Read/write learners constituted a substantial segment, presumably owing to their need for documentation, notes, and written directives in academic tasks. Despite kinesthetic (8%) and auditory (3%) learners being in the minority, their incorporation in VARKonstruk is essential to guarantee that no student is overlooked. Kinesthetic learners gain from immersive simulation tools and virtual laboratories, but auditory learners thrive on podcast-style content, audio tutorials, and collaborative voice discussions.

Instructional Design Based on Data

The VARKonstruk platform was refined to reflect these findings:

- **Visual learners** were accommodated through three-dimensional walkthroughs, construction process animations, and annotated diagrams.
- **Read/Write learners** utilized organized texts, printed resources, and interactive note-taking instruments.
- **Kinesthetic learners** were included through interactive virtual activities, drag-and-drop construction simulations, and field-oriented project assignments.
- **Auditory learners** employed audio explanations, recorded lectures, and peer-group podcast discussions.

This approach ensured an inclusive digital learning ecosystem grounded in evidence-based personalization.

Impact on Learning Outcomes

While long-term effect studies are still under progress, initial feedback from the pilot deployment indicates that it has improved engagement across all learning styles, especially among visual learners, who constituted the majority of respondents. Enhanced understanding and academic achievement in practical evaluations. Favorable student evaluations indicate that learners have enhanced clarity and confidence in the application of construction ideas. A significant decrease in learning anxiety and passive engagement was observed among kinesthetic and auditory learners when their preferences were directly addressed. These results correspond with the research of Belt & Lowenthal (2022) and Fleming (2001), substantiating that instructional alignment with learning styles might enhance motivation, retention, and pleasure.

CONCLUSION

The incorporation of real learner data into the VARKonstruk Model reinforces its capacity to transform

construction education. The results from 37 diploma students indicated a predominant inclination towards visual (59%) and read/write (30%) learning styles, alongside smaller but significant groups of kinesthetic and auditory learners. By aligning instructional content and technological delivery with these preferences, facilitated by real-time and adaptable learning modalities, VARKonstruct exemplifies inclusivity and creativity. It tackles the fundamental problems of disengagement and underachievement that afflict conventional, standardized teaching approaches in technical education.

The model's capacity to generate customized, captivating, and sustainable learning environments renders it more pertinent as the sector transitions towards digital and eco-friendly futures. The focus on flexible pedagogy, technological integration, and individualized learning pathways equips learners for the progressively interdisciplinary and dynamic construction industry. Subsequent versions of VARKonstruct ought to integrate learning analytics, AI-driven customization, and go beyond construction into additional STEM fields. This will guarantee the ongoing significance and scalability of the approach as a leader in sustainable digital education.

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INTEGRATION OF VISUAL, AUDITORY, AND INTERACTIVE ELEMENTS IN TEACHING COMPOUND WORDS: AN INNOVATIVE BEESMART APPROACH

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ABSTRACT

BeeSmart Kuasai Kata Majmuk is an innovative educational project designed to enhance primary students' understanding and mastery of compound words in Bahasa Melayu. The innovation integrates visual, auditory, and interactive elements to make the learning process more engaging, effective, and student-centered. Recognizing the challenges faced by students in identifying and applying various forms of kata majmuk correctly, especially in written compositions and grammar exercises, this project offers a fresh pedagogical approach through digital storytelling, gamified exercises, and character-based facilitation. Central to the innovation is the use of a friendly animated persona, Cikgu Bee, who guides learners through interactive modules. These include video tutorials, quizzes, digital flashcards, and real-life usage scenarios designed to contextualize compound word usage meaningfully. The content is aligned with the primary school Bahasa Melayu curriculum, making it suitable as a supplementary tool for classroom and remote learning. The learning materials are hosted on a mobile-friendly digital platform, making access easier for students from diverse backgrounds. A small-scale Implementation was conducted in a selected classroom involving Year 4 students. Preliminary findings suggest improved student engagement, increased retention of kata majmuk patterns, and better application in sentence construction. Teachers reported that the resource eased their burden in teaching abstract grammar topics and served as an effective revision tool. Additionally, the cheerful and student-relatable branding of Cikgu Bee encouraged independent learning. The project contributes to educational innovation by combining traditional language content with 21st-century learning design, fostering language proficiency, digital literacy, and student motivation. Future improvements include expanding content to other grammar topics and integrating with augmented reality (AR) for a more immersive learning experience.

Keywords: Compound words, Visual, Auditory, Interactive elements

INTRODUCTION

In the rapidly evolving landscape of 21st-century education, traditional teaching methods are increasingly being complemented or replaced by innovative strategies aimed at enhancing student engagement, strengthening knowledge retention, and promoting critical thinking. In line with these developments, BeeSmart: Kuasai Kata Majmuk! emerges as an educational initiative that integrates digital technology and interactive pedagogy to help primary school pupils master the topic of compound words in Bahasa Melayu more effectively. This innovation incorporates a combination of visual, auditory, and interactive elements through approaches such as digital storytelling, gamified quizzes,

and the use of a student-friendly animated character, Cikgu Bee. This extended abstract outlines the theoretical foundations underlying the BeeSmart innovation, its practical applications within real classroom settings, and its potential implications for future teaching practices.

PROBLEM STATEMENT

In an effort to strengthen the mastery of Bahasa Melayu grammar among primary school pupils, technology-based educational innovations are increasingly gaining ground as effective and student-friendly teaching aids (Hushaini, N. H. et al., 2022; Habidin, N. F. et al., 2021; Boudadi, N. A. & Colón, M. G., 2020). BeeSmart: Kuasai Kata Majmuk! is an interactive learning approach designed to enhance students' understanding of compound words through the integration of visual, auditory, and interactive elements. This innovation features digital storytelling, gamified activities, and an animated character, "Cikgu Bee," who guides learners through engaging and meaningful learning sessions.

Aligned with the Bahasa Melayu curriculum and 21st-century pedagogical principles, BeeSmart incorporates approaches such as game-based learning, collaborative platforms, and real-world simulation scenarios to boost student engagement, knowledge retention, and motivation (Azemi, S. A. M., & Hamzah, I., 2024; Ong, Q. K. L., & Annamalai, N., 2024; Ramalingam, K. et al., 2022). The content, delivered via a user-friendly digital platform, also supports self-directed learning and is adaptable for use in various contexts, whether face-to-face or online. This extended abstract outlines the theoretical foundations, practical applications, and future educational implications of implementing the BeeSmart innovation.

The mastery of compound words (kata majmuk) among primary school pupils in Bahasa Melayu remains at an alarming level (Ru, R. L. Y., 2021). One of the main contributing factors is the lack of interactive teaching aids that are aligned with pupils' cognitive development (Rusli, N. F. M. et al., 2021). Many students struggle to identify the forms of compound words, construct correct sentences, and distinguish between different types of compound words, resulting in confusion and grammatical errors (Ali, A. S. S. et al., 2021).

Furthermore, teachers face time and resource constraints in preparing engaging, systematic, and effective teaching and learning (T&L) materials (Ching, M. C. H., & Nordin, N. M., 2021; Yusri, A. A., et al., 2024). These limitations lead to less effective delivery of the topic, ultimately affecting students' motivation and achievement in grammar. Therefore, there is an urgent need to introduce an innovative and user-friendly approach that can holistically and enjoyably assist both teachers and students in overcoming these challenges.

INNOVATION OBJECTIVES

BeeSmart: Kuasai Kata Majmuk! innovation was developed with the objective of enhancing the quality of Bahasa Melayu learning among primary school students through the use of engaging and interactive educational technology. The specific objectives of this innovation are as follows:

1. To encourage active student participation during lessons through interactive elements such as quizzes, games, and digital storytelling.
2. To provide students with the opportunity to learn independently via a user-friendly digital platform that is adaptable to individual abilities.

3. To effectively integrate modern technology into the teaching and learning of Bahasa Melayu in alignment with 21st-century educational demands.
4. To support students in better understanding the concept of compound words through visualization, animation, and contextual simulation.
5. To provide systematic, engaging, and easily accessible teaching aids that help reduce teachers' workload in preparing high-quality lessons.

THEORETICAL FOUNDATIONS

The innovation BeeSmart: Kuasai Kata Majmuk! is grounded in three major psychological learning theories, such as behaviorism, cognitivism, and constructivism, which collectively support an interactive and student-centered learning environment.

- **Behaviorist Theory (B.F. Skinner)**

BeeSmart applies principles of reinforcement through rewards and consequences to encourage effective learning. For instance, when students answer correctly, they receive points and progress to the next level. Conversely, incorrect answers result in the student “falling” and having to repeat the stage. This gamified structure reinforces learning through repetition and motivates learners through immediate feedback and goal-oriented progression (Skinner, 1953).

- **Cognitivist Theory (Jean Piaget & Jerome Bruner)**

BeeSmart emphasizes active exploration, allowing students to build their understanding of compound words. According to Piaget (1954), learning occurs through assimilation and accommodation processes aligned with cognitive development stages. The game structure begins with simpler tasks and progresses to more complex challenges, reflecting Piaget's developmental approach. In addition, Bruner (1966) highlights the importance of spiral curriculum and scaffolding, which BeeSmart applies via stepwise quizzes and digital guidance from the character Cikgu Bee.

- **Social Constructivist Theory (Lev Vygotsky)**

Vygotsky (1978) argued that learning occurs socially through interaction with peers and teachers. The concept of the Zone of Proximal Development (ZPD) is embedded in BeeSmart through animated feedback, gamified guidance, and immediate digital support, enabling students to achieve higher cognitive levels with minimal scaffolding. Teachers serve as facilitators who create meaningful contexts and guide learners toward independent and collaborative knowledge construction.

By integrating these three theoretical foundations, BeeSmart not only enhances mastery of compound words but also cultivates 21st-century competencies such as critical thinking, collaboration, and digital literacy.

METHODS

BeeSmart: Kuasai Kata Majmuk! Innovation begins with an initial design phase, aimed at creating an engaging and interactive Malay language learning environment. The concept of the ‘Taman Bahasa Melayu’ was selected as the central theme, where each zone in the game resembles a playground filled

with linguistic tasks focused on compound words. The main objective of this phase is to capture students' interest, increase their engagement in learning, and facilitate the mastery of compound word concepts in an enjoyable and effective manner.

Next, the development phase utilizes 'Roblox Studio,' a 3D digital game creation platform that allows students to interact within a specially designed virtual world. The development process involves the use of tools such as terrain, buildings, pathways, non-player characters (NPCs), and interactive objects. Lua scripting is integrated to enable interactivity; for example, triggering quiz questions when players touch specific objects. Existing plugins and templates are also utilized and adapted to meet instructional needs while saving time in the development process.

Finally, content integration and interactive features are implemented through the structuring of game levels into four stages of difficulty: easy, moderately easy, moderate, and difficult. Each 'checkpoint' represents a learning zone, and quiz questions appear when players reach that zone. Additional interactivity includes respawning players to the last checkpoint if they fall and automatically updating the checkpoint once a stage is completed. This approach enhances the learning experience, making it more dynamic, responsive, and enjoyable for primary school students.

ANALYTICAL EVALUATION

Empirical feedback from educators suggests that all featured approaches boost intrinsic motivation. Students reported feeling more accountable, curious, and confident. The alignment with self-determination theory is evident: competence is achieved through feedback, autonomy is fostered through choice, and relatedness is promoted through collaboration.

The video underscores the multi-dimensional skill outcomes, including

- Cognitive: problem-solving, analysis, argumentation
- Social: communication, teamwork, peer support
- Emotional: empathy, persistence, confidence

Tracking tools (e.g., digital rubrics, reflection journals) enable instructors to visualize the holistic skill progression.

IMPLICATIONS FOR PRACTICE

- The innovations make clear that tools should align with curriculum goals, not replace them. Placing student agency at the heart enhances ownership and relevance.
- Schools need sustained investment in teacher training and peer communities of practice for collaborative innovation.
- To scale successfully, policy frameworks must provide reliable access to digital tools and infrastructure, allocate time for design experimentation, and encourage localized adaptation of tools.

FUTURE RESEARCH DIRECTIONS

The authors highlight several promising avenues for future exploration, including the implementation of longitudinal studies to assess the long-term impacts of educational innovations on learner identity and career pathways. They also emphasize the value of cross-disciplinary comparisons to uncover domain-specific best practices and the integration of artificial intelligence (AI) to enable personalized feedback and tailored learning experiences. Furthermore, they propose examining the cultural adaptability of these models to understand how effectively they can be transferred and applied across diverse educational contexts.

CONCLUSION

BeeSmart: Kuasai Kata Majmuk! represents a small but meaningful step toward transforming digital learning into an engaging, interactive experience. By integrating gamification, collaborative exploration, real-time simulations, and digital storytelling, this innovation brings educational theories to life, particularly those of Skinner, Piaget, Bruner, and Vygotsky. Each instructional design is grounded in theory, tested through practice, and tailored to meet the diverse needs of 21st-century learners. We hope this innovation continues to grow and inspire, becoming a widely adopted resource among teachers and students throughout Malaysia. More than a digital tool, BeeSmart is a model of learner-centered pedagogy that empowers both teaching and learning in meaningful, creative ways.

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C A T E G O R Y C & D

INNOVATION IN EDUCATIONAL RESEARCH

A METHODOLOGY FOR INTEGRATING VIRTUAL WATER DATA INTO LIFE CYCLE COST IN THE MALAYSIA'S WATER INFRASTRUCTURE SECTOR

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ABSTRACT

Water infrastructures are crucial assets for the nation's development that are purposely designed and built to deliver essential services for supporting economic growth, public health, and environmental sustainability. However, Malaysia's water sector faces mounting challenges, including aging infrastructure, water scarcity, and inefficiencies in cost management. In response to these concerns, the Water Sector Transformation 2040 (WST 2040) roadmap was introduced to realign the water industry towards digitalization, sustainability, and resource optimization. Nevertheless, the existing practices of life cycle cost economic assessment technique remain fragmented and often overlook virtual water that refers to the indirect water consumption throughout the entire service life of water infrastructure. This paper presents a methodology proposed for the study to investigate readiness of cost data as inputs into the integration of virtual water data into the Life Cycle Cost (LCC) practice in supporting more informed and sustainable planning with specific reference to Malaysia's water infrastructure assets. The proposed methodology is designed with a qualitative research strategy, combining a comprehensive literature review with semi-structured interview approach to interview people who have established knowledge, expertise, skills, or experience in virtual water, data integration and water infrastructure planning. The study focuses on exploring the current data availability, quality, and limitations, including the identification of strategic pathways for incorporating virtual water into the LCC practices. The study findings are intended to serve as a foundational input for future data driven framework that can facilitate the stakeholders and cost estimators in Malaysia's water sector to produce more accurate cost estimation and enhance water resource governance to align the Malaysia's WST 2040 goals with the Sustainable Development Goal 6 (SDG 6) in achieving sustainable management of water and sanitation for all.

Keywords: Virtual Water, Life Cycle Costing (LCC)

INTRODUCTION

Water infrastructure is the backbone of Malaysia's socio-economic development, playing a pivotal role in ensuring water security, public health, and environmental sustainability. This critical sector encompasses a wide range of assets—from treatment plants, pipelines, reservoirs, and pumping stations to digital systems and institutional governance mechanisms—which collectively form a fundamental component of the nation's public infrastructure. According to IPSASB (2014), water assets are long-term tangible or intangible resources expected to deliver sustained benefits. These assets enable the abstraction, treatment, distribution, and safe discharge of water, thereby supporting national development goals (AWWA, 2012).

Despite its significance, Malaysia's water infrastructure sector faces a range of persistent and interrelated challenges. Among these are aging systems, frequent pipe bursts, high levels of non-revenue water (NRW), fragmented governance, poor integration of sustainability metrics in cost planning, and a lack of financial resilience. As of 2021, the national average NRW was 36.4%, with some states exceeding 50%, primarily due to leakages and suboptimal asset management (SPAN, 2021). These inefficiencies compromise service delivery and threaten the long-term viability of national water infrastructure.

In response to these systemic issues, the Water Sector Transformation 2040 (WST 2040) roadmap was introduced to modernize and future-proof Malaysia's water services. Central to this initiative are themes of digitalization, sustainability-driven planning, and lifecycle cost optimization (MyWASS, 2020). Within this context, one critical yet often overlooked concept is that of virtual water (VW)—the embedded or indirect water used throughout an infrastructure's lifecycle, from materials production and construction to operation, maintenance, and disposal. Virtual water becomes particularly relevant in resource-intensive infrastructure such as desalination plants, urban pipelines, and treatment facilities.

While Life Cycle Costing (LCC) is increasingly adopted to estimate long-term project costs—including capital expenditure (CapEx), operational expenditure (OpEx), maintenance, and end-of-life disposal—virtual water considerations remain largely absent from current costing practices. Traditionally, infrastructure decisions have focused on minimizing upfront costs, often ignoring future environmental and financial burdens. However, tools such as Net Present Value (NPV), Equivalent Annual Cost (EAC), and cost-per-unit analysis offer more holistic assessments of total cost over time (Woodward, 1997). Notably, Malaysia's Public Works Department (JKR) has mandated the implementation of LCC in public projects through *Surat Arahan KPKR 2023*, reflecting growing institutional awareness of long-term asset stewardship (CIDB, 2020). Nevertheless, without the integration of virtual water data, LCC frameworks remain incomplete and unable to fully support sustainable water governance.

In the Malaysian context, the application of virtual water remains underutilized—particularly in infrastructure planning and environmental management—despite rising water stress in urban regions such as Klang Valley and Penang. Embedding virtual water into LCC models offers the potential to enhance procurement transparency, improve budgeting accuracy, and strengthen infrastructure resilience. This is especially pertinent under WST 2040's emphasis on circular economic principles and data-driven governance. However, successful integration requires robust data infrastructure. High-

resolution data on water use across all life cycle stages—design, construction, operation, and end-of-life—is essential. Such data must include virtual water coefficients for materials, energy use, and operational processes (Lee & Mokhtar, 2023). Currently, however, Malaysia’s data landscape is fragmented, generalized, and often disconnected from infrastructure applications (Tan & Zaini, 2019), limiting evidence-based planning and diminishing the reliability of LCC outcomes.

Despite these limitations, the integration of virtual water into LCC presents significant opportunities. First, it enables a more comprehensive evaluation of water usage across an asset’s lifecycle, helping stakeholders identify high-consumption phases and adopt sustainable alternatives. For instance, selecting materials with lower virtual water footprints or installing efficient technologies may yield long-term environmental and financial gains—even when initial costs are higher (Kounina et al., 2018; Goh et al., 2019). Second, a VW-inclusive LCC aligns with Environmental, Social, and Governance (ESG) frameworks, promoting value-based procurement, green financing, and lifecycle sustainability assessments. This approach supports Malaysia’s shift toward performance-based planning and resource efficiency under WST 2040. Finally, incorporating VW data into LCC can enhance inter-agency coordination and cross-sectoral decision-making. Through multi-criteria analysis, infrastructure planning can better balance economic viability with environmental responsibility.

RESEARCH AIM

This study aims to propose a methodology to explore how virtual water data can be integrated into life cycle cost analysis in Malaysia’s water infrastructure sector.

RESEARCH OBJECTIVES

1. To examine the evolution and current practices of LCC in Malaysia’s water infrastructure.
2. To investigate the relevance and readiness of virtual water data in cost analysis.
3. To assess data quality issues affecting integration into LCC.

METHODS

This study employs a qualitative approach combining secondary and primary data collection.

Secondary Data Collection:

A comprehensive literature review was conducted to:

- Understand current LCC practices and their evolution
- Explore virtual water concepts and integration strategies

- Identify data challenges in the water sector Sources include academic journal articles, government publications (e.g., SPAN, PLANMalaysia), WST 2040 documents, industry reports, conference proceedings and previous dissertations

This review helped to identify knowledge gaps, conceptual frameworks, and key variables required for virtual water data integration.

Primary Data Collection: Semi-structured interviews were carried out with ten professionals from public agencies, water utilities, engineering firms, and academia. Participants were selected based on knowledge, skills or expertise in LCC, virtual water, or infrastructure planning. Key interview topics included:

- Awareness of virtual water
- Current LCC practices
- Data availability and quality
- Barriers to data integration
- Strategies for VW integration

Interviews were transcribed and analysed thematically using software to extract key themes.

The study proposed a four-stage research strategy:

- Stage 1: Literature Synthesis and Data Mapping
- Stage 2: Expert Input via Semi-Structured Interviews
- Stage 3: Gap Identification in Current LCC Practice
- Stage 4: Framework Development for VW Integration into LCC

This method aims to build a foundational structure to guide future implementation of VW-inclusive LCC frameworks.

RESULTS AND DISCUSSION

While the research is in progress, preliminary insights suggest four expected insights:

1. **Limited Awareness and Lack of Guidance:** Many practitioners lack familiarity with virtual water. Current LCC guidelines focus mainly on financial metrics, neglecting water-use or environmental impacts. This highlights the need for educational initiatives and updated guidance.
2. **Fragmented and Inaccessible Data:** Data related to virtual water, energy use, and infrastructure costs are decentralized, outdated, inconsistent or incomplete records. This fragmentation prevents accurate lifecycle analysis and reduces the effectiveness of LCC.

3. Misalignment with WST 2040 Objectives: Although WST 2040 promotes sustainability, there is no standardized framework for including VW in LCC. This gap reveals a disconnect between policy intent and operational tools.
4. Strong Stakeholder Support: Despite challenges, professionals show strong support for integrating VW into LCC. Many view it as a timely innovation to enhance transparency, improve decision-making, and align Malaysia with global ESG standards.

CONCLUSION

This research demonstrates that integrating virtual water into LCC represents a significant leap forward for Malaysia's water sector. This study has proposed a methodology that enhances cost estimation accuracy through virtual water-inclusive analysis and promotes data-driven decision-making. It directly supports the goals of the Water Sector Transformation 2040 (WST 2040), particularly in strengthening resilience and sustainability. Moreover, it aligns infrastructure planning and development with global benchmarks such as Sustainable Development Goal 6 (SDG 6) and environmental, social, and governance (ESG) standards. Beyond its policy implications, the research significantly contributes to the quantity surveying field by expanding traditional cost models to incorporate environmental considerations. Moving forward, the next phase of the research will involve refining the integration framework and testing its applicability across selected case studies to ensure practical implementation.

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This study contributes to the ongoing research undertaken by the first author as part of the dissertation requirement for the Bachelor of Quantity Surveying programme. The dissertation is being conducted under the supervision of the second author at the Kulliyyah of Architecture and Environmental Design, International Islamic University Malaysia.

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A METHODOLOGY STUDY ON THE ROLE OF QUANTITY SURVEYING IN SAFETY COST PLANNING AND RISK MITIGATION IN THE CONSTRUCTION PROJECTS

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ABSTRACT

The construction industry in Malaysia is one of the highest contributors to workplace accidents and fatalities. Despite efforts to reduce accidents through various mechanisms and regulations such as the Occupational Safety and Health Act (OSHA) 1994, Construction Industry Development Board (CIDB) guidelines, and SHASSIC assessment, accidents in the industry remain a major issue. A significant contributing factor is the lack of financial allocation for safety planning, which has a direct impact on safety performance. Quantity Surveyors (Qs) have an essential role in cost management and cost planning. However, in most cases, they do not consider Occupational Safety and Health (OSH) elements during the planning stage, especially in the early phase of project cost estimation. This research aims to study the role of Qs in optimising safety costs to minimise risks and liabilities in construction projects. The research adopts a qualitative approach by combining data gathered from literature review and semi-structured interviews. The interviewees include Qs and safety officers working in building construction projects in Malaysia. The expected outcome is a framework of safety value planning to guide the Quantity Surveyor's involvement in planning for safety-related costs while reducing liabilities and ensuring regulatory compliance.

Keywords: *Quantity Surveyor, Occupational Safety and Health (OSH), Safety cost, Cost planning, Safety value planning*

INTRODUCTION

Malaysia's construction industry continues to face high rates of incident occurrence of workplace accidents despite prevailing workplace safety regulations. This is partially due to an attitude towards treating safety as a cost function excess rather than one of fundamentals of project success. Expenditure

on safety measures such as Personal Protective equipment together with training is maintained low as well as de-emphasised in favour of structural or perceptible project features. Quantity Surveyors (Qs), as responsible as they primarily are cost planners as well as controllers, have a potential role in correcting this imbalance. By being involved in cost planning of expenditure on safety measures, there could be resulting better alignment of measures of Workplace Safety and Health with general project financial structure. By any stretch of imagination, this function is not clearly delineated nor worked out in depth in practice, especially in preliminary plans of projects. This research aims at investigating how Qs can facilitate balanced cost expenditure on issues of safety in order to reduce project risk as well as liability. Towards this goal, it proposes a methodological approach towards determining how Qs can be further involved in veritably treating safety as a construction management expenditure priority.

PROPOSED METHODOLOGY

This qualitative exploratory study uses the Malaysian building sector as the setting in order to probe application of Quantity Surveyors (Qs) to cost optimisation of projects related to risk and safety reduction. The study involves a two-stage phase. The first phase entails the systematic literature review in the preparation of conceptual foundation work. The literature used comprises journal articles, government documents, and building sector guidance of texts regarding occupational safety, safety cost estimations, and risk liability in building projects. CIDB Guidelines on OSH Management System (2020), SHASSIC Assessment Guidelines (CIDB, 2017), and texts of academics like Windapo (2013), among others, comprise the highlighted literature reviewed. The thematic areas insinuated include the omission of expenditure regarding safety in preliminary planning phases, prevention measures underestimation, as well as the systemic absence of Qs in OSH-related expenditure planning. These themes had bearing on planning of an interview protocol as the plan of the subsequent study phase

The second phase entails the collection of primary data through semi-structured interviews among the professionals who actually operate in the building industry. Respondents will be Quantity Surveyors and Safety and Health Officers, sampled through snowball sampling, for relevancy and real-world practice. The respondents will be 8 to 12, comprising respondents from consultancy and contractor backgrounds. Interviews will be conducted online, if possible, or face-to-face, based on respondents' schedules and practical convenience. Interviews will be audio-recorded, transcribed, and thematic analyses conducted through Braun and Clarke's (2006) six-step mathematical analysis process, consisting of coding, identification of themes, as well as interpretation. Qualitative software, NVivo, will be used, if necessary, to facilitate ease of handling the data and pattern identification. This phase shall unveil the real-world challenges as well as opportunities in the areas of safety cost planning and make conceptual contributions towards the enhancement of the role of the Qs in risk-based cost planning. This methodology borrows from Latib et al. (2016), Zakaria et al. (2020), as well as Yusuwan and Adnan (2013), whose individual and joint messages point to the need for value-based construction management as the stimulator of the broadened role of the Qs as well as the increased extent of the professional responsibilities of the Qs.

A conceptual framework diagram as shown in Figure 1 is provided in order to add further clarity on this topic, in which would cover the safety planning role of QSs' process. The framework would cover the safety cost allocation, risk reduction projects outcomes, regulation requirements, and QS roles interaction.

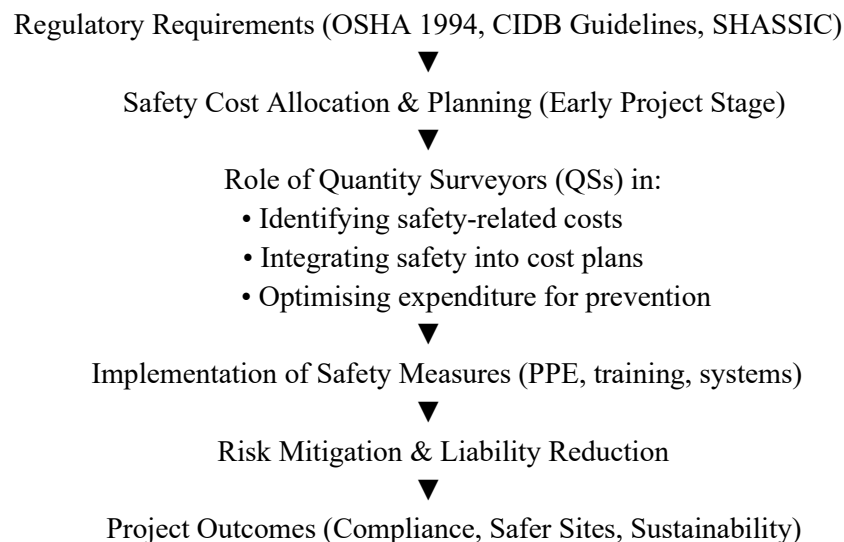


Figure 1.: Conceptual framework of the methodology

CONCLUSION

This research provides a conceptual model of how Quantity Surveyors can be used to reduce the cost of safety and control liability of building works construction projects. Through comparison of theoretical literature as well as practical application through interview, the research would seek to identify gaps and opportunities of application. The potential deliverable would be a conceptual model to reposition the QSs as proactive rather than reactive contributors at the planning of the safety phase. The potential benefit would be improved compliance, safer sites, and more sustainable project results. The research would also strengthen Malaysian building profession policy and professional development.

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This study contributes to the ongoing research undertaken by the first author as part of the dissertation requirement for the Bachelor of Quantity Surveying programme. The dissertation is being conducted under the supervision of the second author at the Kulliyyah of Architecture and Environmental Design, International Islamic University Malaysia.

A METHODOLOGY TO INVESTIGATE COST COMPARISON BETWEEN SOIL NAILING AND SHEET PILING METHODS

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ABSTRACT

Quantitative Analysis Draft Slope protection includes all acts and measures taken to prevent erosion on slopes and hence limit the separation or sliding of rocks from the slopes. Its primary goal is to maintain the structure's integrity, prevent accidents, and avoid material damage or human fatalities. The implications of slope failure are not only providing an adverse effect to physical damages but require a large amount of money to pay as compensation to the impacted damages. Various methods of slope protection have been recognised nowadays, but this study focuses only on two slope protection methods, i.e. soil nailing and sheet piling. Thus, this video is prepared with the objective to present a methodology proposed for the study to investigate cost comparison between the soil nailing and sheet piling methods. A quantitative research strategy is proposed as a methodology for the study that is designed with a comprehensive literature review and survey to interview people that have established knowledge, skills or experience in soil protection methods. The study will review the available literature to identify the comparison between the sheet piling and soil nailing methods, associated with the construction methods, cost-efficiency, maintenance viability and long-term performance. The study is expected to provide cost differences, maintenance demand, longevity, and sustainable performance between the sheet piling and soil nailing methods. The study also will identify strategies that can be recommended to improve the quality of cost data used as reliable input for the cost estimation of sheet piling and soil nailing methods.

Keywords: Slope protection; soil nailing; sheet piling; cost comparison.

INTRODUCTION

Landslides are a serious geologic hazard common to many parts of the world. Landslides inflict billions of ringgits in property damage and hundreds of deaths and injuries worldwide each year. In Malaysia, from 1973 to 2007, some 440 landslides were reported. Of these, 31 cases involved fatalities. In

addition, there are thousands more ‘unreported’ minor slope failures and landslides (National slope master plan, 2009-2023). According to Azmi et al. (2024), slope protection's major goal is to preserve the stability of both naturally occurring and artificially created slopes, protecting both human life and infrastructure. By stopping the loss of soil and plants, it also plays a critical part in protecting the ecosystem. Slope protection techniques that work well might lessen the effects of natural disasters that can cause slope failures, like intense rainstorms or earthquakes. Slope protection strategies also contribute to the preservation of soil fertility, which is necessary for both agriculture and natural vegetation, by stabilising the ground. The case study reveals that Malaysia is facing issues with slope failure, with one such incident occurring at Jalan Serdang and Jalan E6 intersection in Taman Melawati. The landslide occurred due to a failing drainage system, causing water to overflow over the slope surface and uprooting trees. The Ministry of Works (KKR) has proposed using soil nailing to restore the slope, which will be discussed with the Ampang Jaya Municipal Council (MPAJ) and private developers. Another incident occurred at Jalan Wawasan 3/9 in Puchong, affecting nine terrace houses and four cars. The proposed solution is to apply sheet piling. The main objective of piling is to improve safety and stability, preventing further soil movement. Restoration projects include building a monsoon drain, soil filling, and slope reinforcement.

Many previous research has discussed the issues about slope protection methods and determining the best slope protection method. When selecting the best slope protection method, strength and durability are always considered, but cost has gotten less attention. It is essential to study the economic aspect of the slope protection method as not only to look for its initial cost but also the maintenance cost that may cost more. Thus, this paper and video will discuss more about two methods applied in previous cases of slope failure at Taman Melawati and Taman Wawasan which are soil nailing and sheet piling methods including the efficiency, feasibility, reliability, durability, life span and economic perspective. Moreover, there is limited study focusing on soil nailing and sheet piling especially on the cost involved in the construction. Thus, based on the difficulties raised above, this study on the cost comparison of the two methods, sheet piling and soil nailing, will be carried out.

Therefore, these paper and video are prepared to present a designed methodology to investigate cost comparison between soil nailing and sheet piling methods with the aim is to study the cost effectiveness of sheet piling in comparison with soil nailing in slope protection and the objectives are to review and compare the construction methods used in sheet piling and soil nailing, to compare the cost-effectiveness, maintenance viability and long-term performance between sheet piling and soil nailing slope protection methods and to find ways or strategies that can be recommended to improve the quality of cost data for sheet piling and soil nailing.

METHODOLOGY

Research methodology is a systematic way in problem solving. It is a science of studying how research is to be carried out. Essentially, research methodology is the procedures by which researchers go about their work of describing, explaining and predicting phenomena. It is also defined as the study of methods by which knowledge is gained. Its aim is to give a work plan for research (Goundar, 2012). Saraswati

and Devi (2023) explained that collecting data in numerical form and using statistical analysis involves the quantitative method. This is to identify patterns, relationships, and generalizability. Common quantitative methods include surveys, experiments, as well as structured observations. These methods provide a broader understanding of the research topic, often involving a larger sample size. Meanwhile, Goundar (2012) defines quantitative research as based on the measurement of quantity or amount. The process is expressed or described in terms of one or more quantities.

To achieve the research aim, a quantitative research strategy is proposed as the chosen methodology designed for the study due to some reasons. Firstly, there are so many soil erosion issues in Malaysia and the number is larger because Malaysia received heavy rainfall, soil condition problems and so on. Secondly, there are so many people that have knowledge or skills or experiences on soil erosion that can be involved in the study. Thus, the survey is more superior than the focused group. Thus, this study will apply quantitative methods.

As for this study, case study, survey and literature review will be applied. For the case study, the proposed areas to be focused are Jalan Wawasan 3/9 Taman Wawasan, Puchong and Jalan Serdang and Jalan E6 intersection, Taman Melawati where soil erosion has occurred. Meanwhile, the survey will be focused on only 30 respondents that fulfil the criteria in order to ensure the quality of data.

Table 1. The proposed research approaches for the methodology of study.

Proposed Methods	Data collection and analysis	Expected Findings
Case study through condition assessment of cost data	Cost breakdown for each method will be collected and will be analysed to find the differentiation of both methods.	A comparison of the cost efficiency and feasibility of sheet piling and soil nailing, highlighting which method offers better performance, lower maintenance costs, and greater practicality.
Surveys	30 respondents are required to fill the surveys. The result from the surveys will be discussed.	A clear strategy to improve the quality of cost data for sheet piling and soil nailing as well as the differentiation of cost involved for each method.
Literature reviews	Clear reviews on both methods, soil nailing and sheet piling as well as the costs involved.	A clear differentiation between sheet piling and soil nailing in terms of structural behaviour, installation methods, and lifespan.

CONCLUSION

A methodology is designed and proposed for the study to investigate cost comparison between soil nailing and sheet piling methods. The literature study has established there are very limited studies reported on the methodology to investigate cost comparison between soil nailing and sheet piling methods. Hence, the quantitative research strategy has been proposed as the methodology designed for the study to procure data of condition assessment for sheet piling and soil nailing methods in slope protection. The quantitative research strategy is incorporated with a primary data collection, i.e., the surveys to collect comprehensive firsthand data as well as the secondary data collection for example the case study through condition assessment of cost data and the literature reviews to dig deeper into the two methods details. These are to achieve the aim and objectives of this study.

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This study contributes to the ongoing research undertaken by the first author as part of the dissertation requirement for the Bachelor of Quantity Surveying program. The dissertation is being conducted under the supervision of the second author at the Kulliyyah of Architecture and Environmental Design, International Islamic University Malaysia.

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A METHODOLOGY TO INVESTIGATE COST COMPARISON BETWEEN THE EXCLUSIVITY OF END-OF-LIFE (EOL) BATTERIES FOR ELECTRIC VEHICLES (EVs) IN MALAYSIA

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ABSTRACT

The usage of electric vehicles (EVs) is currently experiencing an upward trend in most countries around the world. A similar demand for EVs was also detected in Malaysia, as shown by the surge in the number of EV sales over the past few years. However, the growing number of EVs raises a new environmental concern since it can lead to a potential risk of pollution in the country. This problem is caused by a lack of proper management for the main component in the EV, such as the battery, which has not been properly addressed yet, especially when it reaches the end-of-life phase. This study is prepared with the objective to present a methodology proposed for the study to investigate the cost comparison between the exclusivity of end-of-life (EOL) batteries and management strategies for electric vehicles (EVs) in Malaysia. The methodology of the study is designed with a qualitative research method that encompasses a semi-structured interview approach to interview respondents with established experience, knowledge or skills in electric vehicles (EVs). The study will identify suitable strategies that can be recommended to overcome the issues of end-of-life (EOL) batteries of electric vehicles (EVs), which could be served as bases for decision-makers to ensure the strategies chosen are relatively low-cost and, at the same time, promote broader usage and ownership cost optimisation of electric vehicles in the future.

Keywords: Methodology, Electric vehicles, Batteries, Cost

INTRODUCTION

Electric vehicles (EVs) are alternative vehicles aimed at replacing traditional internal combustion engine vehicles in the future, as they promote a sustainable environment and the use of clean energy. According to Ritchie (2024), there are more than 40 million electric cars in use globally, and the number continues to grow rapidly each year. In response to the latest market trends and technological developments, Malaysia is also seizing the opportunity by adopting electric vehicles. To support this shift, Malaysia has introduced several initiatives to promote EV implementation, including the

installation of numerous charging stations, tax incentives, full exemptions of import and excise duties for imported Completely Built-Up (CBU) vehicles, and a six-year full exemption of excise and sales taxes for locally manufactured Battery Electric Vehicles (BEVs). However, there is growing concern over the environmental risks associated with battery pollution due to the increasing number of EVs. According to Ashaari (2025), Malaysia may face a major crisis in managing battery waste from EVs by 2040 if appropriate strategies are not implemented. Therefore, this paper and accompanying video aim to present a structured methodology to evaluate the life cycle cost (LCC) comparison among selected end-of-life (EOL) BEV strategies in Malaysia. The objectives of this study are to review the latest approaches to EOL battery management strategies for BEVs and to identify strategies that can be recommended to optimise the life cycle cost of EOL battery management. The significance of this study to improve sustainable financial planning for EV ownership, as some EV components involve higher costs. It also aims to acknowledge people about the importance of choosing suitable strategies for managing the end-of-life phase of EV's batteries and raise awareness of the potential for pollution risk caused by unmanageable battery waste.

METHODS

To accomplish the study purposes, the suitable methodology chosen is qualitative research strategy because it would help to uncover insights into the preferred strategies to manage the EOL of batteries in EVs according to the Malaysian environment. Other than that, it also can uncover detailed personal insight and any barriers when applying those strategies in the real world, helping to provide more flexibility and deeper understanding needed to solve the problem since some of the approaches might be new. This method also can be more flexible in terms of questions and also respondents, as they can freely open up their opinion and follow the research requirements compared to quantitative methods that are more fixed and structured. The literature review is used to gather secondary data from existing or past academic sources, reports, and journal articles related to end-of-life (EOL) battery management strategies for electric vehicles (EVs). By doing this, it helps to identify existing practices, challenges, and frameworks from both international and Malaysian perspectives. For primary data collection, the appropriate approach is by using semi-structured interviews. Semi-structured interviews are widely used in qualitative research, as they allow for flexibility for participants' responses while maintaining a structured format aligned with the research objectives (Kallio et al., 2016). This approach was used to find more information about battery management practices, challenges in end-of-life (EOL) handling, and expert opinions on strategies for improvement in Malaysia. Next, the literature review is used to gather secondary data from existing or past academic sources, reports, and journal articles related to end-of-life (EOL) battery management strategies for electric vehicles (EVs). By doing this, it helps to identify existing practices, challenges, and frameworks from both international and Malaysian perspectives. The expected findings from this research are to know the most EOL battery management strategies implemented by other countries and to analyse the total life cycle cost for different EOL battery management approaches for the selected EVs.

CONCLUSION

In this study, an appropriate methodology is designed and proposed to evaluate the total life cycle cost comparison between the end-of-life (EOL) BEV strategies among the selected BEVs. Based on the literature review, it has been found that there are limited studies reported on the methodology to evaluate the total life cycle cost comparison between the end-of-life (EOL) BEV strategies among the selected BEVs. Therefore, the qualitative research strategy is adopted to gather more information for suitable strategies, subjective data for LCC and limitations to implement the strategies in Malaysia to overcome the issues based on the expert insight. Semi-structured interviews are used as an instrument to retrieve information about battery management practices, challenges in end-of-life (EOL) handling, and expert opinions on strategies for improvement in Malaysia. Hence, the expected findings, including identifying widely adopted global EOL battery management strategies and comparing the total life cycle costs of different EOL approaches for the selected EVs in Malaysia, can be achieved through the application of this method.

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This study contributes to the ongoing research undertaken by the first author as part of the dissertation requirement for the Bachelor of Quantity Surveying programme. The dissertation is being conducted under the supervision of the second author at the Kulliyyah of Architecture and Environmental Design, International Islamic University Malaysia.

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A METHODOLOGY TO INVESTIGATE FINANCIAL CHALLENGES AND STRATEGIC RESPONSES OF NET ZERO BUILDING IN MALAYSIA

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ABSTRACT

Net Zero Buildings (NZBs) have become a crucial element in supporting Malaysia's commitment towards achieving environmental sustainability and carbon neutrality. To achieve this imperative goal, the buildings in Malaysia have been demanded to design with a balanced energy consumption and renewable energy generation for providing zero net carbon emissions throughout the entire service life. Despite the noteworthy environmental and economic benefits of NZB, its present implementation in the Malaysian construction industry is still limited due to significant challenges particularly in terms of financial feasibility and sustainability in operating and maintaining the NZB buildings over the life span. This video is prepared with the objective to present a methodology proposed for the study to investigate financial challenges and strategic responses in the implementation of NZBs practice in Malaysia. A qualitative research strategy is proposed as methodology for the study, embedding a comprehensive literature review with interview approach to interview people that have established knowledge, skills or experience in the green building projects. The study will be focusing on identifying the quality of available data used as inputs in the estimation of initial and future costs of NZB building and evaluating the effectiveness of current financial incentives provided to foster the NZB implementation in the Malaysian construction industry. The study is expected to highlight major barriers that hinder the NZB implementation and include with the appropriate strategies for recommendation to enhance the financial viability and adoption of NZB implementation in Malaysia. The study findings could serve as a valuable reference to stakeholders and policymakers in helping them to improve the economic framework in the NZB implementation roadmap to be in line with Malaysia's sustainable development goals and National Energy Transition Roadmap (NETR).

Keywords: Net Zero Building; Sustainability; Methodology; Financial challenges

INTRODUCTION

The global shift toward environmental sustainability has heightened the need for innovative building designs that support carbon reduction targets. In this context, Net Zero Buildings (NZBs) play an increasingly important role. These buildings are developed to ensure a balance between energy usage and renewable generation, thereby achieving a net-zero carbon impact throughout their lifecycle (Abdullah *et.al*, 2024). In Malaysia, NZBs align with national commitments such as the National Energy Transition Roadmap (NETR) and Sustainable Development Goals (SDGs). However, despite the environmental imperative, NZB adoption in the country is still in its infancy. A major limitation is the financial viability of such buildings, which continues to be a concern for developers, contractors, and clients alike.

Significant issues arise from the lack of accurate cost estimation data, unclear return on investment, and limited access to sustainable financial support mechanisms. The absence of a comprehensive financial roadmap and inadequate incentives further hinders progress. Therefore, there is a critical need to investigate the financial challenges hindering NZB implementation and identify practical strategies that stakeholders can adopt to foster its wider adoption.

PROPOSED METHODOLOGY

To achieve the objectives of this study, a qualitative research strategy is proposed. This approach is deemed suitable given the nature of the research, which involves understanding perceptions, experiences, and strategic responses among industry players. The methodology consists of two core components:

1. Comprehensive Literature Review

A review of existing academic and industrial literature will be conducted to examine the financial dimensions of NZB projects, including capital and lifecycle costing methods, available incentives, and implementation models both locally and globally. This review will also identify gaps in Malaysia's current financial framework supporting NZBs.

2. Semi-Structured Interviews

Interviews will be conducted with key stakeholders, including quantity surveyors, architects, sustainability consultants, developers, and government representatives. These interviews aim to gather insights into the financial challenges faced during the planning, construction, and post-occupancy phases of NZB projects. Respondents will also be asked about the effectiveness of existing support mechanisms and suggestions for improvement.

This dual-pronged approach enables the study to generate in-depth findings based on expert experience and supported by documented evidence. The qualitative data will be thematically analysed to extract common themes, identify recurring challenges, and formulate strategic recommendations.

CONCLUSION

This study proposes a structured methodology to examine the financial limitations and strategic responses surrounding Net Zero Building implementation in Malaysia. By employing a qualitative research strategy that integrates a literature review with stakeholder interviews, the research will offer critical insights into the financial viability and institutional readiness for NZB adoption. The outcomes are expected to aid policymakers, industry players, and financial institutions in crafting more effective support mechanisms. Ultimately, the methodology and findings will contribute to enhancing Malaysia's green building landscape in line with national and global sustainability targets.

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A METHODOLOGY TO INVESTIGATE THE CHALLENGES AND STRATEGIES FOR IMPROVING LIFE CYCLE COST (LCC) PRACTICE IN THE MALAYSIAN URBAN RENEWAL

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ABSTRACT

Malaysia began to look into urban renewal in 2015, and subsequently, in 2020, the government planned to establish the Urban Renewal Act (URA), aimed at redeveloping decayed buildings over 30 years old, notably in public housing. Many commentators emphasised the paramount importance of financial sustainability in urban redevelopment. Hence, there is increasing demand to adopt life cycle cost (LCC) practice in urban renewal, an economic assessment technique that provides stakeholders and cost estimators with valuable total cost information, enabling more accurate forecasts of renewal and future costs, resulting in better planning for maintenance, operation and replacement throughout the urban renewal service life. Nevertheless, the adoption of LCC in the Malaysian urban renewal is still at a rudimentary stage, with a need to improve the quality of input data used. Therefore, this study presents a proposed methodology to investigate the challenges in managing and optimising the life cycle cost in urban renewal projects as well as the appropriate strategies that can be recommended to improve the LCC practice in the Malaysian urban renewal projects. The methodology is designed with a qualitative research strategy that incorporates a semi-structured interview approach to interview respondents who have established knowledge, skills or experience in urban renewal and cost estimation. The study is expected to add value to the improvement of LCC practices in the urban renewal projects in Malaysia, in alignment with the Construction Industry Transformation Programme (CITP) and the upcoming policy of the Urban Renewal Act (URA).

Keywords: Methodology, Urban renewal, Life cycle cost

INTRODUCTION

While many abandoned, decayed and old buildings are being redeveloped abroad, Malaysia presently is still debating the Urban Renewal Act (URA) policy, which has been scheduled to be presented for endorsement in the Parliament by mid-2025. To maintain competitiveness and continue to attract investments to the country, Minister of Housing and Local Government (KPKT), Nga Kor Ming, stated

that the URA policy was introduced as a crucial initiative to rejuvenate the city centre, particularly in Kuala Lumpur (Azhar & Lee, 2024). Simultaneously, the government is moving forward with the initiatives to renew or rebuild Kuala Lumpur's decaying areas, identifying 139 locations for redevelopment under the Kuala Lumpur Structure Plan 2040 (KLSP2040) (The Star, 2024). Many commentators emphasised the paramount importance of financial sustainability in urban redevelopment. Hence, there is increasing demand to adopt life cycle cost (LCC) practice in urban renewal, an economic assessment technique that provides stakeholders and cost estimators with valuable total cost information, enabling more accurate forecasts of renewal and future costs, resulting in better planning for maintenance, operation and replacement throughout the urban renewal service life. Nevertheless, the adoption of LCC in the Malaysian urban renewal is still at a rudimentary stage, with a need to improve the quality of input data used. Therefore, this study presents a proposed methodology to investigate the challenges in managing and optimising the life cycle cost in urban renewal projects as well as the appropriate strategies that can be recommended to improve the LCC practice in the Malaysian urban renewal projects.

PROPOSED METHODOLOGY

To achieve the study aim effectively, the methodology is designed with a qualitative research strategy that incorporates literature review and semi-structured interview approach. As the adoption of LCC within the Malaysian urban renewal is still limited, a qualitative research strategy allows a deeper and more thorough understanding of the cost factors of urban renewal in Malaysia. Simultaneously, this research strategy provides insights into the experiences and perspectives of various urban renewal stakeholders, whose actions have a direct impact on life cycle costs. Hence, a semi-structured interview is proposed to interview respondents who have established knowledge, skills or experience in urban renewal and cost estimation. These interviews are expected to produce valuable information that complements the literature findings as well as identify the challenges and strategies in implementing LCC within urban renewal projects. The criteria for respondent selection are i) possession of qualifications in the built environment, ii) have several years of experience in urban renewal construction or cost estimation, iii) provide their thought or discussion or article or paper related to urban renewal or cost estimation and iv) willingness and enthusiasm to support the study.

As the research is still ongoing, mapping of objectives and methodology serves to ensure the goals of the research correspond with the methods used to carry it out. The overall coherence, validity and effectiveness of the study depend heavily on this mapping as illustrated in Table 1 below.

Table 1.: Mapping of Objectives and Methodology

Aim	Research Objectives	Research Questions	Research Methodology	Expected Findings
To investigate the challenges and strategies of urban renewal in Malaysia from the perspective of life cycle cost.	To investigate the current practice of urban renewal in Malaysia versus other countries.	How do urban renewal practices in Malaysia differ than other countries?	i. Literature review. ii. Semi-structured interview.	i. Urban renewal practice in Malaysia. ii. Urban renewal practice in other countries.
	To identify the challenges in managing and optimising the life cycle cost in urban renewal projects.	What are the challenges in applying life cycle cost for cost optimisation in urban renewal projects?	i. Literature review. ii. Semi-structured interview.	Challenges faced by the government and stakeholders in applying life cycle cost for cost optimisation in urban renewal projects.
	To identify the strategies that can be recommended to improve the life cycle cost practice in urban renewal.	How can a comprehensive and reliable life cycle cost analysis be implemented in urban renewal practice in Malaysia?	i. Literature review. ii. Semi-structured interview.	Strategies that can be recommended to improve the life cycle cost practice in urban renewal in Malaysia.

As mentioned above, the expected findings of the study include identifying the urban renewal practice in Malaysia and in other countries, the challenges faced by the government and stakeholders in applying life cycle cost for cost optimisation in urban renewal projects, as well as the strategies that can be recommended to improve life cycle cost practice in urban renewal in Malaysia. Furthermore, it is expected that the study findings would add value to the improvement of LCC practices in the urban renewal projects in Malaysia, in line with the Construction Industry Transformation Programme (CITP) and the upcoming policy of the Urban Renewal Act (URA).

CONCLUSION

A methodology is designed to investigate the challenges and strategies for improving life cycle cost (LCC) practice in the Malaysian Urban Renewal. Since the adoption of LCC within the Malaysian urban renewal is still limited, a qualitative research strategy has been proposed as the methodology for the study. The qualitative research strategy incorporates literature review and semi-structured interview approach to interview respondents who have established knowledge, skills or experience in urban renewal and cost estimation to collect data that complements the literature findings as well as identify the challenges and strategies in implementing LCC within urban renewal projects.

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This study contributes to the ongoing research undertaken by the first author as part of the dissertation requirement for the Bachelor of Quantity Surveying programme. The dissertation is being conducted under the supervision of the second author at the Kulliyyah of Architecture and Environmental Design, International Islamic University Malaysia.

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ADOLESCENT SOCIAL MEDIA USE: UNDERSTANDING ITS IMPACT ON SELF-ESTEEM

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ABSTRACT

This qualitative study explores the impact of social media use on adolescent self-esteem. Previous studies have well-documented the negative impacts of social media on adolescents' self-esteem, but the positive impacts have received less attention. This study involved four participants selected through purposive sampling, based on the criteria of being secondary school students aged thirteen to seventeen years old, of either gender, and active users of social media. Using semi-structured interviews, their experiences with social media were recorded and analyzed through thematic analysis, revealing important insights into the impacts of social media use on adolescents' self-esteem. Results indicate that social media use is a source of positive reinforcement, supporting positive identity formation and motivating personal growth. To enhance the applicability of the results, future studies should include larger and more diverse samples from various aspects and explore the conditions under which social media use can have positive effects.

Keywords: *Adolescents, Self-esteem, Social media, Positive effect*

INTRODUCTION

Social media was purposely introduced as an online platform that provides space to create, share, and exchange content with friends, family, and those people who have similar interests to the user. The information sharing and content across all social media can also reach the virtual communities; the social groups formed through the communication platforms may be geographically dispersed but connected by shared interests. Nowadays, the commonly used social media platforms are Instagram, TikTok, Facebook, and X, formerly Twitter. The number of social users between the ages of 18 and 24 is 24.5% across the entire Malaysian population. This social media offers numerous advantages to adolescents, such as finding information, expanding opportunities for connection and communication, and educational purposes and self-improvement (Gupta et al., 2022; Hidayat et al., 2022; Kovalova, 2024; Khalaf et al., 2023). It also raises a significant concern about a user's psychological impact. One area of interest to explore in this study is social media and how it influences and results in any

consequences, specifically for adolescent self-esteem. Self-esteem generally refers to an individual's positive or negative attitude towards the self. For adolescents, self-esteem is their overall sense of worth or value for themselves. The nature of online content and the constant exposure through social media of adolescents, for instance, to idealized imagery, follow-up trendings, and seeking validation contributed to both positive and negative effects on the adolescents' self-esteem. Many adolescents are increasingly exposed to the idealized content on social media, which negatively impacts body image, self-esteem, and mood. This issue raises concerns among parents and teachers, as it may affect performance and well-being. Past studies have reported the negative impacts of social media on adolescents' self-esteem, but the positive impacts have received less attention, and also limited studies specifically on Malaysian adolescents. For instance, adolescents often engage in social comparison and cyberbullying, which negatively impacts self-esteem. This study purposely gives more information on the impact of social media on adolescents' self-esteem to see whether they experienced either a positive or negative impact. Hence, this qualitative study aimed to explore the impacts of social media use on self-esteem among adolescents.

METHODS

The study implemented a qualitative design, an approach that examines opinions, attitudes, and perspectives of human beings (Akyildiz & Ahmed, 2021). A phenomenological design to collect participants' experiences regarding the impact of actively using social media in their daily lives. Phenomenological studies emphasize the essence of the experiences and the subjective nature of the reality of the individuals. It benefits the study by providing deep insights into participants' perspectives, enhancing understanding of complex social issues, which allows for capturing the richness of narratives. The study involved four participants, two male and two female students, selected from local government secondary schools, aged thirteen to seventeen years old, of either gender, and actively using social media. A set of interview protocols using open-ended questions was created to explore the impact experienced by the participants while using social media. The data was collected through semi-structured interviews, guiding the participants in giving insights into the topic. It allows the researchers to facilitate in-depth exploration of experiences (Boşnak, 2022). All stories collected were recorded and kept safe via recording and transcription, as they are confidential and only used for data analysis purposes. The data collected was then analyzed using thematic analysis, which helps identify recurring themes from the data and makes it easier to interpret qualitative data. The patterns of responses were identified using coding and emerged into noun phrases that served as themes.

RESULTS AND DISCUSSION

This study purposefully explored the impacts of social media use on adolescents' self-esteem. The findings revealed that these adolescents' daily interactions with social media content had influenced their self-esteem in a positive way. Three key themes emerged from the data collected, which are social media as a source of positive reinforcement, social media supporting positive identity formation, and social media as a motivator of personal growth.

Several participants mentioned how receiving encouraging comments or viewing motivational content on social media platforms contributed to their self-esteem. Participant 1 mentioned that *“If the comments are good, then we can get something positive...”*. This description of gaining something positive from the content emphasizes the role of social media as a source of encouragement and validation. Participant 2 stated that *“For me, when I see motivational videos from TikTokers, I can understand them.”* This statement shows the participant found value in the content and helped them understand and relate to positive messages. The act of sharing content on social media that receives favorable responses can lead to increased feelings of worth and acceptance, and the positive feedback enhances their self-esteem. Adding to that, these adolescents who actively engage in supportive interactions and inspirational content are likely connected to overall flourishing and well-being, including self-esteem (Marciano & Viswanath, 2023). These insights suggest that social media use can provide adolescents with a form of positive reinforcement that reinforces their self-esteem.

The study also found that this social media use through the platforms allows adolescents to explore their identity in diverse and empowering ways. For instance, participant 3 expressed that *“My clothing style has always been like that. Since I never had a specific style before, now I just improvise.”* This shows how social media inspires their clothing styles and encourages self-expression through improvisation, and contributes to positive identity formation. Participant 4 also stated that *“The content ideas make me feel more confident because there are people who create content even though they have plus-size bodies...”* and *“When I see their fashion, it doesn't make me feel insecure. It's like there are still other alternatives for someone to feel confident.”* This noted view of diverse body types and fashion helped them feel confident and secure, suggesting a growing sense of acceptance of body diversity and self-representation. Referring to past studies, adolescents use social media to explore different facets of their identity, experimenting with presenting themselves and then seeking validation on the platforms, which boosts their self-esteem and encourages healthy identity development (Pérez-Torres, 2024; Regita et al., 2024). Moreover, exposure to various role models on social media can also inspire them to adopt positive attitudes and values, supporting their identity exploration too (Pérez-Torres, 2024). These findings indicate that social media use among adolescents can act as an alternative for identity exploration, specifically when the adolescents see themselves positively represented.

Last but not least, another finding was the motivational influence that helps adolescent personal growth, which leads to boosting their self-esteem. According to participant 3, *“When I see other people succeed...others succeeding, getting awards and everything, I want that too. So because of that, I work hard.”* This is the description of seeing others succeed, whether through awards or recognition; it helped as a motivational factor to work harder. This shows that upward social comparison on social media, when these adolescents interpreted it positively, can navigate them toward self-improvement. The use of social media helps adolescents to satisfy their psychological needs, for instance, autonomy and relatedness, which are important for their personal growth. According to Devos et al. (2023), exposure to positive social media content reported can increase the beliefs in their potential to achieve similar lifestyles, but can also lead to pressure if they feel they are not meeting these ideals. Therefore, it shows that adolescents perceive others' success not as a threat but as an inspiration to strive for personal achievement and boost their self-esteem.

CONCLUSION

This study was presented to explore the impact of social media use on adolescents' self-esteem. The findings reported that social media use plays a significant role in shaping adolescents' self-esteem in positive ways. Specifically, it can serve as a source of positive reinforcement, a platform that supports positive identity formation, and a motivator for personal growth. The insights gathered call attention to the constructive use of social media, which has the potential to support the development of self-esteem among adolescents. Educators and parents should promote supportive and empowering online environments for them by engaging in beneficial content. This study was limited to studying the impact on self-esteem of adolescents and participants selected from similar settings. Future studies may further explore larger and more diverse samples from various aspects and explore the conditions under which social media use can have a positive impact.

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ANALISIS KOS-MANFAAT RePlasPro : TRANSFORMASI PLASTIK TERBUANG MENJADI PRODUK INOVATIF

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ABSTRAK

Plastik merupakan pencemar utama alam sekitar yang memerlukan pengurusan lestari (Nasir & Zaini, 2021). Kajian ini menilai keberkesanan Program RePlasPro (Recycling Plastic Products) di SK Rantau Panjang, Klang, selama enam bulan bermula September 2024. Program ini bertujuan memberi nilai tambah kepada sisa plastik melalui pendekatan kolaboratif melibatkan guru, murid, PIBG, syarikat kitar semula dan NGO (Ahmad & Hashim, 2022). Data dikumpul melalui pemerhatian, soal selidik, pameran serta rekod kewangan, dan dianalisis dari segi kos, manfaat dan impak pelaksanaan. Dapatan menunjukkan program ini menjana pulangan kewangan bersih sebanyak RM6,780.00 serta berjaya mengitar semula lebih 260 kg plastik. Menurut Yusof & Salim (2020) murid memperoleh manfaat dalam bentuk peningkatan kesedaran tentang kitar semula, kemahiran kerja tangan, keusahawanan dan pembelajaran merentas kurikulum melalui program ini. Seramai lebih 3,073 murid dan 177 guru terlibat secara langsung, menyemai budaya hijau yang meluas hingga ke peringkat keluarga dan komuniti. RePlasPro terbukti berkesan bukan sahaja dari sudut kewangan dan alam sekitar, tetapi juga dalam membentuk generasi yang lebih peka dan kreatif. Ia berpotensi diperluas ke sekolah lain sebagai model pengurusan sisa plastik yang mampan. Inisiatif ini turut menyumbang secara langsung kepada Matlamat Pembangunan Mampan (SDG) seperti Pendidikan Berkualiti (SDG 4), Inovasi (SDG 9), Komuniti Mampan (SDG 11), Pengeluaran Bertanggungjawab (SDG 12), Tindakan Iklim (SDG 13) dan Perkongsian Global (SDG 17).

Kata kunci: RePlasPro, Kitar semula plastik, Pengurusan lestari, Kesedaran alam sekitar, Matlamat Pembangunan Mampan (SDG)

PENGENALAN

Isu pencemaran plastik global memerlukan penyelesaian pendidikan peringkat akar umbi. Sekolah sebagai institusi pembentukan sahsiah murid memainkan peranan kritikal dalam membudayakan amalan lestari (Nasir & Zaini, 2021). ReplasPro atau *Recycle Plastic to Product* diperkenalkan di Sekolah Kebangsaan Rantau Panjang sebagai intervensi berasaskan tindakan bagi menangani lambakan plastik terbuang melalui pendekatan pembelajaran kontekstual. Ia juga menyokong Matlamat Pembangunan Lestari (SDG 4 dan 12) melalui pengintegrasian pendidikan berkualiti dengan penggunaan sumber secara bertanggungjawab (Ahmad & Hashim, 2022). Kajian ini bertujuan menganalisis keberkesanan kos dan manfaat Program *ReplasPro* dalam dimensi pendidikan, ekonomi dan alam sekitar.

KAEDAH

Kajian ini dilaksanakan menggunakan pendekatan kajian tindakan secara kualitatif bagi menilai keberkesanan program yang dijalankan. Pengumpulan data dilakukan melalui beberapa kaedah utama iaitu pemerhatian langsung terhadap pelaksanaan program selama enam bulan, borang maklumbalas pelaksanaan program yang disebarluaskan kepada 3073 orang murid dan 177 orang guru dan staf, serta analisis dokumen dan data kewangan seperti resit pembelian, penyata jualan produk, dan catatan log aktiviti. Kaedah ini bersesuaian kerana ia memberi peluang murid terlibat secara langsung dalam pembelajaran kontekstual berasaskan tindakan alam sekitar (Yusof & Salim, 2020).

Bagi menilai keberkesanan dari sudut kewangan, satu analisis kos-manfaat telah dijalankan yang merangkumi tiga kategori utama. Kategori pertama ialah kos permulaan (CapEx) yang melibatkan perbelanjaan awal seperti pembelian mesin, latihan kepada warga sekolah, serta bahan permulaan. Kategori kedua ialah kos operasi (OpEx) yang merangkumi kos penggunaan elektrik, pembelian mesin dan peralatan, serta bahan guna habis pakai yang diperlukan dalam pelaksanaan program. Manakala kategori ketiga ialah manfaat yang diperoleh daripada pelaksanaan program ini, termasuk hasil jualan produk, peningkatan tahap kesedaran dalam kalangan warga sekolah, penyertaan dalam pameran berkaitan pendidikan lestari, serta penerimaan pelbagai bentuk pengiktirafan daripada pihak luar.

DAPATAN DAN PERBINCANGAN

Kos Permulaan dan Operasi

Kajian ini turut merangkumi analisis kos dan manfaat pelaksanaan program kitar semula di sekolah. Jumlah kos permulaan yang diperuntukkan adalah sebanyak RM4,000, yang meliputi pembelian mesin pengisar plastik dan acuan produk. Di samping itu, kos operasi tahunan yang merangkumi penggunaan elektrik, alat keselamatan, dan bahan guna habis dianggarkan sebanyak RM700. Oleh itu, jumlah keseluruhan pelaburan pada tahun pertama adalah RM4,700.

Manfaat ketara hasil daripada pelaksanaan program ini dapat dilihat dari dua sudut utama: manfaat

langsung dan manfaat tidak langsung. Dari segi manfaat langsung, program ini berjaya menjana hasil jualan sebanyak RM11,480 setahun melalui penjualan produk kitar semula seperti rantai kunci, pingat sukan dan pelapik cawan, yang dipasarkan semasa pameran sekolah. Keuntungan bersih yang diperolehi adalah sebanyak RM6780 dalam tempoh enam bulan program *RePlasPro* ini dilaksanakan. Manakala manfaat tidak langsung pula merangkumi penjimatan kos pelupusan sisa, peningkatan imej sekolah dalam kalangan komuniti, serta peningkatan kesedaran terhadap kelestarian alam sekitar dalam kalangan murid dan guru. Selain itu, pelaksanaan program ini turut menyumbang kepada peningkatan literasi STEM dan penguasaan kemahiran abad ke-21 dalam kalangan murid melalui pendekatan pembelajaran berasaskan projek (Project-Based Learning, PBL), di mana menurut Yusuf & Salim (2020) ianya menjadikan pengalaman pembelajaran lebih menyeronokkan dan bermakna.

Perbandingan Kos-Manfaat

Dari perspektif kewangan dan sosial, kadar pulangan pelaburan (Return on Investment, ROI) dalam tempoh 6 bulan didapati positif apabila mengambil kira gabungan manfaat langsung dan tidak langsung. Justeru, pelaburan awal sebanyak RM4,700 dianggap berbaloi kerana memberi impak berpanjangan terhadap pembangunan sahsiah, akademik dan kesedaran sivik murid. Jackson (2019) turut menyatakan perubahan sikap, motivasi, dan rasa tanggungjawab dalam diri murid adalah penting untuk pembentukan sahsiah serta kesedaran sivik.

Daripada analisis borang soal selidik yang dijalankan, empat tema utama telah dikenal pasti. Pertama, wujudnya rasa kepemilikan dalam kalangan murid terhadap produk yang dihasilkan, yang menunjukkan peningkatan motivasi dan tanggungjawab. Kedua, melalui kajian ini juga, kesedaran murid terhadap pemeliharaan dan pemuliharaan alam sekitar meningkat sebanyak 68.8%. Hal ini selaras dengan penekanan pendidikan lestari melalui kolaborasi sekolah dan komuniti (Ahmad & Hashim, 2022). Ketiga, pendekatan pembelajaran STEM melalui projek ini didapati lebih bermakna dan menyeronokkan, manakala tema keempat merujuk kepada komitmen guru yang menjadi faktor utama kejayaan pelaksanaan program ini.

Jadual 1.: Kos-Manfaat Program RePlasPro

Komponen	Perincian	Anggaran / Catatan
Kos Permulaan	Pembelian mesin pengisar plastik dan acuan produk	RM4,000
Kos Operasi Tahunan	Elektrik, alat keselamatan, bahan guna habis	RM700
Jumlah Pelaburan Tahun Pertama	Gabungan kos permulaan dan operasi	RM4,700
Manfaat Langsung	Hasil jualan produk (rantai kunci, pingat, pelapik cawan semasa pameran sekolah)	RM11480-RM4700 = RM6780

Komponen	Perincian	Anggaran / Catatan
Manfaat Tidak Langsung	· Penjimatan kos pelupusan sisa · Peningkatan imej sekolah · Kesedaran dalam kalangan murid dan guru	Tidak dinyatakan secara kuantitatif
Manfaat Pendidikan	· Peningkatan literasi STEM · Penguasaan kemahiran abad ke-21 melalui pendekatan PBL	Tidak dinyatakan secara kuantitatif
Kadar Pulangan Pelaburan	ROI dalam tempoh 6 bulan adalah positif	Pelaburan dianggap berbaloi
Tema Borang Maklumbalas 1	Kepemilikan murid terhadap hasil produk	Murid lebih bertanggungjawab
Tema Borang Maklumbalas 2	Kesedaran alam sekitar meningkat	68.8 % bersetuju program ini dapat meningkatkan kesedaran terhadap pemeliharaan dan pemuliharaan alam sekitar
Tema Borang Maklumbalas 3	Pembelajaran STEM lebih bermakna	Aktiviti lebih kontekstual dan menyeronokkan
Tema Borang Maklumbalas 4	Komitmen guru sebagai pemangkin kejayaan	Guru memainkan peranan aktif

KESIMPULAN

Program *ReplasPro* menunjukkan potensi besar sebagai model pendidikan lestari berasaskan komuniti sekolah. Analisis kos-manfaat menunjukkan bahawa walaupun terdapat pelaburan awal yang tinggi, manfaat pendidikan dan ekonomi yang berterusan menjadikannya inisiatif yang berdaya maju. Model ini sejajar dengan dapatan kajian lepas mengenai pendidikan lestari di sekolah (Nasir & Zaini, 2021; Ahmad & Hashim, 2022). Cadangan utama ialah memperluas program ini ke sekolah lain dengan pembiayaan komuniti dan sokongan pihak berwajib. Model ini selaras dengan falsafah pendidikan kebangsaan dan prinsip SDG, serta menyokong pembinaan generasi yang bertanggungjawab terhadap alam.

PENGHARGAAN

Penulis merakamkan penghargaan kepada pihak pengurusan Sekolah Kebangsaan Rantau Panjang, semua warga SK Rantau Panjang, Klang, serta semua murid-murid atas penyertaan aktif mereka dalam program *RePlasPro* ini. Juga setinggi-tinggi penghargaan kepada pihak Yakult (M) yang turut mengiktiraf *RePlasPro* sebagai salah satu projek lestari alam sekitar.

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BEYOND AI: THE HUMAN LIBRARY IN HIGHER EDUCATION – A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

As universities increasingly embrace digital tools, the value of genuine human connection can be overlooked. The review examines the Human Library (HL) as a dialogue-based approach that brings authentic narratives into higher education to foster empathy, critical thinking, and social inclusion. A comprehensive search was conducted across five major platforms which are Web of Science, Elicit AI, ResearchGate, Semantic Scholar, and Academia. The study is also supplemented by hand-selected sources, covering literature from 2000 to mid-2025. Following PRISMA guidelines, 267 records and 30 additional items were identified; after removing duplicates and screening titles and abstracts, 30 full-text articles were assessed, resulting in 17 studies included in the qualitative analysis and seven in the quantitative synthesis. Findings indicate that HL research primarily employs qualitative case studies, practitioner reflections, and thematic analyses, with fewer mixed-methods or controlled designs. Reported impacts include reductions in prejudice and social distance, enhanced cultural awareness, and strengthened empathy among participants. The Human Books often describe increased confidence, self-reflection, and therapeutic benefits. Notably, empirical evidence on HL's role in Malaysian universities remains scarce, leaving its potential to address soft-skill development, intercultural competence, and social cohesion largely unexplored. The review recommends that future studies in Malaysia adopt rigorous, context-specific methodologies such as longitudinal or experimental designs and integrate HL into curricula to cultivate both cultural literacies and the deeply human skills inspired by personal storytelling.

Keywords: Higher Education, Human Library, Social Inclusion, Systematic Literature Review (SLR)

INTRODUCTION

As higher education increasingly embraces digital tools like AI, the importance of human-centered learning remains critical. The Human Library (HL) offers a pedagogical model that emphasizes empathy, dialogue, and cultural understanding. HL events involve “human books” sharing lived experiences with student “readers,” fostering authentic conversations that challenge stereotypes and promote inclusion. For example, HL has been used in occupational therapy programs to enhance cultural competence (Pope et al., 2023), and in social work to explore intersectionality and oppression (Blizzard et al., 2018). Globally, HL has expanded to over 80 countries and is integrated into university courses, diversity programs, and workshops. Despite its growing popularity, empirical research on HL in higher education institutions (HEIs), especially in Malaysia, remains limited (Malhi et al., 2024). This review aims to evaluate HL’s pedagogical value and explore its potential to complement technological advancements in education.

Malaysian Context

Malaysia’s national education policies, such as the Malaysia Education Blueprint 2015–2025 and the EXCEL Playbook (2021), emphasize the development of soft skills including empathy, communication, and leadership. HL aligns with these goals by promoting respectful dialogue and multicultural understanding (Davis et al., 2024). In Malaysia’s diverse society, HL can support social cohesion and inclusive learning environments (Badiozaman et al., 2019). However, localized research on HL is scarce. Studies suggest that HL can reduce prejudice and improve communication skills (Pope et al., 2023), but its adaptation to Malaysia’s sociocultural context requires further investigation (Bagci & Blazhenkova, 2020; Lam et al., 2023). Tailored HL models may be necessary to address sensitive topics such as ethnicity and religion (Bagci & Blazhenkova, 2020).

METHODOLOGY

This systematic literature review followed PRISMA guidelines and included studies from Web of Science, Elicit AI, ResearchGate, Semantic Scholar, and Academia. The search spanned from 2000 to mid-2025 and used keywords such as “Human Library,” “Living Library,” and “Human Books.” Inclusion criteria focused on HL in higher education, with outcomes related to empathy, prejudice reduction, and intercultural competence. Theoretical frameworks included Vygotsky’s Constructivist Learning Theory (Vygotsky, 1978), and Kolb’s Experiential Learning Theory (Kolb, 1984). Out of 267 screened records and 30 hand-selected sources, 27 studies were included: 17 qualitative, 7 quantitative, and 3 mixed-methods. Most studies were Western based, with limited representation from Southeast Asia.

FINDINGS

HL as a Pedagogical Tool

HL has been implemented across disciplines such as medicine, social work, and occupational therapy. In medical education, HL exposes students to rural healthcare experiences, reducing biases (Malhi et al., 2024; Perez et al., 2024). In social work, it helps students understand oppression through direct dialogue (Blizzard et al., 2018). HL also enhances mental health literacy and challenges stereotypes (Chung & Tse, 2022; Bagci & Blazhenkova, 2020). Some universities embed HL into course curricula, linking sessions to learning outcomes and using pre- and post-event reflections to consolidate learning (Malhi et al., 2024;). Ethical considerations, such as informed consent and emotional safety, are essential (Chung & Tse, 2022).

Research Designs and Limitations

Most studies employed qualitative designs, including case studies, reflective journals, and interviews. While these methods provide rich insights, they are often limited by self-report bias and lack of control groups. Quantitative studies, though fewer, offer stronger evidence of HL’s impact on empathy and prejudice reduction. For example, Pope et al., 2023; Blizzard et al., 2018 used pre- and post-intervention surveys to measure changes in student attitudes, revealing statistically significant improvements. Mixed-methods studies also show improvements in empathy and communication (Pope et al., 2023). However, challenges persist including self-report bias, lack of control groups, and difficulty measuring long-term impact (Lam et al., 2023). Volunteer dependency and logistical hurdles also affect scalability (Lam et al., 2023). Logistical issues such as recruiting diverse human books and scheduling sessions can hinder implementation. Ethical concerns also arise, particularly regarding the emotional safety of both books and readers. Additionally, measuring long-term impact remains difficult due to the subjective nature of outcomes like empathy and personal growth. Figure 1 below presents the PRISMA 2020 flow diagram illustrating the systematic process of study identification, screening, eligibility assessment, and inclusion for this Human Library review in higher education.

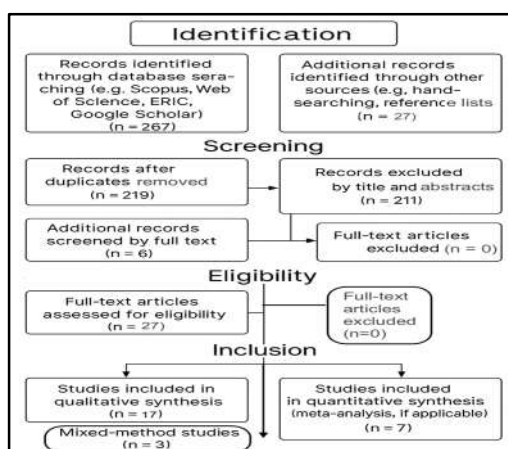


Figure 1.: PRISMA 2020

CONCLUSION

The Human Library offers several strengths as a pedagogical tool. It creates a safe space for sensitive discussions, encourages experiential learning (Pope et al., 2023), and is adaptable across disciplines. Its emphasis on dialogue and storytelling makes it especially effective in promoting empathy and critical thinking (Lam et al., 2023). In an AI-driven era, HL emphasizes the irreplaceable value of human connection in education. It cultivates empathy, reduces prejudice, and promotes cross-cultural understanding (Davis et al., 2024). Nonetheless, the model is not without challenges. Dependence on volunteers, emotional vulnerability, and inconsistent assessment methods can limit its scalability (Lam et al., 2024). These issues are compounded in contexts where cultural taboos or institutional constraints restrict open dialogue.

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BIBLIOVERSE TOK BAYU EDU: BRIDGING SOCIAL AND EMOTIONAL LEARNING THROUGH DIGITAL BIBLIOTHERAPY FOR SUSTAINABLE EDUCATION

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ABSTRACT

This BIBLIOVERSE TOK BAYU EDU is an all-in-one digital bibliotherapy platform that integrates emotional literacy, cultural wisdom, and technology for sustainable emotional learning. Aimed at educational settings and underserved communities, it supports stigma-free mental wellness aligned with SDGs 3, 4, and 10. The platform offers AI-guided mood check-ins, personalized content, and a rich Emotional Library of books, fan fiction, videos, music, podcasts, and games curated based on users' feelings. Through Bayu Academy, users explore microlearning modules on empathy, conflict resolution, emotional intelligence, and healing, earning certificates, XP, and badges along the way. It's supported by BiblioBot, a chat companion guiding journaling and reflection. Healing is gamified: players complete BiblioBot Quests, gain Emotional XP, and unlock titles like Empathy Mage or Bayu Guardian. With the Bayukit Builder, users craft their emotional survival toolkit, blending journaling, quotes, music, and reflections logged on their Achievement Board. Safe emotional expression is fostered in moderated spaces, such as the Grief Café and the Joy Zone. Ethical AI ensures content moderation, trigger warnings, and trauma-sensitive filters. Accessibility is core, featuring multilingual options, readable fonts, haptic feedback, sign language avatars, and voice-to-text tools. TOK BAYU reimagines emotional education as a right, not a privilege. By merging emotional learning with technology and storytelling, it empowers students, educators, and youth to build lifelong emotional resilience in an inclusive, future-ready ecosystem.

Keywords: Bibliotherapy, Sustainable education, Emotional literacy, Mental Wellness, Social and emotional learning

INTRODUCTION

The National Health and Morbidity Survey (2023) reports that Depressive symptoms among adults are 4.6%, and mental health problems among children aged 5 to 15 years old are 16.5%. Contributing factors include stigma, limited access to mental health resources, and so on, all of which highlight the multifaceted nature of mental health issues in the Malaysian population. The rise of mental health concerns among students and young people highlights the need for culturally sensitive, digital-first emotional support. Traditional methods often lack engagement or accessibility, especially for underserved groups. Bibliotherapy, using reading as a therapeutic tool, has shown promise but remains underutilized in digital education. Despite the increasing interest in digital mental health tools, many of these face issues with user engagement, adoption, and long-term use. A key reason, as highlighted by Vial et al. (2022), is the lack of user perspectives or the limited involvement of actual users, whether those who face the mental health issue or those who are not involved in the development process. Tok Bayu EDU addresses this gap by merging bibliotherapy, cultural wisdom, and AI in a gamified, inclusive emotional learning experience.

METHODS

This project adopts the Double Diamond design model introduced by the British Design Council, which consists of four phases: Discover, Define, Develop, and Deliver. This approach was selected to ensure a user-centered, iterative development of the BiblioVerse Tok Bayu EDU platform, balancing educational psychology, digital innovation, and emotional well-being.

1. Discover Phase

The initial phase involved exploratory research to understand existing gaps in emotional literacy and mental health tools in education. A literature review was conducted across scholarly databases, focusing on bibliotherapy, emotional intelligence, youth mental wellness, and technology integration in therapeutic platforms. Additionally, benchmarking was performed on established wellness applications, such as Quabble, Wysa, VOS, and Finch, to analyze their interface design, gamification techniques, and accessibility features.

2. Define Phase

Key insights from the Discover phase were synthesized into emotional user personas, design goals, and content categories. The emotional content was categorized by tone (e.g., grief, joy, stress) and target audience. Informal feedback was gathered through casual interviews with students, educators, and youth workers. This provided early insight into users' emotional pain points and content preferences, including journaling, fanfiction, audio, and interactive elements.

3. Develop Phase

In this phase, initial mockups of the BiblioVerse Tok Bayu platform were created using Canva. Features such as the AI chatbot (BiblioBot), Emotional Zones, Bayu Academy, and the digital Emotional Library were designed and structured based on feedback and design principles. Small

evaluations and feedback for refinement.

4. Deliver Phase

Currently in the blueprint and prototyping phase, the Deliver phase has not yet been implemented. Still, a full visual prototype is available for conceptual presentation and review in this innovation competition. Further development and pilot testing are planned in the future.

RESULTS AND DISCUSSION

The current result of this innovation is a digital prototype of Biblioverse Tok Bayu EDU, developed using Canva and structured based on the Double Diamond design model. The prototype platform visualized how bibliotherapy, emotional literacy, and cultural storytelling can be integrated into a single, gamified learning environment tailored for students, educators, and underserved youth communities.

The platform consists of five main features: (1) Emotional Zones where users engage with content based on their feelings; (2) Bayu Academy for microlearning in empathy, conflict resolution, emotional intelligence, resilience and healing; (3) BiblioBot, an AI-powered journaling companion; (4) an Emotional Library containing books, videos, music, podcasts, and games; and (5) the Support, where users can get professional support and SOS access. These features are supported by inclusive design elements such as trauma-sensitive filters, multilingual support, dyslexia-friendly fonts, and voice navigation. Each component is designed to be gamified, culturally inclusive, and accessible to all users.

Although the project is in its early stage, informal feedback from educators, students, and youth workers has been positive. Respondents appreciated the creative use of local cultural elements, the safe emotional expression zones (e.g., Grief Café, Joy Zone), and the gamified healing journey using titles like

Empathy Mage and Bayu Guardian. Also found that the users need tools that feel warm, relatable, and non-clinical. These early observations informed several design adjustments, such as adding mood-tracking options and ensuring trauma-sensitive filters. Users also emphasized the need for platforms that normalize emotional learning without stigma, especially in school environments.

The prototype embodies the potential of integrating digital bibliotherapy into formal and informal education settings. Its alignment with SDGs 3 (Good Health and Well-being), 4 (Quality Education), and 10 (Reduced Inequalities) strengthens its value as a sustainable emotional learning innovation. While formal usability testing and data collection are planned for the next phase, the current design phase has generated valuable insights on user needs, emotional pain points, and preferred digital interventions. For now, Biblioverse Tok Bayu EDU offers a promising and innovative model for promoting inclusive, technology-enhanced emotional education and digital bibliotherapy into

sustainable education ecosystems.

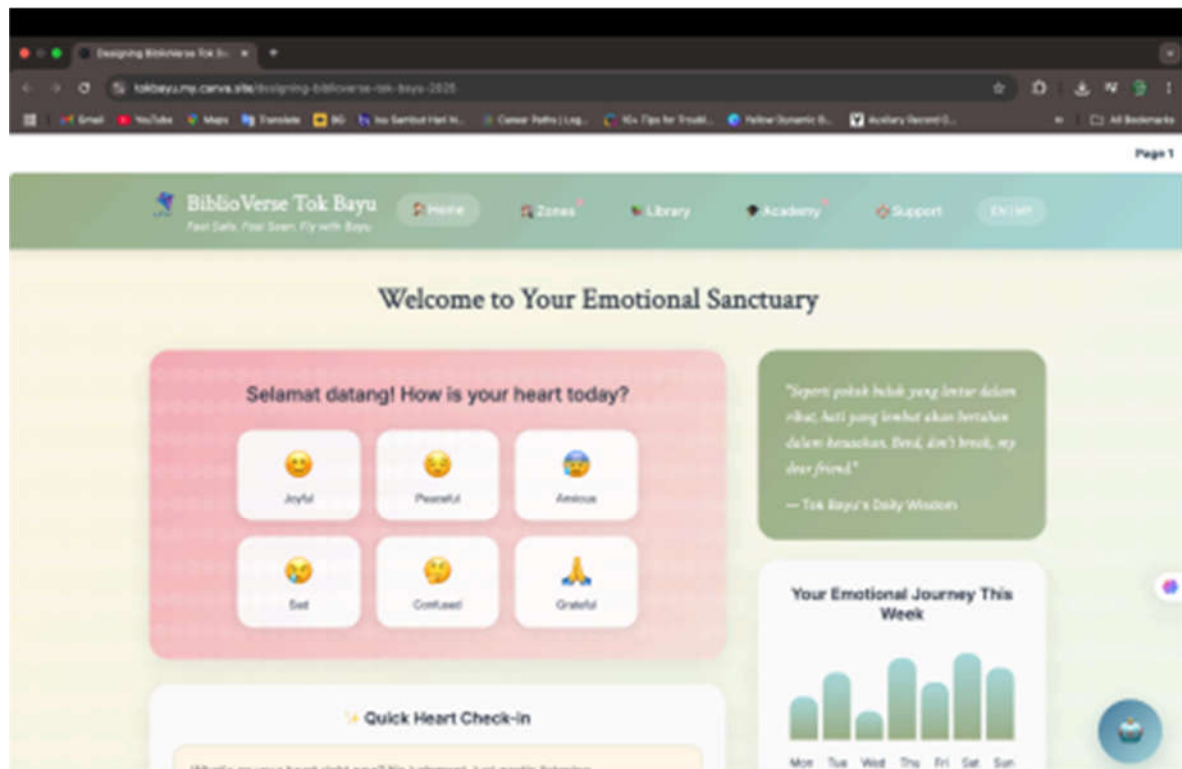


Figure 1.: BiblioVerse Tok Bayu (Website Version)

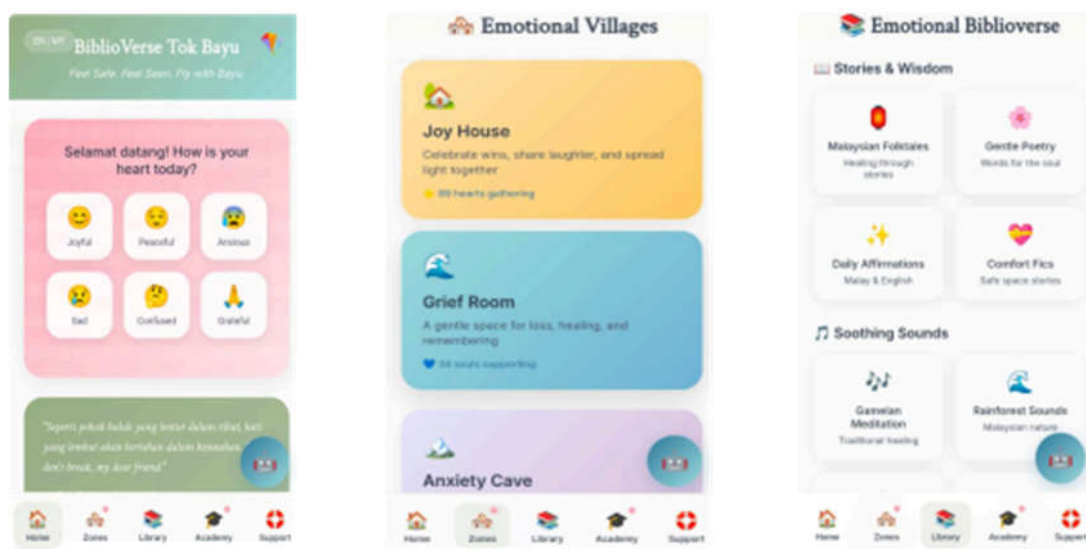




Figure 2.: Mobile Application of BiblioVerse Tok Bayu

Table 1.: Key Features of Tok Bayu and Corresponding Emotional Literacy Goals

Features	Goals
Bayu Academy	Learning & Practice
Emotional Library	Exploration
BiblioBot	Reflection & Companion
Emotional Zones	Expression & Support

CONCLUSION

Biblioverse Tok Bayu EDU represents a novel step toward culturally rooted, tech-driven emotional literacy. By framing emotional well-being as both a learning journey and a basic right, this innovation bridges digital bibliotherapy with inclusive, gamified healing. It supports SDG 3 (Good Health), SDG 4 (Quality Education), and SDG 10 (Reduced Inequalities) through a safe, human-

centered emotional ecosystem for students and communities.

ACKNOWLEDGEMENTS

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CHALLENGES FACED BY NON-NATIVE SPEAKERS IN LEARNING ARABIC SYNTAX IN DIPLOMA COURSE

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ABSTRACT

This study explores the specific challenges faced by non-native speakers enrolled in diploma-level Arabic language courses, with a focus on syntax (*nahu*). The research highlights recurrent challenges such as identifying verb forms (*māḍī*, *muḍāriʿ*), mastering sentence structures, using grammatical rules, and memorizing morphological patterns (*tasrīf*) based on qualitative data gathered through open-ended survey responses. Many students stated that their difficulties were rooted in a lack of early exposure to Arabic, limited vocabulary, and fast-paced teaching methods that assumed prior knowledge. Despite these challenges, students expressed strong motivation to improve, driven by their desire to understand the Qur'an, pursue religious knowledge, and succeed academically. The findings suggest that more scaffolded and learner-friendly teaching strategies are needed, including simplified explanations, practical exercises, and supportive learning environments. This study provides valuable insight into how to enhance diploma-level Arabic syntax instruction to promote student achievement, especially for those without a fundamental background.

Keywords: *Arabic syntax, non-native speakers, diploma students, language learning challenges, educational research, pedagogical strategies*

INTRODUCTION

This chapter reviews existing studies related to the learning of Arabic syntax by non-native speakers. It begins by exploring the importance of syntax in learning Arabic, followed by challenges faced non-native students, and the context of Arabic Syntax instruction in higher education.

Understanding Arabic grammar, or *nahw*, is essential to being fluent in the language. However, because of disparities in language backgrounds, teaching philosophies, and inadequate fundamental experience, non-native learners frequently find it difficult to understand syntactic norms, particularly at the certificate level. Fewer studies have explicitly examined the syntactic obstacles faced by diploma-level

students in non-Arabic-speaking nations like Malaysia, despite the fact that several have addressed general difficulties in learning Arabic.

By investigating the actual experiences of diploma students learning Arabic as a second or foreign language, this study aims to close that gap. The study intends to provide pertinent pedagogical solutions to improve learning results in Arabic syntax by identifying prevalent impediments and student views. Although the general problems with learning Arabic have been covered in a number of studies (e.g., Al-Batal, 1992; Mahmoud, 2018; Nor Hasliza & Mohd Nazri, 2020), little is known about the syntactic difficulties that diploma students face.

METHODOLOGY

This study adopts a qualitative case study approach, using purposive sampling to explore the syntactic learning challenges among 17 non-native diploma students, with data collected through an Arabic grammar test and an online open-ended questionnaire to enable methodological triangulation.

Research Instruments

Two research instruments were developed for this study:

- **Open-ended Questionnaire**

A structured open-ended questionnaire was designed to explore students' personal experiences and challenges in learning Arabic grammar (syntax). The questionnaire consists of three sections: Section A: Personal Information (e.g., academic background, language exposure) and Section B: Learning Experience (e.g., difficult grammar topics, effective methods). While, Section C: Personal Reflection (e.g., motivation and self-confidence). This format allowed participants to express their thoughts freely, providing rich qualitative data.

- **Arabic Grammar Test**

A short Arabic grammar test was created to assess participants' basic understanding of Arabic syntax. The test focused on common grammatical structures such as verb forms (*fi'l māḍī, muḍāri*), sentence construction, and morphological patterns (*tasrīf*). The test helped triangulate data from the questionnaire and identify common areas of difficulty.

RESULT

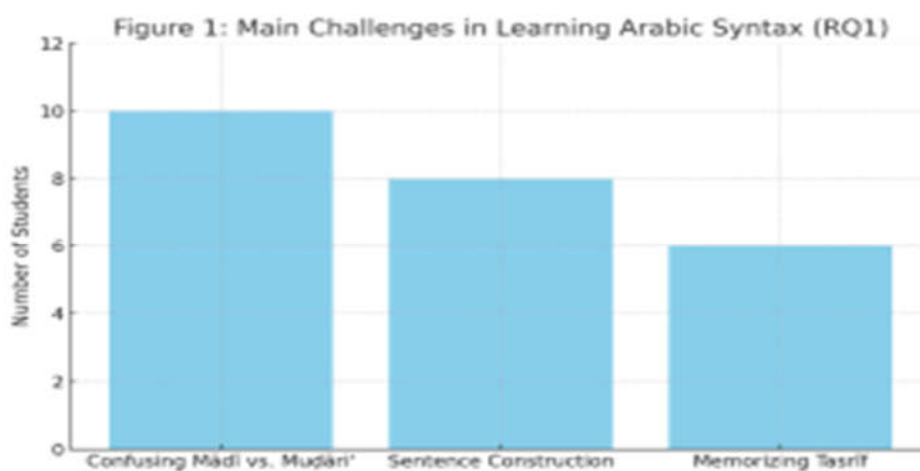


Figure 1 shows the main challenges in learning Arabic syntax faced by non - native speakers. Among the highest challenges faced were, the students confuse to identify the Present tense (Mudari') and Past Tense (Madi). The students also have trouble to construct sentences and memorizing the tasrif.

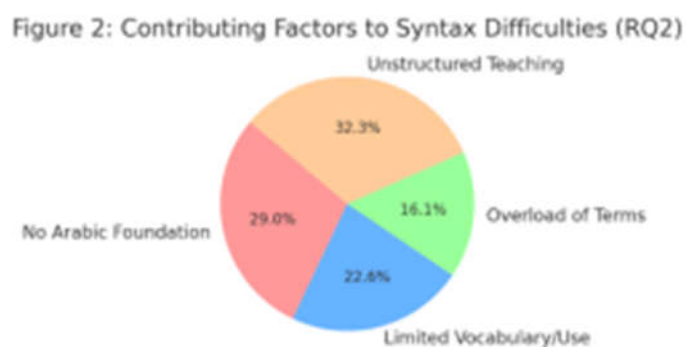


Figure 2 presents the factors that contribute to syntax difficulties. Unstructured Teaching contributes the highest factor in syntax difficulties, followed by no arabic foundation 29% and limited vocabulary and usage 22.6%. While, overload of terms shows 16.1%.

DISCUSSION

Based on the findings, several key issues can be highlighted regarding the challenges faced by non-native diploma students in learning Arabic syntax:

1. Having trouble distinguishing between the verb forms *muḍāri‘* and *māḍī*

When it came to identifying and using the appropriate verb tense in sentences, most students displayed uncertainty. Verb conjugation is one of the more difficult parts of learning Arabic for second language learners, and this reflects a recognized problem in the language (Al-Batal, 2017; Mahmoud, 2018).

2. Insufficient early Arabic exposure

More difficulties were observed by students who had little to no prior knowledge of Arabic grammar before beginning their diploma courses. This result confirms earlier findings that early and regular language exposure has a major impact on syntactic development (Ibrahim & Al-Tamimi, 2021).

3. Instruction that is too technical or moves quickly impairs understanding.

Students become overwhelmed and disinterested when grammar courses are hurried or overflowing with new vocabulary. Studies on effective Arabic pedagogy for non-native learners have also shown that clear and scaffolded explanations are essential (Nor Hasliza & Mohd Nazri, 2020; Al-Batal, 2017).

4. Preference for methodical training that includes practice and examples

Participants made it apparent that they preferred instruction that included methodical, incremental explanations backed up with real-world examples of sentences and exercises. According to Richards (2006), guided practice improves grammatical retention, which is consistent with constructivist learning ideas.

5. The value of a cooperative learning environment and peer cooperation

Peer support, careful instruction, and fostering classroom relationships were all thought to be beneficial for improving motivation and comprehension. This demonstrates how social and emotional elements play a part in learning a second language (Lightbown & Spada, 2013).

CONCLUSION

This study has shed important light on the difficulties non-native diploma students encounter when learning Arabic syntax. The results show that a lot of students have trouble with basic grammar skills including morphological memorization, sentence formation, and verb identification (*māḍī* and *muḍāri‘*). Lack of early exposure, a small vocabulary, and fast-paced or extremely technical teaching techniques are all strongly associated with these challenges.

Students show a tremendous willingness to learn Arabic in spite of these challenges, motivated by academic, personal, and spiritual reasons. Thus, more scaffolded, learner-friendly teaching methods are obviously needed. Step-by-step instructions, real-world examples, and the creation of encouraging classroom conditions that promote active involvement should be the top priorities for teachers.

Arabic syntax instruction can be greatly enhanced by matching teaching strategies to students' needs. This will increase learner engagement and success, particularly for students who have no prior Arabic knowledge.

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COMPOSITE MICROMECHANICAL ANALYSIS LEARNING TOOL (CMALT)

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ABSTRACT

Micromechanical analysis is essential for predicting the effective stiffness of composite laminas based on fiber and matrix properties. However, the mathematical complexity of models such as the Rule of Mixtures, used to calculate longitudinal (E_1) and transverse (E_2) moduli, often presents difficulties for undergraduate learners. To address this educational gap, the Composite Micromechanical Analysis Learning Tool (CMALT) was developed as an interactive web-based platform aimed at enhancing understanding of composite behavior through real-time simulation. Built using Python and Streamlit, CMALT enables users to input the elastic moduli of constituent materials and fiber volume fraction to compute E_1 and E_2 using established micromechanical equations. The tool features dual case study comparisons, predefined material presets, graphical visualization, and immediate numerical output to support interactive exploration of composite configurations. Validation against analytical calculations showed complete agreement, confirming the tool's computational accuracy. With its clean interface, browser-based accessibility, and integration of theoretical concepts with simulation, CMALT offers a practical solution for improving teaching and learning in composite mechanics. Future developments may include support for advanced micromechanical models, additional property calculations, and exportable results to further enhance its academic and research applications.

Keywords: Composite materials, Micromechanics, Elastic modulus, Rule of Mixtures

INTRODUCTION

Understanding the micromechanical behavior of composite materials is essential in modern engineering education and practice. As composites continue to replace conventional materials across a wide range of industries, the ability to predict and tailor their mechanical properties becomes a critical skill for engineering students (Reddy, Kumar, & Ramesh, 2022; Thakur & Patel, 2021). Micromechanics provides the foundation for analyzing how individual constituents such as fibers and matrix interact to form a composite lamina with specific stiffness and strength properties. This knowledge is vital for

designing lightweight, high-performance structures used in aerospace, automotive, marine, biomedical, and civil applications (Chawla, 2019; Daniel & Ishai, 2006). Despite its importance, micromechanics is often perceived as a challenging subject among undergraduate students due to its mathematical complexity and abstract theoretical models. Many struggle to visualize how changes in material properties and volume fractions affect the overall elastic behavior of composites, particularly when computing longitudinal (E_1) and transverse (E_2) moduli using analytical methods such as the Rule of Mixtures (Kaw, 2021). This learning gap can hinder students' ability to apply composite design principles in practical contexts, reducing their confidence and engagement in material science courses. To address these challenges, interactive learning tools play a pivotal role in bridging theory and application. By integrating simulation and visualization into the learning process, such tools enhance students' conceptual understanding and foster independent exploration of composite behavior. The Composite Micromechanical Analysis Learning Tool (CMALT) was developed in response to this need. CMALT is a web-based application that enables users to input fiber and matrix properties, calculate E_1 and E_2 , and observe how different combinations influence composite stiffness. Developed using Python and Streamlit, it supports structured case scenarios with real-time output, making micromechanical concepts more accessible and intuitive. As industries increasingly rely on composite materials and design optimization, proficiency in micromechanics is becoming a sought-after competency among engineering graduates. Tools like CMALT not only support academic instruction but also prepare students for advanced study and research in material engineering, structural analysis, and composite manufacturing. Equipping learners with such tools fosters deeper understanding, better retention, and stronger readiness to tackle engineering challenges involving advanced material systems.

METHODS

The development of the Composite Micromechanical Analysis Learning Tool (CMALT) involved a structured, iterative approach that integrates both frontend interactivity and backend computational logic to effectively support student learning in micromechanics. The core architecture of CMALT is built using Python as the main programming language and Streamlit as the framework for creating an interactive web-based graphical user interface (GUI). This choice of technology allows for rapid prototyping, cross-platform compatibility, and intuitive deployment without requiring local software installation. The GUI is designed to be clean and user-friendly, featuring dedicated input fields for fiber modulus, matrix modulus, and fiber volume fraction, along with clearly labeled case selection options to guide users through various predefined composite material scenarios. Upon submission of the input values, the tool computes the longitudinal modulus (E_1) and transverse modulus (E_2) using the Rule of Mixtures, with instant numerical output rendered directly within the interface to facilitate real-time learning and analysis. The longitudinal modulus of the composite is calculated using the Rule of Mixtures, expressed as:

$$E_1 = E_f V_f + E_m V_m \quad (1)$$

where E_1 is the longitudinal modulus of the composite, E_f is the modulus of the fiber, E_m is the modulus of the matrix, V_f is the volume fraction of the fiber, and $V_m = 1 - V_f$ is the volume fraction of the matrix. The transverse modulus is calculated using the inverse Rule of Mixtures:

$$\frac{1}{E_2} = \frac{V_f}{E_f} + \frac{V_m}{E_m} \quad (2)$$

where E_2 is the transverse modulus of the composite. These equations, shown in Equation (1) and Equation (2), form the theoretical foundation for CMALT's internal calculation engine and ensure that the computed values reflect established micromechanical modeling principles. The overall system architecture follows a logical and linear flow, beginning with user input, followed by automatic validation, backend computation, and visual display of results, as illustrated in Figure 1. This seamless interaction sequence promotes an intuitive and engaging learning experience by allowing users to observe how changes in constituent properties affect the stiffness of composite lamina. To ensure data integrity and computational accuracy, error handling mechanisms and validation routines are embedded throughout the interface to prevent incomplete or invalid entries from being processed. The lightweight and accessible nature of CMALT makes it especially suited for integration into academic environments. To enable flexible deployment, version control, and collaborative development, the full application is hosted on GitHub. Furthermore, the final tool is deployed publicly using Streamlit Cloud, making it accessible to students, educators, and researchers worldwide from any device with an internet connection.

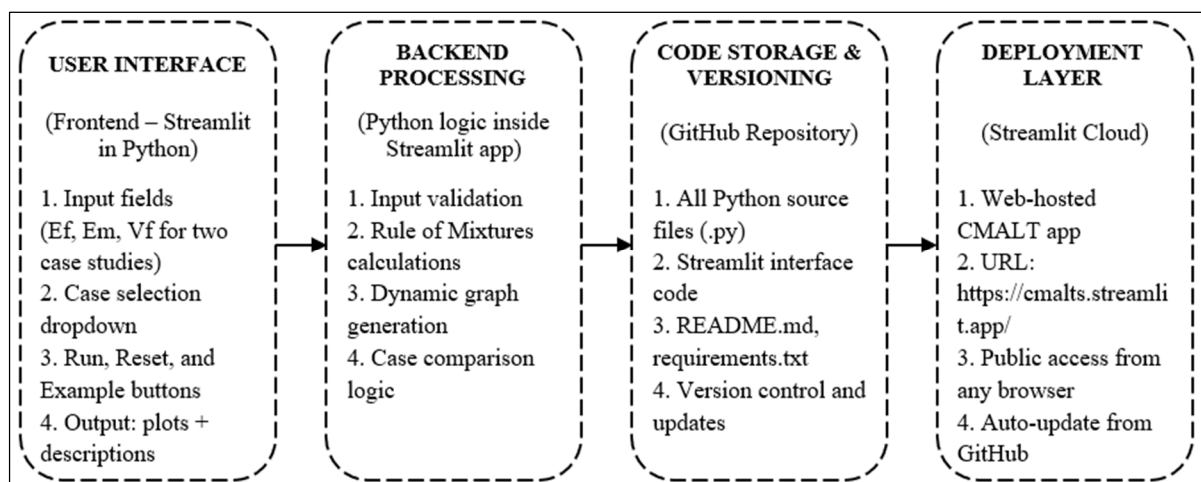


Figure 1.: CMALT System Workflow

Table 1 summarizes the technology stack used in the development of CMALT, highlighting the key components and their respective functions in ensuring the tool’s operational efficiency and educational value. Each element plays a distinct role in delivering a seamless and interactive user experience. Streamlit serves as the frontend framework that facilitates the development of the graphical interface, enabling the creation of input fields, buttons, and controls that guide users through the tool with minimal effort. Python, combined with numerical libraries such as NumPy, manages the backend logic responsible for performing accurate calculations of the longitudinal and transverse moduli using the

Rule of Mixtures. GitHub functions as the central platform for version control and documentation storage, supporting both development and future scalability. Lastly, the deployment of CMALT on Streamlit Cloud ensures that the application is easily accessible via a public URL without requiring any local installation. The integration of these technologies allows CMALT to remain robust, responsive, and adaptable for use in both classroom instruction and independent learning.

Table 1.: Technology Stack Used in the Development of CMALT

Component	Technology Used	Description
Frontend	Streamlit (Python)	User interface, buttons, inputs
Backend	Python (with NumPy, etc.)	Rule of Mixtures logic, validation
Visualization	Matplotlib / Plotly	Optional graphs, E_1 vs V_f
Code Hosting	GitHub	All source code and documentation
App Deployment	Streamlit Cloud	Public link for users to access CMALT

RESULTS AND DISCUSSION

The user interface of the Composite Micromechanical Analysis Learning Tool (CMALT) is structured to guide users through input and output processes efficiently, as shown in Figure 2. The interface provides clearly labeled fields for entering fiber and matrix properties and delivers immediate results for the longitudinal modulus (E_1) and transverse modulus (E_2) upon execution. Users can select predefined cases or manually input custom values, allowing flexibility in exploring different composite configurations. The streamlined layout ensures ease of navigation, making the tool accessible even to first-time users with minimal technical background.

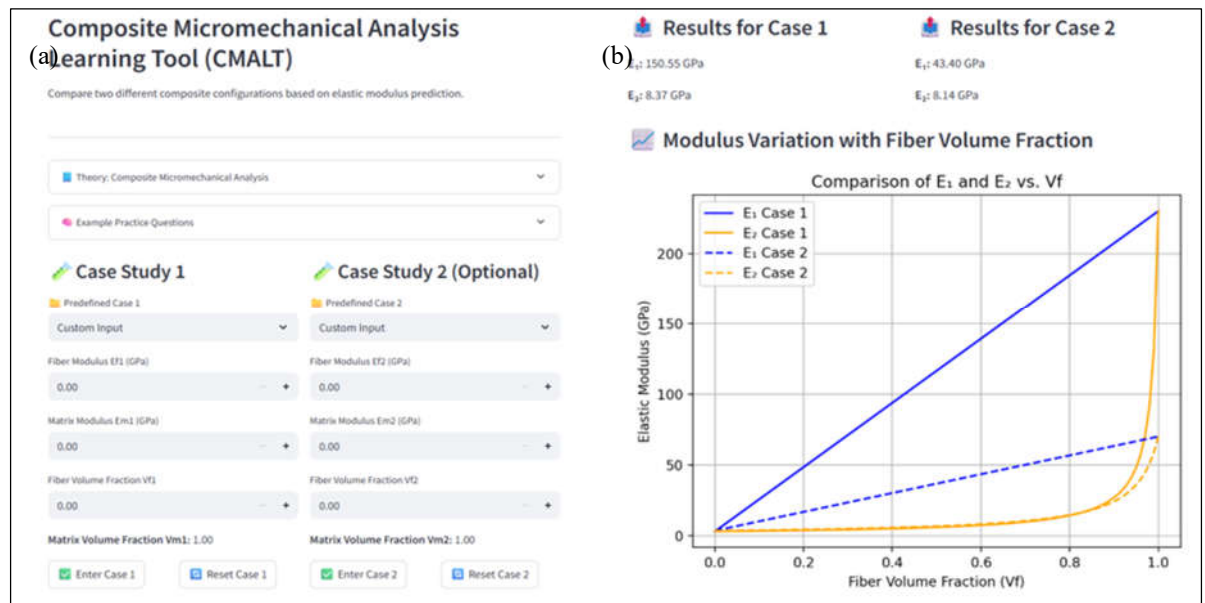


Figure 2.: CMALT User Interface: (a) Before Execution, (b) After Execution

To evaluate the accuracy of CMALT, two case studies were performed and compared against theoretical calculations using the Rule of Mixtures. In Case Study 1, the input parameters were a fiber modulus of 240 GPa, a matrix modulus of 3 GPa, and a fiber volume fraction of 0.6. In Case Study 2, the fiber modulus was 70 GPa, the matrix modulus was 5 GPa, and the fiber volume fraction was 0.5. Analytical values were manually calculated, while CMALT was used to generate numerical outputs. Table 2 presents a side-by-side comparison between the analytical results and CMALT outputs. Both case studies show complete agreement between the values, with a 0% error recorded. This confirms the computational reliability of CMALT in evaluating micromechanical stiffness properties of composite laminas. The consistency and accuracy of the tool's outputs further support its effectiveness as an interactive learning platform for understanding composite material behavior.

Table 2. Comparison of the Results of CMALT with the Theoretical Calculation

Case Study	Variable (GPa)	Analytical (GPa)	CMALT (GPa)	Error (%)
Case 1	Longitudinal modulus, E_1	145.20	145.20	0
	Transverse modulus, E_2	7.36	7.36	0
Case 2	Longitudinal modulus, E_1	37.50	37.50	0
	Transverse modulus, E_2	9.33	9.33	0

CONCLUSION

The Composite Micromechanical Analysis Learning Tool (CMALT) serves as an effective and user-friendly educational platform for enhancing understanding of composite material behavior at the micromechanical level. By allowing users to input fiber and matrix properties and instantly compute the longitudinal (E_1) and transverse (E_2) moduli using the Rule of Mixtures, CMALT bridges theoretical learning with interactive application. The accuracy of its computational engine, validated against analytical solutions with 0% error, reinforces its reliability for both instructional and self-directed learning purposes. From an educational perspective, CMALT addresses key challenges in teaching micromechanics by offering a visual, intuitive, and parameter-driven interface that supports various learning styles. Its real-time feedback mechanism helps learners directly observe the impact of fiber volume fraction and material properties on composite stiffness, promoting active exploration of micromechanical concepts. The lightweight web-based design, built using Python and Streamlit, ensures accessibility across platforms without requiring installation, making it a valuable tool for integration into undergraduate composite materials courses, online modules, or laboratory settings. The broader implications of CMALT lie in its demonstration of how interactive learning tools can demystify abstract engineering principles. By embedding theoretical equations such as the Rule of Mixtures (Equations 1 and 2) into a responsive digital environment, CMALT highlights the pedagogical benefits of simulation-assisted instruction. Its open-source availability on GitHub and public deployment on Streamlit Cloud exemplify scalable, collaborative educational design aligned with modern engineering education practices. Looking ahead, future iterations of CMALT could incorporate more advanced micromechanical models, such as Halpin-Tsai or Mori-Tanaka methods, and extend support to other mechanical properties including shear modulus and Poisson's ratio. Additional features like graphical plotting of moduli trends, multi-case comparisons, and exportable result summaries could further elevate its instructional value. Integrating CMALT with learning management systems (LMS) or interactive quizzes would also enable structured assessments and classroom use. With continued development, CMALT holds strong potential to evolve into a comprehensive educational resource that fosters deeper comprehension of composite mechanics across academic and professional domains.

ACKNOWLEDGEMENTS

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DELIVERA (DELIVERY AND ASSESSMENT MODEL): THE IMPACTS OF COLLABORATIVE TEACHING ON STUDENTS

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ABSTRACT

Collaboration has been shown to enhance student learning and engagement, yet interdisciplinary collaborative teaching remains underexplored. This study investigates how collaborative delivery and assessment in two subjects, i.e., Islamic Consumer Behavior (IMU253) and Fundamentals of Entrepreneurship (ENT300), promote practical knowledge and application among students. Grounded in Synergistic Integration Theory (SIT), this research examines the effects of DELIVERA (Delivery and Assessment Model) collaborative teaching on course learning and application. Mid-semester, an international speaker was invited to deliver insights on the halal market that catered to both subjects' requirements. At the end of the semester, students were required to submit a video presentation integrating both subjects' learning outcomes and demonstrating a Shari'ah-compliant business idea. Lecturers assessed the videos using distinct rubrics aligned with each course's objectives. This quantitative study surveyed 97 students from the March 2024 semester. Findings revealed that 88.6% of students found the international guest speaker beneficial in enhancing their understanding of the halal market, while 92.8% reported they could effectively apply knowledge from both subjects in their assignments. The results highlight the value of collaborative teaching in bridging theoretical learning with real-world application, particularly in Islamic-based and entrepreneurial education. The study recommends broader adoption of collaborative delivery and assessment models in higher education. Future research should explore its impact on students' long-term memory, critical thinking, and cross-disciplinary problem-solving skills.

Keywords: Collaborative Teaching, Collaborative Delivery, Collaborative Assessment, Interdisciplinary, Higher Education

INTRODUCTION

Collaborative teaching for interdisciplinary subjects is increasingly recognized as an effective pedagogical strategy to enhance student learning outcomes. It offers emotional, social, and cognitive benefits by fostering student engagement and creating meaningful learning experiences. Through continuous interaction and shared responsibility, collaborative teaching boosts participation and motivation (Yan, Zuo, & Luo, 2024). Co-teaching and team teaching have also been linked to higher academic achievement and satisfaction, especially in applied learning contexts (Saeed, Mutashar, & Aldakheel, 2018). In the context of sustainability and real-world problem-solving, interdisciplinary methodologies have been found to promote critical reflection and cooperative skills, thereby enriching the overall learning environment (Berasategi et al., 2020). Similarly, nursing education research has demonstrated that interdisciplinary teaching can significantly improve communication, trust, and team dynamics while reducing relational conflicts, compared to traditional instruction methods (Liu, 2021).

The strength of interdisciplinary learning lies in its ability to help students develop a holistic and practical understanding of complex topics (Hajiyeva, 2024). Integrative teaching enables students to explore issues from multiple perspectives, enhancing engagement and academic success (Moser, Ivy, & Hopper, 2019). It also supports a positive learning environment where students feel safe to take intellectual risks (Baumfield & McLaughlin, 2006). Despite these advantages, interdisciplinary collaborative teaching is underexplored in Islamic-based education, particularly where ethical, spiritual, and entrepreneurial values intersect. This study applies Synergistic Integration Theory (SIT) (Hutchins, 1995), which posits that purposeful collaboration across disciplines generates learning greater than the sum of its parts. SIT underpins the DELIVERA model introduced in this study, which integrates delivery, such as one international speaker for both IMU253 and ENT300, and assessment via one video submission evaluated by both courses. This research investigates the impact of collaborative delivery and assessment strategies in IMU253 and ENT300 at UiTM Terengganu, with a focus on students' perceptions of interdisciplinary learning in an Islamic higher education context.

METHODS

This study implemented an interdisciplinary collaborative teaching approach involving two lecturers co-teaching Islamic Consumer Behaviour (IMU253) and Fundamentals of Entrepreneurship (ENT300). The collaboration included jointly designing the scheme of work, delivering lessons, and assessing students' final business pitching videos. The teaching strategy incorporated two integrated models: delivery and assessment. For the delivery model, an international guest speaker was invited to present a lecture titled "Cracking the Code: Deciphering Islamic Consumer Behaviour in the Halal Market." This session was aligned with the course learning outcomes of both subjects and provided students with global perspectives on halal market practices.

For the assessment model, students produced a group pitching video that addressed requirements from both subjects. Although the video was a single submission, it was assessed using two distinct rubrics to reflect the unique objectives of each course. This model encouraged students to apply integrated knowledge from IMU253 and ENT300, fostering a deeper interdisciplinary understanding. They were

expected to demonstrate the ability to design a Shari'ah-compliant business model by synthesising concepts from both disciplines.

The assignment followed a project-based learning approach, specifically in the form of business planning. This collaborative teaching method was applied to IC110 (Diploma in Muamalat) students, where IMU253 is a programme-specific subject and ENT300 is a university-wide course. At UiTM, collaborative teaching initiatives are currently supported through Collaborative Groups (CG) under the Centre for Innovative Delivery and Learning Development (CIDL, 2023). This study employed a quantitative research design using a structured questionnaire. The instrument was distributed via Google Form to 97 Semester 4 Diploma in Muamalat students enrolled in both IMU253 and ENT300 at UiTM Cawangan Terengganu.

RESULTS AND DISCUSSION

All 97 respondents selected answered the survey. They were coming from four classes. All of them have been This experience provides exposure to collaborative teaching and learning. Out of 97 students, almost 97% admitted that it was their first experience doing two related assignments for two different subjects.

The first part of the survey evaluated students' perceptions of an international collaborative teaching webinar on Islamic Consumer Behavior. Using descriptive analysis with frequency and percentage, responses were gathered from 97 students using a 5-point Likert scale. Overall, students responded positively. For Question 1, 90.7% agreed or strongly agreed that the international speaker's session was beneficial. In Question 2, 86.6% agreed the webinar offered new perspectives, particularly from Indonesia. Question 3 revealed that 91.7% of students viewed the webinar as opening a new learning horizon. Question 4, which asked about the value of inviting guest speakers, had the highest combined agreement at 90.7%, with 47.4% strongly agreeing. Question 5 showed that 88.6% felt they learned effectively about the halal market from the speaker. Neutral responses ranged between 7.2% and 12.4%, while disagreement remained low at under 2.1%.

These findings highlight the effectiveness of international collaborative teaching in enhancing engagement and comprehension. Students valued the guest lecture format and gained global insights into Islamic consumer behavior (Appiah-Kubi & Annan, 2020). High agreement on international exposure and interdisciplinary learning (Q2, Q3) reflects the success of this model in promoting intercultural understanding (Berasategi et al., 2020; Hajiyeva, 2024). Strong support for guest speakers (Q4) affirms their pedagogical value (Liu, 2021), while the ability to relate theory to practice, especially halal market applications (Q5), supports experiential learning (Saeed et al., 2018).

These outcomes reinforce Synergistic Integration Theory (SIT), which suggests intentional collaboration across disciplines promotes more profound understanding. The DELIVERA model enabled such integration by linking IMU253 and ENT300 in both teaching and assessment. This supports literature promoting collaborative teaching to improve knowledge retention, critical thinking, and real-world application. Institutions should consider adopting similar delivery models, especially for culturally contextual subjects like Islamic consumer behavior and entrepreneurship.

The second part of the survey examined students' perceptions of the collaborative assessment model, in which students completed a single business pitching video to fulfill outcomes for both subjects. Again, the data reflected strong approval. In Q1, 86.6% enjoyed working on one business idea for both subjects. Q2 showed that 95.9% believed submitting one video saved time, and this is supported by Wan Jusoh, Ghazi Ahmad, Ibrahim, and Nik Hassan (2025). Time management benefits were confirmed in Q3, with 90.7% agreeing. For Q4, 92.8% indicated they were able to apply what they learned in both subjects effectively.

Students also demonstrated strong agreement in terms of knowledge integration:

Q5: 88.6% saw clear relevancy between the two subjects.

Q6 & Q7: 91.8% felt they better understood both subjects.

Q8: 87.6% felt the assignment benefitted both subjects fully.

In Q9, 92.8% expressed satisfaction with the lecturers' joint explanation of the business plan. Finally, Q10 showed that 86.6% would like this type of collaboration applied to other subjects. Disagreement levels across items were low (0–2%), with neutral responses between 3.1% and 13.4%. These findings further support the DELIVERA model's impact and reinforce the value of collaborative assessment as a practical and efficient interdisciplinary learning approach. Full details are presented in Table 1 and Figure 1.

Table 1.: Findings of Collaborative Delivery and Collaborative Assessment

INTERNATIONAL COLLABORATIVE TEACHING WEBINAR						
No	Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	The international speaker on Islamic consumer behavior was beneficial.	0%	2.1%	7.2%	51.5%	39.2%
2	The webinar gave me new perspectives, especially from Indonesia.	0%	1%	12.4%	42.3%	44.3%
3	The webinar broadened my learning on Islamic consumer behavior.	0%	0%	8.2%	47.4%	44.3%

4	Guest speaker sessions are a good teaching practice.	1%	0%	8.2%	43.3%	47.4%
5	I learned effectively about the halal market from the guest speaker.	0%	1%	10.3%	41.2%	47.4%

COLLABORATIVE ASSESSMENT

No .	Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I enjoyed doing IMU253 and ENT300 assignments using the same business idea.	0%	1%	12.4%	36.1%	50.5%
2	Submitting one video for both subjects saved time.	1%	0%	3.1%	25.8%	70.1%
3	These assignments helped me manage time better.	1%	1%	7.2%	40.2%	50.5%
4	I applied what I learned in both subjects to the assignments.	1%	1%	5.2%	28.9%	63.9%
5	The assignments showed the relevance between both subjects.	1%	0%	10.3%	38.1%	50.5%
6	The assignments helped me understand both subjects better.	1%	0%	7.2%	42.3%	49.5%
7	By doing these kind of assignments, I can understand both subjects effectively.	0%	0%	13.4%	42.3%	44.3%
8	The assignments benefitted both subjects fully.	0%	1%	11.3%	41.2%	46.4%
9	I'm satisfied with the business plan explanation by both lecturers.	0%	1%	6.2%	45.4%	47.4%
10	I'd like this type of subject collaboration used in other courses.	1%	1%	11.3%	41.2%	45.4%

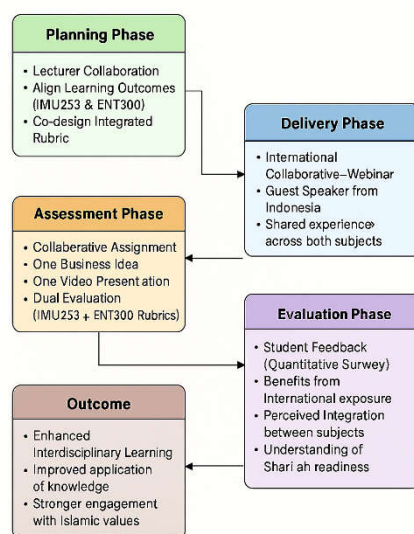


Figure 1.: “DELIVERA” Innovative Interdisciplinary Collaborative Teaching Model

CONCLUSION

The findings show that collaborative delivery, particularly through an international guest speaker, greatly enhanced student engagement, global perspective, and real-world application of knowledge. Likewise, the collaborative assessment model received strong approval, with students reporting better time management, clearer understanding, and the ability to apply integrated knowledge effectively. These results highlight that well-designed interdisciplinary collaboration can be a powerful tool to improve applied learning, link theory to practice, and develop holistic thinking. Integrating content from different disciplines also nurtures students’ ability to connect Islamic values with entrepreneurship, aligning well with the goals of the Muamalat curriculum.

The study supports Synergistic Integration Theory (SIT), which suggests that intentional collaboration fosters deeper learning. The DELIVERA model helped students meaningfully connect IMU253 and ENT300, linking knowledge with practice. The implications point to the importance of institutionalising collaborative teaching strategies in higher education. Success depends on clear rubrics, strong lecturer coordination, and curriculum support. Future research should explore the long-term impact on students’ critical thinking, memory retention, and readiness for real-world challenges, especially in Islamic-based interdisciplinary programs.

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DESIGN AND DEVELOPMENT OF MOBILE APPLICATION FOR ASSESSING CRIME RISK FOR INVESTIGATION OFFICER (IO)

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ABSTRACT

This paper presents the design and development of the Integrated Crime Risk Assessment System (ICRAS), a mobile based, AI driven tool tailored specifically for Investigation Officers (IOs) in Malaysia. Recognizing the challenges faced by law enforcement personnel in dynamic and resource constrained environments, this study proposes a novel mobile application that integrates real time analytics with field operations, empowering IOs to assess and manage crime risk proactively. ICRAS is the first system of its kind in Malaysia, utilizing Light Gradient Boosting Machine (LightGBM) models for predictive crime risk assessment and geospatial hotspot mapping to visualize high risk areas. By seamlessly combining predictive analytics with field-based decision making, ICRAS enhances situational awareness and improves operational efficiency. This paper outlines the methodological framework for the development of ICRAS, analyses its performance, and discusses its potential to transform conventional policing into a more proactive, intelligence led model. Through extensive testing and user feedback, the results demonstrate significant improvements in decision making efficiency, resource allocation, and officer satisfaction. The research underscores the application's relevance in modernizing law enforcement tools and its alignment with national strategies to improve public safety.

Keywords: *Integrated Crime Risk Assessment System (ICRAS), Investigation Officers (IO), Predictive Analytics, Intelligence Led Policing, Mobile Application*

INTRODUCTION

In recent years, the complexity of crime has intensified, driven by socio economic pressures, urbanization, and the increasing sophistication of criminal tactics (Malik, A.A., 2016). In Malaysia, Investigation Officers (IOs) play a pivotal role in managing and mitigating crime at the ground level (Othman, S.Z., 2023). Current crime risk assessment methods rely on fragmented data and lack real time insights, which significantly hinder rapid decision making and effective resource allocation. Traditional methods are further obstructed by inconsistent methodologies and limited access to real time intelligence (Granite, GRC, 2025). This impedes the ability of IOs to respond swiftly and accurately, particularly in high stakes situations (Maidin, 2024). To address these challenges, this study introduces the Integrated Crime Risk Assessment System (ICRAS), a mobile application designed to bridge the gap between data science and frontline law enforcement (Lee, Tan, & Tan, 2022). The primary aim is to provide IOs with a digital companion capable of evaluating crime risk, mapping hotspots, and generating predictive insights using machine learning models (Singh, 2021). By digitizing and systematizing crime risk assessment, ICRAS represents a step forward in Malaysia's journey towards smart policing and improved public safety infrastructure (Kamaruddin, 2021).

METHODOLOGY

The development of ICRAS employed a mixed methods approach, combining qualitative input from law enforcement stakeholders with quantitative analysis of crime data. The research design followed a multi-phase process. Initially, a needs assessment was conducted through interviews and focus group discussions involving 30 (thirty) Investigation Officers in Shah Alam Selangor. These sessions provided valuable insights into current operational challenges, expectations for technological integration, and concerns around usability and data privacy. Subsequently, historical crime data obtained from the Royal Malaysian Police (RMP) spanning the years 2015 to 2021 was subjected to analytical processing. This dataset encompassed variables such as crime location, type, time, socio-economic conditions, and reoffending indicators. Based on this data, machine learning algorithms, particularly Random Forest and Decision Trees, were employed to construct predictive models that identify high risk areas and potential crime occurrences. The mobile application itself was developed using Android Studio, supported by Firebase for real time cloud-based data management. Google Maps API was integrated for dynamic geospatial visualization. The application includes several key modules such as a Crime Risk Matrix and Officer Dashboard. Usability testing followed, where participants engaged in scenario-based evaluations to determine practical utility and user friendliness. Metrics like the System Usability Scale (SUS) and structured feedback instruments were used to gather evaluative data (Saunders, 2016).

RESULTS AND DISCUSSION

The pilot implementation of ICRAS produced highly encouraging outcomes. From a technical perspective, the predictive models demonstrated strong performance, achieving an accuracy rate of 89.3% in forecasting high-risk areas. The application notably improved response efficiency among IOs, with an average reduction of 35% in case handling time. These findings underscore the operational benefits of equipping IOs with intelligent digital tools that enhance situational awareness and enable informed decision-making. To further substantiate these results, a comparison of traditional and application-supported crime assessment workflows was conducted. As shown in Table 1, the integration of ICRAS resulted in marked improvements across key performance indicators including response time, accuracy of risk assessment, and user confidence levels.

Table 1. Performance Comparison of Crime Assessment Approaches

Metric	Traditional Method	With ICRAS	Improvement (%)
Average Response Time	52 minutes	34 Minute	35
Assessment Accuracy	64.1%	89.3%	39
Officer Satisfaction (SUS)	61.2	82.5	34.8

Usability testing yielded positive feedback. According to the SUS score, ICRAS received a rating of 82.5, placing it in the "excellent" category (UXtweak, 2023). Participants praised the intuitive interface, rapid data retrieval, and the practicality of the hotspot mapping module. Commonly requested improvements included the addition of offline capabilities for areas with poor connectivity and enhanced encryption protocols to secure sensitive information. Field simulations provided valuable insights into the application's operational impact. Officers used ICRAS to identify and prioritize top high-risk locations within their jurisdictions (Chong, 2018). The Risk Appetite Index allowed for nuanced prioritization of cases based on the severity of threats and potential community impact (Six Sigma, 2025). This capability proved especially valuable in optimizing patrol routes and allocating investigative resources efficiently (Kamaruddin, 2021).

Table 2.: User Feedback on ICRAS Features

Features	Satisfaction Rating (1-5)	Comment Summary
Crime Risk Matrix	4.5	Helped to analyze crime risk assessment

Real Time Alerts	4.2	Improve responsive, some notification issues
Dashboard	4.8	Comprehensive and easy to use
Apps Features	4.7	Includes report generation and secure data encryption

Initial feedback from the field was promising. Officers using ICRAS during the pilot reported quicker situational assessments, with many noting that the system helped them identify and respond to emerging threats faster than before. On average, officers could make informed decisions in less than five minutes down from an estimated 25 minutes when relying on traditional methods. From a performance standpoint, ICRAS achieved strong predictive accuracy, correctly identifying high risk locations in over 80% of cases tested during the pilot phase. This was a significant improvement over the estimated 60% accuracy of conventional assessments. While no system is perfect, the combination of algorithmic precision and expert-informed logic created a tool that officers trusted and used confidently (Kamaruddin, 2021).

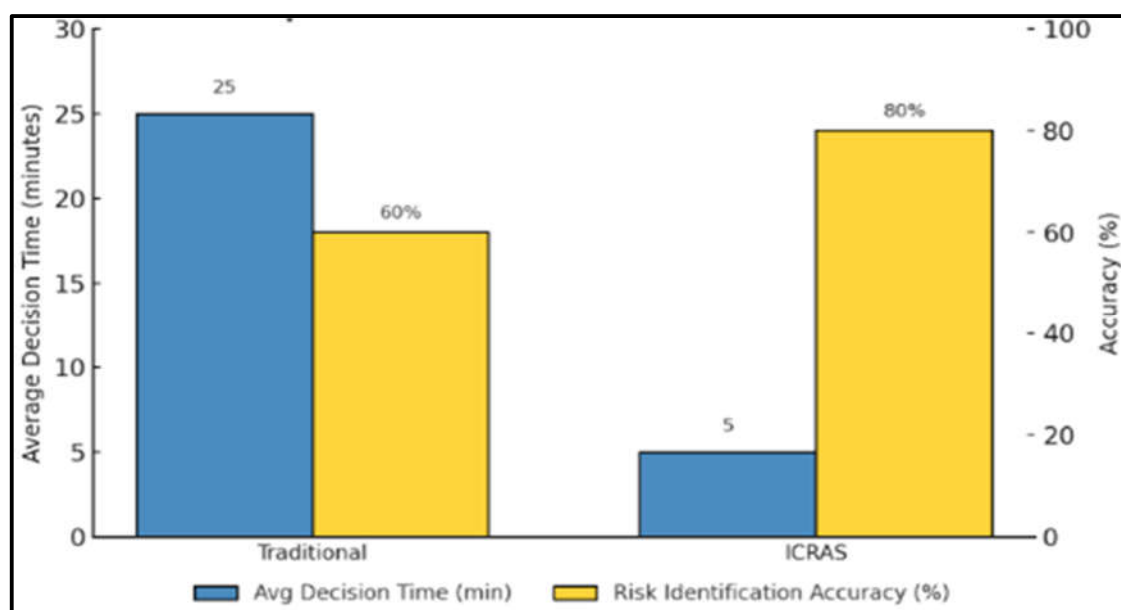


Figure 1.: Comparison of Crime Risk Assessment Method

	Severity		Likelihood / Probability				
	Personnel	Asset	Very unlikely (hasn't occur before)	Slight (rarely occur)	Feasible (possible but no common)	Likely (has before / will again)	Very likely (occurs frequently)
			Rare	Unlikely	Possible	Likely	Almost Certain
5	Fatality / Major Injury	Massive loss (50k above)	5	10	15	20	25
4	Multiple casualty / hospitalized	Major loss (20K- 49K)	4	8	12	16	20
3	Outpatient treatment	Moderate loss (5K-19K)	3	6	9	12	15
2	Basic first aid	Minor loss (1K- 4.9K)	2	4	6	8	10
1	Slight injury	Sight loss (less than 1K)	1	2	3	4	5

Figure 2.: Crime Risk Assessment Matrix

CONCLUSION

The development and deployment of the ICRAS mobile application represent a significant advancement in crime risk assessment for Investigation Officers in Malaysia. The fusion of artificial intelligence, mobile technology, and geospatial analysis empowers officers with a comprehensive and responsive toolkit to manage crime proactively (CloudTweaks, 2023). The system has shown to enhance operational efficiency, improve the accuracy of assessments, and foster greater trust in technology supported decision making. Looking ahead, further enhancements are envisioned, including the integration of additional data sources such as community reports and environmental variables. A nationwide rollout, supported by continuous officer training and institutional policy integration, could catalyze a paradigm shift toward data driven policing. ICRAS sets a compelling precedent for future innovations at the intersection of law enforcement and digital transformation.

ACKNOWLEDGEMENTS

This project owes its success to the invaluable collaboration of the Royal Malaysia Police, the participating Investigation Officers, and the technical advisors, whose dedication and expertise played a crucial role. We also extend our heartfelt gratitude to our academic mentors and innovation grant

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DEVELOPMENT OF A COMPACT AND SUSTAINABLE CNC MILLING MACHINE FOR PCB PROTOTYPING

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ABSTRACT

The growing demand for printed circuit boards (PCBs) in various electronic applications calls for sustainable and accessible advancements in PCB manufacturing. Traditional fabrication methods are often manual, resource-intensive, and lack precision, making them unsuitable for rapid prototyping in educational or low-budget environments. This study presents a cost-effective desktop PCB milling machine prototype designed to support sustainable learning and innovation by enabling students and makers to produce high-quality PCBs in-house. The machine utilizes open-source Marlin firmware and is modeled using SolidWorks. It features mesh bed leveling, gantry movement, and real-time monitoring via the TFT43 V3.0 touchscreen integrated with the BigTreeTech SKR Mini E3 V3.0 control board, enhancing operational efficiency and user experience. Testing demonstrated the stepper motors high positional accuracy of $99.49\% \pm 0.1\%$ on both X and Y axes, confirming the machine's reliability for precise PCB layout production. This project promotes sustainable engineering education and provides a practical tool to advance digital fabrication and lifelong learning in the Industry 4.0 era.

Keywords: PCB milling machine, sustainable engineering education, open-source firmware, digital fabrication; Industry 4.0

INTRODUCTION

The demand for printed circuit boards (PCBs) continues to rise due to their role as essential components in electronic devices across various industries. Conventional fabrication methods, which involve heat transfer and chemical etching, are time-consuming, inconsistent, and environmentally harmful. As a sustainable alternative, CNC-based PCB milling enables precise, automated removal of copper layers through computer-controlled operations. Commercial machines, such as the Wegstr 3-axis system, demonstrate the feasibility of this approach by offering high-precision milling and drilling for rapid

prototyping.

1.2 Problem Statement

Conventional PCB fabrication methods are inconsistent, time-consuming, and highly dependent on operator skill. They also involve hazardous chemicals, posing safety and environmental risks while increasing the likelihood of defects. Desktop PCB milling provides a safer, faster, and more sustainable alternative, reducing human error and eliminating chemical use.

1.3 Objectives

This project aims to develop a desktop PCB milling machine that offers a safer, more sustainable, and more efficient alternative to conventional chemical-based fabrication. The objectives are:

1. To design and prototype the machine with features that support precision and sustainability.
2. To implement mesh bed leveling for consistent first-layer calibration and reduced waste.
3. To evaluate performance in terms of accuracy, reliability, and usability compared with manual methods.

1.4 Project Scope

The prototype was designed in SolidWorks and fabricated mainly using 3D-printed parts to minimize cost and time. The compact machine (30 × 30 × 30 cm, milling bed 15 × 15 cm) integrates a Cartesian motion system, Genmitsu GS-775M spindle motor, and open-source Marlin firmware. A TFT35 V3.0 touchscreen provides the user interface, while the system incorporates spindle control and mesh bed leveling to enable precise PCB prototyping.

METHODS

The PCB milling machine was first modeled in SolidWorks and fabricated using 3D-printed parts to minimize cost and allow rapid redesign. The compact structure (30 × 30 × 30 cm, bed size 15 × 15 cm) integrates motion along three Cartesian axes with functional spindle control and mesh bed leveling.

Key hardware components include NEMA 17 stepper motors with microstepping for high positional accuracy, the Genmitsu GS-775M spindle motor capable of speeds up to 12,000 RPM, and the BigTreeTech SKR Mini E3 V3.0 control board with integrated TMC2209 drivers for quiet and precise operation. A TFT43 touchscreen was employed as the user interface, providing real-time

monitoring and control. These components were selected for their affordability, wide availability, and proven reliability in CNC and 3D printing applications.

For software, Marlin open-source firmware was configured through Visual Studio Code to define axis steps, spindle parameters, and mesh bed leveling. PronterFace was used as the host interface for sending G-code, calibration, and machine testing. Together, the hardware and software integration ensured flexible control, iterative fine-tuning, and sustainable PCB milling performance.

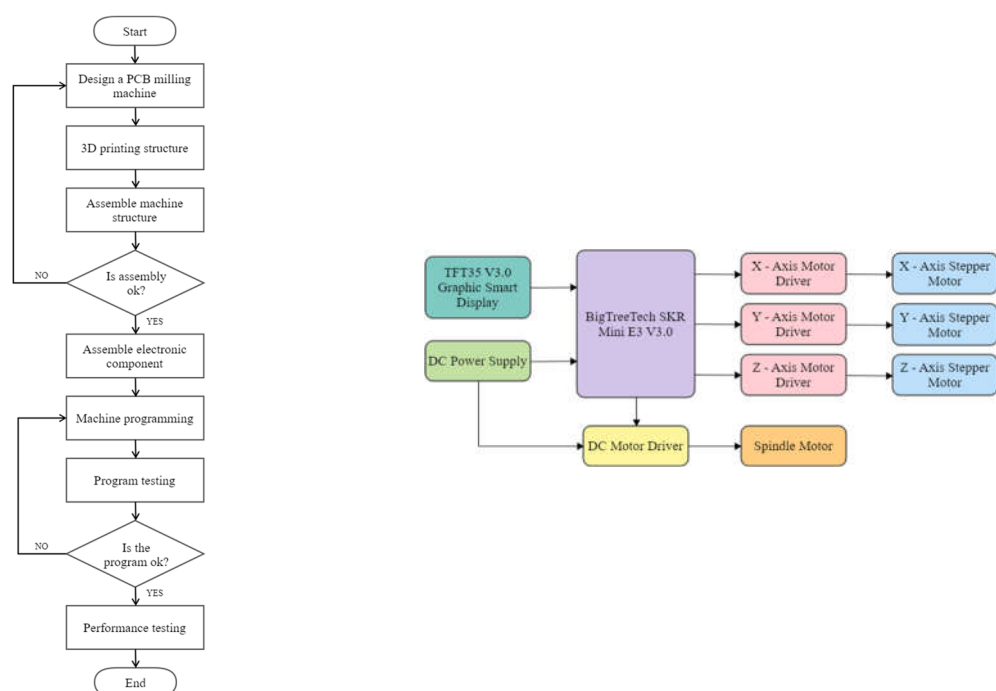


Figure 3.1: Flowchart and block diagram of the project design.

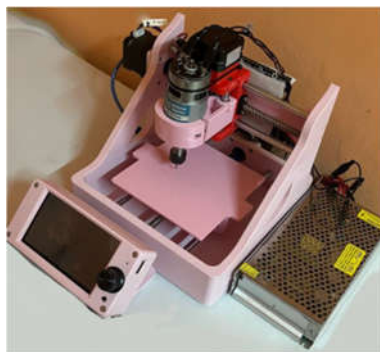
RESULTS AND DISCUSION

The prototype was successfully assembled using 3D-printed PLA components, a gantry-based structure, and linear rails, ensuring stability and smooth axis movement. The SKR Mini E3 V3.0 control board with TMC2209 drivers provided efficient motion control, while the TFT43 touchscreen enabled intuitive parameter adjustment.

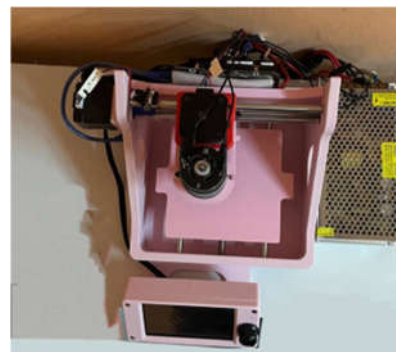
Performance testing validated the functionality of the main subsystems. The stepper motors demonstrated reliable operation with high positional accuracy, averaging $99.49\% \pm 0.1\%$ across both X and Y axes. Mesh bed leveling, implemented through manual calibration, improved surface uniformity and resulted in consistent milling depths, reducing rework and waste. The Genmitsu GS-

775M spindle motor operated smoothly up to 12,000 RPM, maintaining stable performance under light machining loads.

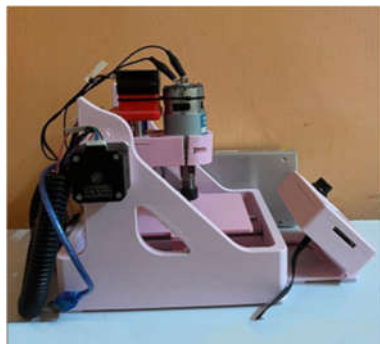
The integration of PronterFace software allowed direct G-code communication and calibration, complementing the touchscreen interface for flexible operation. Combined, these results confirm that the prototype achieves precise PCB prototyping with repeatable accuracy, supporting its suitability for sustainable, small-scale electronic fabrication.



(a)



(b)



(c)



(d)

Figure 4.1.: Machine design in (a) isometric, (b) top, (c) side, and (d) front view

Table 4.3.: Performance results of randomized X- and Y-Axis testing

Test	Result	Outcome
Stepper motor accuracy	99.49% $\pm$ 0.1%	Reliable axis precision
Mesh bed leveling	Uniform surface mapping	Improved cutting consistency
Spindle motor (GS-775M)	Up to 12,000 RPM, stable under load	Effective for PCB milling

CONCLUSION

The developed desktop PCB milling machine proved effective for prototyping, combining a compact 3D-printed structure with open-source hardware and software. Key components, including the SKR Mini E3 V3.0 control board, NEMA 17 stepper motors, GS-775M spindle motor, and TFT43 touchscreen, enabled reliable performance with high accuracy. Stepper motors achieved an average precision of **99.49% $\pm$ 0.1%**, while mesh bed leveling improved surface consistency and milling quality.

The system eliminates hazardous chemical etching, supports sustainable, low-waste fabrication, and provides a practical tool for education and small-scale innovation. Future work will focus on refining calibration methods and enhancing advanced features to further improve usability and performance.

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DysDetectV1: DYSLEXIA-DYSGRAPHIA SEVERITY CLASSIFICATION USING HANDWRITING IMAGE AND MACHINE LEARNING MODEL

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ABSTRACT

The existence of dyslexia-dysgraphia symptoms is assessed by a specialist or evaluator through observation of the candidate using prescribed techniques and a scoring system. Nonetheless, this methodology presents some limitations, including time consumption, the potential for activities to be incomplete, and ultimately, the risk of yielding biased outcomes. The growth of technology has significantly evolved ways for automatic dysgraphia detection, leading to a diversity of handwriting-based methodologies. Nevertheless, limited research highlights the detection of handwritten images using a handwritten image collection, particularly in the development of machine learning models. Therefore, this study introduces DysDetectV1, which is an innovative approach to classifying the severity of dyslexia-dysgraphia using handwritten samples. It uses Residual network feature extraction and a bagged tree model to classify the severity of dyslexia-dysgraphia levels. The model was then evaluated using a multi-class confusion matrix and represented accuracy, precision, and recall measurements. This research has the potential to enhance handwriting classification for individuals with dyslexia-dysgraphia by utilizing handwritten images and a machine learning model. This comprehensive approach is crucial for developing reliable tools that facilitate the early identification and support of children experiencing learning difficulties, in line with the overarching goal of improving educational outcomes. This research aligns with the primary objective of enhancing handwritten recognition for educational purposes, thereby fostering early childhood development in relation to SDG 4 (Quality Education).

Keywords: Dysgraphia, Dyslexia, Handwriting Disorder, Machine Learning, Convolutional Neural Network

INTRODUCTION

Dyslexia-Dysgraphia is a neurological learning disability that affects fine motor abilities and written expression. It frequently results in unreadable handwriting, irregular letter sizing, and poor spatial organization on paper (Chung et al., 2020). Children with dysgraphia often struggle in classrooms where handwriting is the major medium of communication and evaluation. Despite its impact on learning outcomes, dysgraphia is frequently underdiagnosed, especially in early school settings where traditional evaluation methods are time-consuming and may be biased due to human observation, which could overlook the criteria and errors (Biotteau et al., 2019).

Recent advances in artificial intelligence and computer vision have created new opportunities for spotting learning issues using image-based handwriting analysis. Handwriting images feature rich visual patterns that represent a child's motor coordination, pressure control, and letter constructional abilities, which are crucial in recognizing dysgraphia severity (Asselborn et al., 2018). This project describes an AI-based detection framework that uses handwriting images to diagnose dysgraphia in children. A Residual Network (ResNet) extracts sophisticated and discriminative visual properties from handwriting samples, including letter deformation, alignment irregularity, and spacing anomalies (Liao et al., 2025). These features are then classified using a Bagged Tree Ensemble model, which integrates multiple decision trees to increase classification accuracy and generalizability while lowering the risk of overfitting.

The proposed method is intended to be non-invasive, low-cost, and scalable, allowing educators and practitioners to assess children for dysgraphia based purely on handwriting. This immediately contributes to the Sustainable Development Goal 4 (SDG 4), which promotes inclusive and equitable quality education and supports early interventions for students with special needs.

METHODS

This study describes an approach for image-based classification of dysgraphia severity that uses Bagged Tree ensemble learning and features recovered from a Convolutional Neural Network (CNN) Residual Network. The approach stresses robust evaluation by K-Fold cross-validation, with k set to 3, ensuring reliable performance estimation despite the small sample size. The evaluation includes 136 handwriting images covering three severity levels, which are high-risk, moderate-risk, and low-risk. The handwriting images were collected from the Association of Dyslexia Malaysia (PDM), which involved 136 students aged six to twelve years old.

Figure 1 depicts the proposed automated system's architecture, which combines CNN-based feature extraction with ensemble classification. A Residual Network is modified to meet the input image dimensions and satisfy multiclass output needs, while capturing hierarchical visual cues important to handwriting impairments. The deep feature maps generated by the ResNet model are high-level abstractions of handwriting features like stroke irregularity, letter distortion, and spatial alignment. These extracted characteristics are then fed into a Bagged Tree classifier, which combines the

predictions of numerous decision trees trained on random subsets of the data to improve generalization and reduce model variance. The ensemble approach protects against overfitting while maximizing the discriminative ability of ResNet-extracted features for accurate classification.

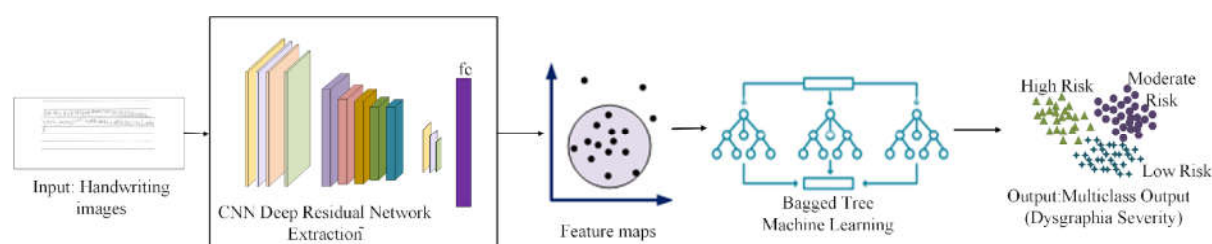


Figure 1.: The architecture of the automated classification level of dyslexia-dysgraphia severity

This study creates a dependable practical image classification system for dysgraphia detection by integrating deep learning and ensemble machine learning approaches. The addition of K-Fold cross-validation strengthens the model's performance stability and provides a realistic option for early detection of handwriting-related learning problems in educational settings.

RESULTS AND DISCUSSION

The proposed dysgraphia detection model achieved an outstanding overall accuracy of 92.65%, illustrating the effectiveness of combining deep feature extraction with a CNN Residual Network (ResNet-18) and a Bagged Tree Ensemble Classifier. As shown in Table 1, the system functioned consistently at all severity levels, with precision values of 96.88%, 91.29%, and 90.06%, and recall values of 92.52%, 91.38%, and 95.21% for the high, moderate, and low severity classes, respectively. The high severity class showed the best precision, demonstrating the model's superior ability to identify pronounced dysgraphic characteristics, whereas the low severity class produced the highest recall, highlighting its sensitivity in recognizing mild cases, which is an important aspect for early screening. The balanced performance in the moderate class adds to the model's robustness. These findings demonstrate that, even with a small dataset, the combination of residual learning and ensemble approaches provides a robust and reliable methodology for multiclass dysgraphia severity classification. The addition of K-Fold cross-validation improves the model's generalizability and stability, making it a viable tool for detecting handwriting-related learning issues in educational settings.

Table 1.: Classification performance for each class

Severity Classes	Precision (%)	Recall (%)
high	96.88	92.52
moderate	91.29	91.38
low	90.06	95.21

CONCLUSION

In conclusion, this innovative system successfully demonstrates the effectiveness of automated feature extraction from handwriting images in classifying the severity levels of dyslexia-dysgraphia. The findings highlight its potential to significantly enhance the screening methods, enabling early detection, timely intervention, and targeted support for affected individuals. Overall, the automated extraction approach has proven effective in assessing dysgraphia severity and may also indirectly contribute to the identification of dyslexia-dysgraphia.

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e-MANUAL INTERAKTIF BAHASA ARAB: BANGUN PASUKAN, BINA BAHASA

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ABSTRAK

Projek inovasi ini mengetengahkan pembangunan e-Manual Interaktif Aktiviti Bahasa Arab yang dibangunkan melalui platform digital Padlet, sebagai satu inisiatif kreatif dan kontemporari dalam usaha memperkukuh semangat berpasukan serta memperkasakan penguasaan bahasa Arab dalam kalangan ahli persatuan bahasa. Pendekatan yang digunakan berteraskan pembelajaran santai, menyeronokkan dan interaktif melalui konsep game-based learning, sekali gus menjadikan proses pengajaran dan pembelajaran lebih menarik dan relevan kepada generasi pelajar masa kini. E-manual ini menghimpunkan empat aktiviti utama yang dirancang secara sistematik dengan objektif membina dan mengukuhkan kemahiran insaniah seperti komunikasi berkesan, kepimpinan, kreativiti, fokus serta semangat kerja berpasukan. Setiap aktiviti telah disusun agar peserta dapat berinteraksi dalam bahasa sasaran, iaitu bahasa Arab, secara aktif melalui tugas berkumpulan, arahan dalam bahasa sasaran, serta elemen cabaran dan kerjasama. Penggunaan Padlet sebagai medium utama membolehkan penyampaian bahan dalam bentuk visual dan interaktif seperti panduan aktiviti, video demonstrasi, gambar interaksi peserta, ruangan maklum balas dan refleksi pelajar. Ciri mesra pengguna Padlet turut membolehkan akses yang mudah dan fleksibel oleh fasilitator dan peserta dari pelbagai peranti. Secara keseluruhannya, inovasi ini bukan sahaja menyemarakkan minat terhadap bahasa Arab, malah mewujudkan satu bentuk latihan sosial dan bahasa yang holistik dan inklusif terhadap keperluan pembelajaran abad ke-21. Ia berpotensi untuk menjadi model rujukan dalam penganjuran aktiviti berimpak tinggi oleh persatuan bahasa secara berstruktur dan berkesan.

Kata kunci: Team building; Permainan bahasa Arab; E-manual interaktif; Kemahiran insaniah

PENGENALAN

Program persatuan di universiti, khususnya kelab dan aktiviti luar kelas, berperanan penting dalam perkembangan holistik pelajar melalui pembangunan kemahiran kepimpinan, komunikasi, jaringan sosial dan persediaan kerjaya (Johnson & Schall, 2022; Md Rashid et al., 2024). Kajian terdahulu menunjukkan penglibatan aktif dalam persatuan meningkatkan keyakinan diri, kecekapan komunikasi dan kerja berpasukan (Adams & Lee, 2022; Edwards & Muir, 2023; Thompson & Green, 2022).

Dalam konteks pengajaran bahasa Arab di IPT, pendekatan konvensional masih kurang menekankan elemen interaktif, pengalaman sebenar dan kemahiran insaniah. Aktiviti persatuan berteraskan bahasa juga kekurangan modul latihan yang menyeronokkan serta menyokong pembelajaran secara kontekstual. Justeru, kajian ini membangunkan **e-Manual Interaktif Aktiviti Bahasa Arab** menggunakan Padlet, yang menggabungkan *game-based learning*, kemahiran insaniah dan penguasaan bahasa Arab melalui aktiviti dinamik khusus untuk ahli persatuan bahasa.

Manual ini menggunakan bahasa Arab sebagai medium utama, selari dengan prinsip PAK-21 yang menekankan komunikasi, kolaborasi, kreativiti dan pemikiran kritikal. Aktiviti permainan direka untuk mengasah kemahiran qira'ah, kitabah, istima' dan kalam, dengan fokus pada mendengar dan bertutur. Penggunaan gamifikasi, seperti Model MDA (Mechanics, Dynamics, Aesthetics), membantu menjadikan pembelajaran lebih sistematik, menyeronokkan dan berkesan (Ramlan et al., 2018).

METODOLOGI KAJIAN

Pembentukan dan penyusunan e-manual ini menggunakan pendekatan **Model Reka Bentuk Instruksional ADDIE** yang mencakupi fasa-fasa analisis (Analysis), reka bentuk (Design), pembangunan (Development), pelaksanaan (Implementation) dan penilaian (Evaluation) (Chang L. & Mohamad Jafre, 2024). Model ADDIE ialah model reka bentuk yang berperanan sebagai garis panduan dalam rangka pembinaan perisian dan bahan pengajaran dan pembelajaran yang berdasarkan keperluan. Pendekatan ini dipilih kerana kesesuaiannya dalam menghasilkan modul latihan yang berstruktur dan mudah untuk diadaptasi sekaligus menghasilkan penyampaian pengajaran menjadi lebih efektif dan efisien. Kajian ini juga menggunakan kaedah tinjauan bagi mendapatkan maklum balas aktiviti permainan yang dijalankan. Instrumen kajian yang digunakan ialah borang soal selidik yang dibangunkan melalui *google form*. Data yang diperoleh dianalisis secara deskriptif menggunakan peratusan.

2.1 Analisis Keperluan

Dapatan awal diperoleh melalui tinjauan dalam kalangan ahli Persatuan Bahasa Arab Universiti Teknologi Mara (UiTM) Cawangan Negeri Sembilan Kampus Kuala Pilah mengenai keperluan latihan berkumpulan yang menyeronokkan, interaktif dan berkonsepkan bahasa. Hasil yang diperolehi menunjukkan bahawa sebahagian besar pelajar lebih gemar aktiviti di luar kelas yang tidak bersifat peperiksaan (pentaksiran) dan serius namun masih menyokong penggunaan bahasa secara praktikal.

2.2 Reka Bentuk & Pembangunan

Berdasarkan analisis tersebut, empat aktiviti utama dirancang:

Jadual 1.: Aktiviti permainan yang dirancang

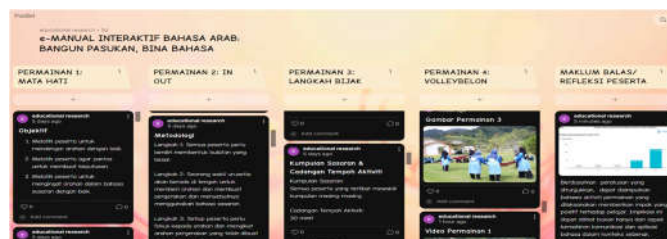
Bil.	Nama Aktiviti	Penerangan
1.	Mata Hati	Aktiviti ini bertujuan untuk melatih kemahiran mendengar arahan dan membina perkataan dalam bahasa Arab yang disusun menggunakan huruf-huruf yang diperolehi oleh pelajar.
2.	In Out	Aktiviti ini melatih pelajar fokus dan cekap untuk melakukan pergerakan berdasarkan arahan yang menggunakan kosa kata daripada kategori kata arah dalam bahasa Arab.
3.	Langkah Bijak	Aktiviti fizikal menggunakan belon yang berwarna-warni untuk menyerang kumpulan lawan, sambil mempraktikkan kosa kata warna dalam bahasa Arab.
4.	Volleybelon	Aktiviti permainan belon berisi air yang menggabungkan aktiviti soal jawab secara umum berkaitan kosa kata, tatabahasa dan terjemahan dalam bahasa Arab secara berkumpulan dalam suasana kompetitif, menarik dan menghiburkan.

Kajian ini telah memilih empat aktiviti permainan. Setiap aktiviti permainan boleh diubah suai mengikut tema, tahap (asas, pertengahan, lanjutan), serta keperluan pelajar. Aktiviti perlu merangkumi empat kemahiran bahasa Arab iaitu membaca (qira'ah), bertutur (kalām), menulis (kitābah) dan mendengar (istimā'). Selain menguasai bahasa, aktiviti ini juga menerapkan kemahiran insaniah seperti kepimpinan, kerja berpasukan, kreativiti, pengurusan masa dan komunikasi. Panduan pelaksanaan disediakan dalam bentuk teks dan video di Padlet, dengan ruangan refleksi serta hasil kerja untuk interaksi peserta dan fasilitator.

2.3 Pelaksanaan

Semua aktiviti permainan dilaksanakan dalam satu program *team building* oleh Persatuan Bahasa Arab UiTM Cawangan Negeri Sembilan Kampus Kuala Pilah yang melibatkan seramai 40 peserta dan 2 orang fasilitator merangkap penasihat persatuan bahasa. Program tersebut telah dinamakan sebagai *PBA Bonding Bliss*. Para peserta telah dibahagikan kepada beberapa kumpulan kecil dan melaksanakan empat aktiviti permainan tersebut secara bergilir. Fasilitator berperanan sebagai pemudah cara dan

menjadi penilai refleksi pelajar. Pautan ke e-Manual:<https://padlet.com/eduresn9/e-manual-interaktif-bahasa-arab-bangun-pasukan-bina-bahasa-xveh01owlongip49>



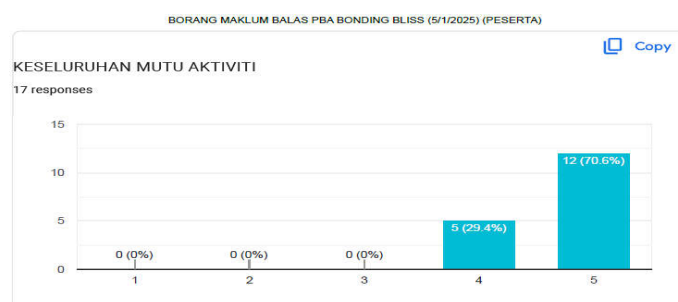
Rajah 1.: e-Manual Interaktif Bahasa Arab: Bangun Pasukan, Bina Bahasa

2.4 Penilaian

Fasa terakhir ialah penilaian untuk memastikan keberkesanan aktiviti permainan dalam pembelajaran bahasa Arab melalui refleksi peserta dan pemerhatian fasilitator. Penilaian dilaksanakan secara formatif pada setiap fasa ADDIE (termasuk analisis keperluan pelajar dan reka bentuk aktiviti berasaskan bahasa Arab) serta secara sumatif melalui borang maklum balas selepas pelaksanaan. Hasil penilaian digunakan bagi penambahbaikan dan maklum balas kepada pengguna.

DAPATAN DAN PERBINCANGAN

Hasil daripada borang maklum balas yang telah diberikan kepada pelajar yang menyertai aktiviti permainan ini menunjukkan dapatan yang positif. Berikut merupakan perbincangan hasil data yang telah diperolehi.



Rajah 2.: Maklum balas keseluruhan aktiviti permainan

Rajah 2 menunjukkan skala likert yang digunakan adalah 5 mata penilaian melibatkan sangat tidak setuju (1), tidak setuju (2), sederhana setuju (3), setuju (4), dan sangat setuju (5). Berdasarkan rajah tersebut, semua pelajar memberikan respon yang positif melibatkan respon sederhana setuju, setuju, dan sangat setuju. Perincian maklum balas pelajar terhadap keberkesanan aktiviti permainan ini dapat dilihat dalam Jadual 2 berikut:

Jadual 2.: Soalan maklum balas peserta

No.	SOALAN MAKLUM BALAS	Sederhana Setuju	Setuju	Sangat Setuju
S1.	Saya boleh mengenal pasti dan menganalisis masalah dalam situasi kompleks, serta membuat penilaian yang berjustifikasi.	5.9%	35.3%	58.8%
S2.	Saya berkebolehan mengembangkan kemahiran berfikir seperti menjelaskan, menganalisis dan menilai perbincangan.	-	41.2%	58.8%
S3.	Saya berkebolehan menyampaikan idea dengan jelas, berkesan dan yakin, secara lisan dan bertulis.	5.9%	29.4%	64.7%
S4.	Saya berkebolehan mengamalkan kemahiran mendengar yang aktif dan memberi maklum balas.	-	29.4%	70.6%
S5.	Saya berkebolehan membuat pembentangan secara jelas dengan penuh keyakinan dan bersesuaian dengan tahap pendengar.	5.9%	35.3%	58.8%
S6.	Saya berkebolehan membina hubungan baik, berinteraksi dengan orang lain dan bekerja secara efektif bersama mereka untuk mencapai objektif yang sama.	-	23.5%	76.5%
S7.	Saya berkebolehan memahami dan mengambil peranan bersilih ganti antara ketua kumpulan dan ahli kumpulan.	5.9%	29.4%	64.7%
S8.	Saya berkebolehan memahami kesan ekonomi, alam sekitar dan sosiobudaya dalam amalan profesional.	-	41.2%	58.8%
S9.	Saya berkebolehan menganalisis dan membuat keputusan dalam menyelesaikan masalah berkaitan etika.	-	35.3%	64.7%
S10.	Saya berkebolehan mencari dan mengurus maklumat yang relevan daripada pelbagai sumber.	-	41.2%	58.8%
S11.	Saya berpengetahuan tentang teori asas kepimpinan.	-	29.4%	70.6%
S12.	Saya berkebolehan untuk memimpin projek.	5.9%	41.2%	52.9%

Berdasarkan peratusan yang ditunjukkan dalam Jadual 2, dapat disimpulkan bahawa aktiviti permainan yang dilaksanakan memberikan impak yang positif terhadap pelajar. Implikasi ini dapat dilihat bukan hanya dari aspek kemahiran komunikasi dan aplikasi bahasa dalam konteks sebenar, malah dari aspek kemahiran berfikir secara kritis, pembangunan kemahiran insaniah, kemahiran kepimpinan dan

kerjasama kumpulan serta elemen keseronokan dan persaingan yang sihat dalam proses pembelajaran bahasa.

KESIMPULAN

e-Manual Interaktif ini terbukti sebagai salah satu inovasi yang mengintegrasikan pembelajaran bahasa dengan kemahiran insaniah melalui pendekatan santai, kolaboratif dan kontekstual. Gabungan aktiviti permainan secara fizikal dan elemen bahasa dalam platform digital mewujudkan proses pengajaran dan pembelajaran lebih mesra pelajar, menyeronokkan dan efektif. Ia bukan sahaja boleh mengukuhkan penguasaan bahasa Arab dalam kalangan pelajar, tetapi juga membina pasukan persatuan bahasa yang lebih kuat dan bersatu hati. Kekuatan e-manual ini terletak pada kebolehannya untuk diadaptasi dan diubah mengikut pelbagai bahasa, konteks, tema dan tahap penguasaan pelajar. Ia sesuai digunakan dan diaplikasikan oleh pensyarah, guru, fasilitator, organisasi atau pelajar untuk pelbagai tujuan seperti aktiviti pengukuhan dan penguasaan bahasa atau program seperti induksi dan latihan kepimpinan. Projek ini berpotensi untuk dikembangkan ke peringkat yang lebih luas sebagai salah satu model modul intervensi bahasa Arab, rujukan kepada tenaga pengajar bahasa Arab, digunakan sebagai bahan modul bagi program CSR di sekolah rendah dan menengah atau dijadikan sebahagian daripada pengisian ko-kurikulum pelajar bahasa Arab.

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ENHANCING UNIVERSITY BUILDING PERFORMANCE: A METHODOLOGY TO INVESTIGATE MAINTENANCE AND OPERATIONAL CONDITIONS

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ABSTRACT

Maintaining decaying and aging educational buildings and multi-effects of inflation to maintenance cost are complex issues. The connection between quality education and building operational performance is of paramount importance to shape a well-developed educational system in the universities. Commentators asserted that the traditional maintenance procurement practice focuses on reactive maintenance, however little emphasis is given to optimize the long-term in-use costs that have to be paid to prolong the educational building service life. These papers and videos are prepared to present a designed methodology to investigate maintenance condition and operational performance of an education building for teaching and learning in one of the higher educational institutions in Malaysia with the objective to develop a prototype of life cycle cost (LCC) database requirements for a sustainable facilities management system of educational buildings. A qualitative research strategy is proposed for the study encompasses three fieldwork approaches, i.e., semi-structured interview, building condition assessment (BCA), and quick response codes (QR). The designed methodology is expected to serve as a foundational input for carrying out a comprehensive study in the development of prototype of database requirements for life cycle cost analysis of maintenance of education buildings for teaching and learning in the university. The study findings yielded from the proposed methodology is of paramount significance that would add value for improvement of life cycle cost practices in the facilities maintenance management system of the university to be in line with the key drivers of Malaysian Science, Technology, Innovation, and Economy (MySTIE) framework.

Keywords: Methodology, University building, Maintenance, Life cycle cost

INTRODUCTION

Education buildings are important assets in the universities for teaching and learning activities but have become very complex to be maintained at the optimum cost as the in-use costs were normally ignored and calculated separately from design and construction costs during the early phases of the projects. Commentators pointed out that there has been a critical demand to relook the present practice of university building maintenance methodology by giving greater emphasis on the optimization of maintenance cost and long-term financial capability in paying maintenance cost based on the efficient use of capital and resources throughout the service life. Therefore, these paper and video are prepared to present a designed methodology to investigate the maintenance condition and operational performance of an education building for teaching and learning in one of the higher educational institutions in Malaysia with the objective to develop a prototype of life cycle cost (LCC) database requirements for sustainable facilities management system of educational building. Life Cycle Cost (LCC) is an economic assessment technique that can estimate all costs associated with the ownership of the building from cradle to grave, which includes the initial capital costs, financial costs, operation costs, maintenance and replacement costs, and the salvage costs throughout anticipated life span (Davis Langdon Management Consulting, 2007; BS ISO 15686-5, 2008; Langdon, 2010).

METHODOLOGY

To achieve the study aim, a qualitative research strategy is proposed as the chosen methodology designed for the study because it is more suitable rather than quantitative and mixed methods research strategies for procuring data of LCC that is subjective, profound and limited in nature, which requires supplementary analysis and interpretation on the meanings, definitions, characteristics, experiences, descriptions, thoughts and emotions from the respondents' feedback (Pawar, 2020). The qualitative research strategy is designed to incorporate three fieldwork approaches, i.e., semi-structured interview, building condition assessment (BCA), and quick response (QR) codes to achieve the expected findings as illustrated in Figure 1 below. A triangular primary data collection is designed to investigate the operational performance and maintenance condition of teaching and learning facilities in the chosen university building case study.

Triangular Primary Data Collection Approaches

1. BUILDING CONDITION ASSESSMENT (BCA)	2. SEMI- STRUCTURED INTERVIEW	3. QUICK RESPONSE CODE (QR CODE)
Data collection and analysis: It involves visual inspection with appropriate rating instruments of Likert score, based on the degrees of defect and degrees of priority repair. The collected data is analysed by using Matrix technique. Expected findings: To provide useful input for the remedy planning and strategies that can be prioritized according to the maintenance needs and optimum life cycle cost of maintenance based the severity of faults or defects found.	Data collection and analysis: Two rounds of interview are implemented. The 1st round of interview is conducted to analyse feedback of respondents to each question. The 2nd round of interview is conducted to require each respondent to validate the outcome of the 1st round interview based on the mean and standard deviation group scores versus the individual scores. Expected findings: To provide consensuses of opinions on the operational performance and maintenance condition, the issues and influencing factors, and the improvement strategies that can help to prioritize the maintenance needs and plan for remedy repair based on the efficient use of resources for achieving optimum life cycle cost of maintenance.	Data collection and analysis: The digitalized complain report data presents any defects or issues that arise by reporters/complainers on the operational problem of teaching and learning facilities Expected findings: Collected maintenance complaints and reports from building users that include basic information like contact info, defect location, dates of the new and previous reports, and photos taking as proofs to support the submission of complaint report that that can help to prioritize the maintenance needs and plan for immediate remedy repair to achieve optimum life cycle cost of maintenance.

Figure 1.: The proposed research approaches designed for the methodology of study

An education building in one of the higher educational institutions in Malaysia is chosen as a subject of the case study because plenty of issues have been reported by the end-user community on the decaying of teaching and learning facilities in the education building. Indeed, there has been a very limited study carried out to identify the maintenance condition and operational performance on the subject case study. Hence, it is a critical demand for the study to relook the maintenance methodology presently implemented in the selected building case study by giving emphasis on the optimization of maintenance life cycle cost. The study is expected to provide useful input that can facilitate the university and maintenance agencies for the remedy planning and strategies that can be prioritized according to the maintenance needs and optimum life cycle cost based on the efficient use of capital

and resources, and could enhance the university's core services, aligning with two key drivers of the Malaysian Science, Technology, Innovation, and Economy (MySTIE) Framework—namely, augmented analytics and data discovery (science and technology driver) and education (socio-economic driver) (Academy of Sciences Malaysia, 2020).

CONCLUSION

A methodology is designed and proposed for the study to investigate the university building maintenance condition and operational performance as inputs for the development of a prototype of life cycle cost (LCC) database requirements for sustainable facilities management system of educational buildings. The literature study has established that there are very limited studies reported on the methodology to investigate the university building maintenance condition and operational performance with specific reference to the life cycle cost (LCC) of maintenance. Hence, the qualitative research strategy has been proposed as the methodology designed for the study to procure data of LCC that is subjective, profound, and limited in nature. The qualitative research strategy is incorporated with a triangular primary data collection, i.e., the semi-structured interview, building condition assessment (BCA), and quick response (QR) codes to collect comprehensive firsthand data that can facilitate the facilities management practitioners to produce a thorough and trustworthy LCC analysis of maintenance in achieving cost-effectiveness and value for money maintenance management decision making.

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FRAME BY FRAME: EMPOWERING ESL LEARNERS THROUGH VISUAL WRITING

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ABSTRACT

This study explores the use of storyboard templates as a visual learning tool to support ESL students in writing the CEFR-aligned PT3 English Essay (Part 1). Storyboarding allows students to visualize, plan, and organize their ideas in sequence, helping them write with greater confidence, creativity, and clarity. Rooted in cognitive and constructivist learning theories, and aligned with the multiliteracies approach, the method promotes student-centered, multimodal engagement. A qualitative research design was employed using semi-structured interviews to investigate students' perceptions and the impact of storyboard use on their writing process. Thematic analysis of the data revealed three major themes: (1) improved writing skills in terms of structure and fluency, (2) enhanced confidence and time management, and (3) mixed reactions toward the fixed visuals and limited writing space. While many students appreciated the storyboard's guidance, others expressed a desire for more creative freedom. Nevertheless, most acknowledged its usefulness in supporting idea development and essay planning. Some students even recommended its application in other subjects, such as Malay Language and History. This research highlights the pedagogical value of visual tools in language instruction and suggests that storyboarding offers a practical, accessible shift from traditional text-heavy approaches to a more engaging, student-focused writing model.

Keywords: *ESL writing, storyboard technique, CEFR PT3, visual literacy, student perspectives*

INTRODUCTION

Writing is widely regarded as the most challenging of the four language skills for English as a Second Language (ESL) learners in Malaysia. It demands not only linguistic accuracy but also the ability to generate, organize, and express ideas clearly. Despite years of English instruction, many secondary school students continue to struggle, particularly with the CEFR-aligned PT3 Essay Part 1, which tests narrative and descriptive writing (Alih et al., 2021). Among the contributing factors are limited vocabulary, weak grammatical knowledge, and a lack of effective writing strategies (Fareed et al., 2016). To address this challenge, this study introduces the storyboard technique, a visual-based learning strategy designed to support idea generation and organization through sequenced images.

Storyboards offer a multimodal approach that helps learners translate visual cues into structured written narratives, making writing more accessible, engaging, and less intimidating (Hasan & Wijaya, 2016; Shabiralyani et al., 2015). This method aligns with cognitive and constructivist learning theories, which emphasize the importance of activating prior knowledge and constructing meaning through learner-centered activities (Smeda et al., 2014).

The existing literature highlights the persistent nature of ESL writing difficulties and identifies several strategies that have shown promise in improving writing performance. Techniques such as brainwriting (Yulianti et al., 2019), Language Learning Strategies (LLS) (Kakoty, 2020), and visual aids (Sakkir, 2020) have been found effective in enhancing both learner engagement and writing outcomes. In particular, visual strategies like storyboarding have demonstrated the potential to increase students' motivation, support vocabulary development, and improve overall writing fluency (Gutiérrez et al., 2015). Research shows that storyboarding fosters critical thinking, creativity, and collaboration, especially among learners in rural or low-proficiency contexts where exposure to English is limited (Gobel et al., 2013; Ler, 2012). Studies also confirm that the technique enhances syntactic complexity, writing confidence, and classroom participation, compared to more traditional, text-heavy instructional methods (Uematsu, 2012). Moreover, storyboarding allows for differentiated learning experiences, making it suitable for students with varied learning styles and needs.

In this study, a qualitative approach was employed to explore ESL students' perceptions and experiences with the storyboard technique. Semi-structured interviews were conducted with selected students to examine the impact of using storyboard templates in writing CEFR PT3 Essay Part 1. The data were analyzed thematically to identify recurring patterns, benefits, and challenges associated with this strategy. This research aims to contribute to the growing body of evidence supporting multimodal learning tools in ESL education. While the findings are based on a small sample and limited geographic context, they are expected to offer valuable insights for educators seeking more effective, student-centered approaches to teaching writing. By exploring how storyboards influence students' writing processes and confidence, the study highlights the potential of visual-based instruction to transform the ESL writing classroom and bridge the gap between visual thinking and textual expression.

METHODS

This qualitative study was conducted at a secondary school in Kulai, Johor, Malaysia, where Malay is the primary medium of instruction. English is taught five times per week, with two periods allocated specifically for CEFR PT3 writing lessons. The focus of the writing assessment is divided into two parts, aligned with A2 and B1 CEFR levels. Purposive sampling was used to select three ESL students from Form 2 Camar based on their writing proficiency levels, as measured by their CEFR PT3 Essay Part 1 scores in a recent school assessment (UPK1). The selected participants represented A2 to B1 proficiency levels, ensuring relevance to the research objective of exploring perceptions and impacts of storyboard use in writing instruction. Semi-structured interviews served as the main data collection tool, allowing flexibility in question delivery while maintaining consistency across respondents. Each participant was interviewed individually for approximately 25–30 minutes after school, with parental and school consent. A total of 31 interview questions were prepared, categorized under five themes:

introduction, perceptions of storyboard use, impacts on writing performance, challenges, and conclusion. The data were analyzed using thematic analysis, involving segmentation, categorization, and relinking of interview transcripts to identify recurring themes and patterns. Initial themes were drawn from the interview structure and refined through multiple readings of the transcriptions. Ethical procedures were strictly followed. Participants were informed of the study's purpose, ensured confidentiality, and provided written consent. Participation was voluntary, and respondents retained the right to withdraw at any point. Interview recordings were securely stored and used solely for research purposes. This methodology aimed to gain meaningful insights into the effects of storyboard techniques on ESL learners' writing proficiency within a real classroom context.

RESULTS AND DISCUSSION

This study explored ESL students' perceptions and the impact of using the storyboard technique to enhance their writing proficiency in CEFR PT3 Essay Part 1. Through semi-structured interviews with three students, several key themes emerged, reflecting both the benefits and challenges of implementing storyboard-based writing instruction. All participants initially identified writing as the most difficult English language skill due to grammar issues, limited vocabulary, and difficulty in generating ideas. However, their perceptions shifted positively after being introduced to the storyboard. Students reported that the visual prompts helped them understand essay structure more clearly, organize their thoughts, and manage their time more effectively during writing tasks. The use of pictures as a visual guide was particularly helpful in reducing planning time and building confidence, especially in a high-stakes writing context. The visual prompts helped them better understand essay structure, organize ideas, and manage their writing time more effectively—especially for CEFR Part 1. These results align with previous research highlighting the effectiveness of visual aids in enhancing comprehension and writing performance (Hasan & Wijaya, 2016; Gutiérrez et al., 2015).

Despite these positive effects, the students also expressed certain limitations. One recurring concern was the restricted writing space provided in the storyboard template, which limited their ability to elaborate or expand on their ideas. Moreover, some students felt creatively constrained when their own ideas did not align with the sequence or content of the storyboard images. Additionally, unfamiliar or unclear pictures posed further challenges, especially for students with limited vocabulary who struggled to describe the visuals in English. These difficulties were compounded by their tendency to translate from Malay to English, leading to further hesitation or confusion during the writing process.

The impacts of using storyboards in the ESL classroom were categorized into three areas: advantages, disadvantages, and challenges. Among the advantages, students showed improvement in writing structure, idea development, and overall engagement. They appreciated how the visuals provided direction and helped them stay focused. The disadvantages, however, stemmed from the lack of flexibility in idea expression and the difficulty in interpreting certain visuals, which sometimes hindered the writing process. Challenges were primarily related to the physical constraints of the template (e.g., limited space) and the need for clearer, culturally relevant images to ensure comprehension.

In summary, the storyboard technique was perceived as both a supportive and restrictive tool. It helped students write more efficiently and with clearer structure, but it also limited creativity when the visuals or format did not match students' intended content. The study concludes that while storyboard is a useful instructional tool for improving ESL writing, its effectiveness depends significantly on thoughtful implementation—particularly in the selection of visuals and the design of the template. Students suggested extending storyboard use to other parts of the English exam, and even to subjects like Bahasa Melayu and History, where visual prompts could similarly aid comprehension and idea development- suggesting cross-disciplinary benefits (Martikainen, 2017).

CONCLUSION

This study examined ESL students' perceptions and the impact of using storyboard techniques for writing CEFR PT3 Essay Part 1. The findings revealed both positive and negative responses. Students found storyboards helpful for organizing ideas, understanding essay structure, and improving time management. The visuals acted as a guide, allowing them to generate ideas more easily and focus their writing efforts. These results support prior studies that show visual aids enhance comprehension and writing fluency by providing a clear and engaging structure. However, limitations were also noted. Students expressed frustration with the restricted writing space in the storyboard template and the lack of freedom to express personal ideas. Some felt constrained when their thoughts did not align with the pictures, and unfamiliar visuals made it difficult to find the right words due to limited vocabulary. These challenges align with previous research indicating that a lack of vocabulary and inappropriate image selection can impede writing performance.

Despite these drawbacks, students were optimistic about the method's broader application. They suggested that storyboards could benefit not only English classes but also subjects like Malay Language and History. The study demonstrates that integrating visuals can enhance student engagement, creativity, and narrative skills across subjects. This research contributes to a growing body of literature advocating for multimodal learning. It encourages educators to shift from traditional instruction to visual-based approaches that are more inclusive and engaging, particularly for ESL learners. For future research, it is recommended to extend the use of storyboard techniques to CEFR Essay Part 2, which involves more complex writing tasks. Expanding the scope would help explore how visual strategies can support students in navigating higher-level composition and overcome challenges in other academic contexts.

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GAMIFYING SUSTAINABILITY: CREATING AN APP TO PROMOTE SDG PRACTICES AMONG STUDENTS

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ABSTRACT

Despite widespread awareness of the United Nations' Sustainable Development Goals (SDGs) among students, with 92% of surveyed students demonstrating familiarity, a disconnect remains between knowledge and consistent sustainable practices. This project addresses this gap through an innovative gamified mobile app designed to transform SDG education into an engaging, habit-forming experience. Building on survey results showing that 89% of students favour gamified learning, the app employs behavioural psychology principles through daily challenges with progress tracking, AR mini-games, social leaderboards, and real-world impact dashboards to incentivise sustainable actions such as recycling and energy conservation. By merging education with interactive gameplay, the initiative aims to increase student engagement with SDGs by 50% while fostering measurable behaviour change. Future development plans include school partnerships for curriculum integration, amplifying the app's potential to redefine sustainability education as a dynamic, student-driven process that empowers youth as active change agents for a sustainable future, perfectly aligning with the competition's theme of 'Transforming Education.'

Keywords: Sustainable Development Goals, Mobile app, Student engagement

INTRODUCTION

Awareness of the Sustainable Development Goals (SDGs) among youth is a crucial foundation for fostering a generation committed to sustainability. The SDGs, launched by the United Nations in 2015, aim to address demanding global issues such as poverty, climate change, and inequality. These 17 interconnected goals provide a universal framework for sustainable development, emphasising the urgent need for collective action across all sectors of society. Youth, as future leaders and innovators, represent a critical demographic whose understanding and internalisation of these goals are important

for achieving the 2030 Agenda. However, understanding and internalising these goals require thoughtful engagement mechanisms, particularly among youth populations.

Despite a growing global discourse around sustainability, a significant challenge continues where many students are aware of sustainability concepts but lack practical engagement with the SDGs (Maoela et al., 2024; Yuan et al., 2021). Traditional educational methods, often relying on lectures and textbooks, have proven insufficient in driving the behavioural change necessary for adopting sustainable practices (Espino-Díaz et al., 2025; Ribeiro et al., 2023). This leads to a disconnect between theoretical knowledge and actionable habits. Furthermore, there is a significant lack of personalised, interactive tools that effectively encourage students to integrate sustainable habits into their daily lives (Rivera, 2025; Yaacob et al., 2024). Our survey results indicate that while 92% of students are familiar with SDGs and sustainability practices, there is a clear demand for more engaging approaches, with 89% expressing interest in an app that makes sustainability fun and rewarding.

Existing solutions primarily encompass awareness campaigns, workshops, and theoretical lessons on sustainability. While these initiatives are valuable for disseminating information, they often fall short in fostering sustained engagement and translating knowledge into consistent behavioural change. Although some mobile applications exist in the sustainability space, most tend to focus on information delivery rather than incorporating gamified engagement and habit-building mechanics. This project addresses this critical gap by proposing a novel approach that combines gamification and behavioural nudges to make learning about and practicing sustainability both fun and actionable. Our solution aims to foster community-driven challenges, encouraging peer participation, and providing real-world impact tracking to demonstrate to students that their contributions matter.

The primary objective of this project is to design, develop, and evaluate a gamified mobile application aimed at enhancing students' knowledge of the SDGs and promoting their active engagement in SDG-aligned practices. Specifically, the app seeks to: 1) raise awareness of SDGs through interactive quizzes, mini-games, and augmented reality (AR) experiences; 2) promote sustainable habits via daily challenges and rewards; 3) encourage participation in local sustainability initiatives; and 4) foster a sense of responsibility by tracking both individual and collective impact.

The significance of this project lies in its potential to enhance sustainable education by transforming abstract sustainability concepts into tangible, rewarding experiences. By leveraging the pervasive nature of mobile technology and the inherent appeal of gamification, this app can foster responsible citizenship and catalyse a shift towards more sustainable behaviours among the youth. The expected short-term impact includes increased engagement with SDG topics, while the long-term goal is to drive concrete behaviour change, ultimately leading to more sustainable campus communities and beyond. In essence, this mobile application will transform daily sustainable actions into engaging challenges, rewarding users for their participation and demonstrating their collective impact on global goals.

METHODS

This study employed a quantitative research design to investigate the effectiveness of a gamified mobile application in promoting Sustainable Development Goal (SDG) practices among students. The target audience comprised youth, specifically university students, who were digitally native and represented a crucial demographic for fostering sustainable habits. A convenience sampling technique was utilised to recruit participants for data collection. Primary data was gathered through an online survey, designed using Google Forms, and widely distributed via university WhatsApp groups to ensure a broad reach within the target population. This survey assessed students' current awareness, knowledge, and attitudes towards SDGs, as well as their existing sustainable habits.

RESULTS AND DISCUSSION

The preliminary data collected from 49 student respondents provided crucial insights into their awareness of Sustainable Development Goals (SDGs) and their receptiveness to gamified approaches for promoting sustainable practices.

Table 1. The level of familiarity with SDGs

Level of familiarity	Percentage
Very familiar	44.9%
Somewhat familiar	46.9%
Not familiar at all.	8.2%

Table 1 revealed a high level of familiarity with SDGs and the general concept of sustainability, with 92% of respondents indicating familiarity. Specifically, 44.9% reported being "Very familiar" and 46.9% "Somewhat familiar" with the SDGs, confirming a foundational awareness among the youth demographic. However, this awareness did not consistently translate into widespread practical engagement across all sustainable habits.

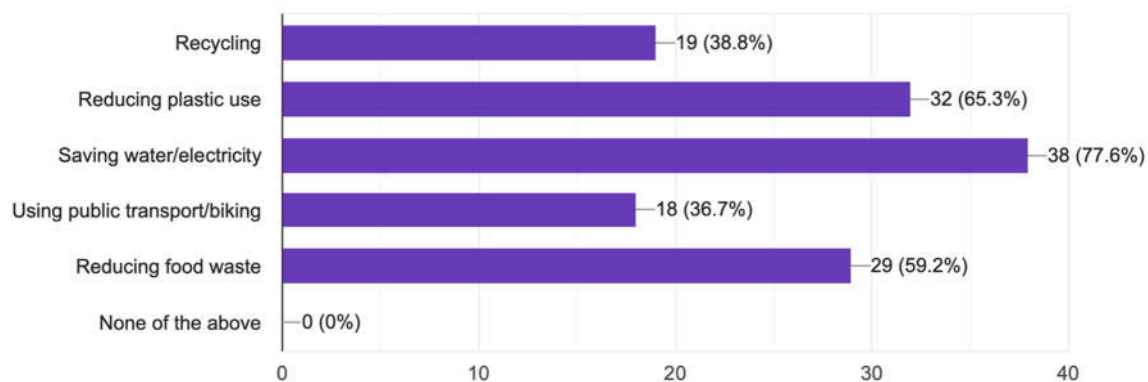


Figure 1.: Current practice of any sustainable habits

While a significant portion of students practised saving water/electricity (77.6%) and reducing plastic use (65.3%), engagement in other crucial habits like recycling (38.8%), using public transport/biking (36.7%), and reducing food waste (59.2%) showed room for improvement (see Figure 1). This disparity between awareness and consistent action validates our initial problem statement, highlighting the need for more effective mechanisms to bridge this gap.

The survey results strongly indicated a demand for more engaging and rewarding methods to promote sustainable behaviours. Notably, 89% of respondents expressed that they would engage more with sustainability if it were presented in a fun and rewarding manner.

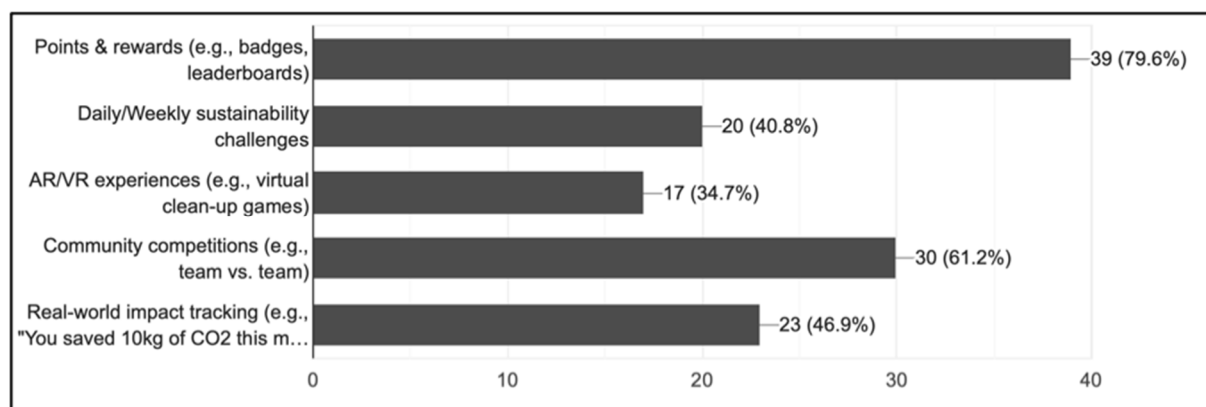


Figure 2.: Features that motivate engagement with a sustainability app

Figure 2 shows that this finding directly supports the core premise of our project: gamification can serve as a powerful tool to motivate behavioural change. When asked about motivating features for a sustainability app, the top preferences were a points and rewards system (79.6%), community

competitions (61.2%), and real-world impact tracking (46.9%). Daily/weekly sustainability challenges (40.8%) and AR/VR experiences (34.7%) also garnered significant interest.

Table 2.: Intention to use of mobile app

Intention to use	Percentage
Yes	67.3%
No	10.2%
Maybe	22.4%

Furthermore, 67.3% of respondents explicitly stated they would use a mobile app that makes learning about sustainability fun through games, challenges, and rewards, with an additional 22.4% indicating "Maybe." Table 2 collectively affirms the viability and potential impact of a gamified mobile application. The high demand for features like points, community challenges, and progress tracking directly informs the design of our app, ensuring it incorporates elements that are most likely to drive user engagement and facilitate the adoption of sustainable habits, thereby fostering both individual responsibility and collective contribution towards the SDGs.

The results align closely with Piki et al. (2024) and Silveira et al. (2023) on sustainability education, both of which emphasise the effectiveness of mobile game-based learning in enhancing engagement with the SDGs. Similar to the students' strong preference for interactive and rewarding approaches, SDG Quest (Piki et al., 2024) and the IGI app (Silveira et al., 2023) demonstrated that gamified features, such as rewards, challenges, and progress tracking, can significantly increase motivation and behaviour change. These studies reinforce the idea that while awareness exists, gamification offers a promising method to transform that awareness into sustained, actionable habits supporting environmental and social goals.

CONCLUSION

This study highlights the critical need for innovative approaches to foster sustainable development practices among youth. The "Gamifying Sustainability" mobile application emerges as an important tool to bridge the gap between awareness and action regarding the Sustainable Development Goals (SDGs). By leveraging gamification, the app aims to actively engage youth, transforming abstract concepts into tangible, rewarding daily habits. Our preliminary survey data strongly validates this approach, with the majority of them expressing a desire for fun and rewarding sustainability engagement and a clear preference for gamified features like points, community challenges, and progress tracking. While the convenience sampling method and limited sample size of this initial survey present a limitation in generalizability, the findings provide significant evidence of the app's potential to significantly raise SDG awareness and promote practical, sustainable habits among the target demographic. This app represents a scalable and engaging solution to cultivate a generation committed to a sustainable future.

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GLOWSAFE LUNCHBOX: AN EARLY-WARNING INNOVATION FOR FOOD SAFETY IN SCHOOLCHILDREN

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ABSTRACT

The GlowSafe Lunchbox is a student-led innovation aimed at addressing food safety issues among schoolchildren. The device uses a saltwater-dried strip connected to a basic electrical circuit to detect the presence of unwanted moisture in a lunchbox, often a sign of leaking or spoiled food. When moisture is present, it completes the circuit and triggers a warning light. This extended abstract presents the rationale, methodology, findings, and implications of the GlowSafe Lunchbox project, which emphasizes early detection and low-cost design. Data were collected by testing various food items under controlled conditions. Results show consistent light activation with common moist foods, demonstrating its value as a practical early-warning tool. The study concludes that the GlowSafe Lunchbox offers a simple yet effective solution for enhancing food safety awareness in children.

Keywords: *food safety, early warning system, moisture detection, low-cost design, school children*

INTRODUCTION

Foodborne illnesses among children often arise from improper storage or spoiled food in lunchboxes. These risks are difficult to detect early, particularly for younger children who may not recognize signs of food spoilage. This concern is evident in Malaysia where the food poisoning incidence in schools reached **50.90 per 100,000 population** in 2019, and half of foodborne disease outbreaks have historically occurred in institutional settings such as schools (Salini Devi Rajendran, 2024; Soon-Sinclair & Singh, 2011). The GlowSafe Lunchbox was developed to address this issue by providing a visual alert when moisture—often linked to spoilage—is detected inside the container. Unlike chemical test kits or advanced sensors, this model uses a simple, low-cost mechanism that is both educational and practical for school use.

METHODOLOGY

The GlowSafe Lunchbox integrates two compartments: one for food and another housing a saltwater-dried paper strip connected via crocodile clips to a battery-powered LED. A small channel allows any leaking moisture from food to flow into the sensor compartment. When moisture reactivates the salt, it facilitates electrical conductivity and completes the circuit, lighting the LED. The device was tested with various food samples (fresh and spoiled), including rice, curry, and milk. Observations were recorded based on LED response. This low-cost, easily understandable moisture-based detection mechanism is especially important in the Malaysian context, where foodborne illnesses linked to improper handling in schools have been a persistent concern, with the Ministry of Health reporting that food poisoning cases remain among the most common communicable diseases in educational institutions (Ministry of Health Malaysia, 2020).

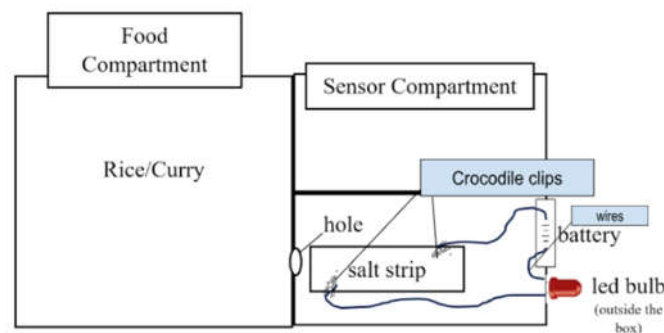


Figure 1: GlowSafe Lunchbox Setup (schematic representation of the moisture sensor circuit)

Table 1: LED Response to Food Samples with Varying Moisture Levels

Food Sample	Condition	LED Response
Rice	Dry	No Light
Rice	Moist (Fresh)	Light On
Curry	Fresh	Light On
Milk	Fresh	Light On
Milk	Spoiled	Light On

RESULTS AND DISCUSSION

Testing confirmed that any moist or leaking food—regardless of whether it was spoiled—was sufficient to trigger the LED. This is because the dried salt strip, once rehydrated by moisture, becomes conductive. While the system does not directly detect spoilage, the presence of unexpected moisture in a sealed container strongly correlates with leakage or potential bacterial activity. Importantly, This early-warning feature aligns with the World Health Organization’s (WHO) emphasis on preventive measures to reduce foodborne illnesses, particularly among vulnerable groups such as children.WHO (2024) highlights that unsafe food containing harmful bacteria, viruses, or chemical substances causes more than 200 diseases globally, with young children being at the highest risk. In this context, the GlowSafe Lunchbox provides a practical low-cost school-based solution that supports WHO’s call for safe food practices and early detection mechanisms to protect children’s health.Table 1 presents LED responses for various samples. Figure 1 shows the internal setup of the GlowSafe Lunchbox with sensor wiring.

Table 2.: Observed Moisture Levels and Activation Time

Food Item	Moisture Level	LED Activation Time
Dry Bread	Low	No Light
Cooked Rice	Medium	3 seconds
Curry	High	1 second
Milk (Fresh)	High	1 second
Milk (Spoiled)	High	1 second

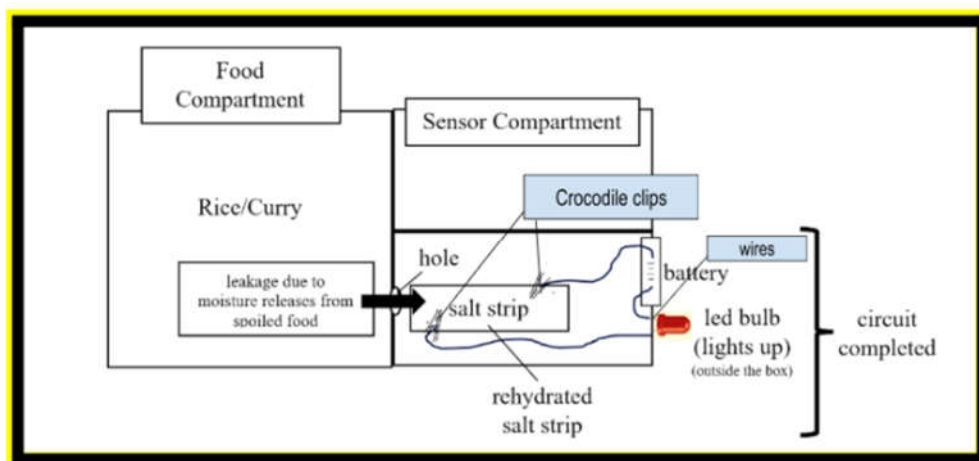


Figure 2: Conceptual Diagram – Moisture flow through compartment to trigger salt strip circuit

CONCLUSION

The GlowSafe Lunchbox demonstrates a functional, low-cost method to promote food safety awareness among primary students. Its simplicity and practicality make it suitable for school environments. Although it does not detect spoilage directly, its ability to indicate the presence of moisture offers a proactive warning to prevent consumption of potentially unsafe food.

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IMPLEMENTATION OF MEDIATION IN THE ESTATE DISTRIBUTION DIVISION (EDD) TO RESOLVE ESTATE DISPUTES

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ABSTRACT

Disputes among family members can disrupt the administration of estate if they are not properly addressed. Despite the existence of the Estate Distribution Division to cater estate administration cases, the approach by the agency does not take into account the emotional grievance suffered by the family members which tend to be the cause of family disputes. Without proper means to address family disputes, cases involving incomplete estate administration will continue to increase to the detriment of the stakeholders including the family members, beneficiaries and the government. Research found that mediation is an excellent tool in resolving family disputes in estate administration due to its flexibility and ability to address emotional issues. This paper looks into the possibility of implementing mediation in the Estate Distribution Division in addressing the family disputes in estate administration. This research employs library-based research with specific references to articles, case laws and statutes including but not limited to the Mediation Act 2012 and Small Estates (Distribution) Act 1955. Findings show that the Estate Distribution Division is perceived as a suitable administrative body to implement mediation due to its coverage of most estate cases in Malaysia. Mediation will be able to assist in the resolution of disputes, preventing adverse issues that would result in delay and incompleteness of estate administration in Malaysia.

Keywords: Mediation, Estate Distribution Division, Family Disputes, Inheritance, Beneficiaries

INTRODUCTION

Estate disputes are an unfortunate common occurrence within estate administration. Such disputes may disrupt the overall process of estate administration, which affects not only the family members of the deceased, but also other beneficiaries and the government. One such negative impact is delay, which can bring about emotional strain on the family members the longer the process is delayed and negative economic effects on not only the estate and family of the deceased, but also the government as any property belonging to the deceased is essentially left in limbo in regards to its ownership (Roslan & Ahmad, 2022).

The Estate Distribution Division under the Department of Director-General of Land and Mines (JKPTG) (“the Division”) receives the highest amount of estate cases out of all administrative bodies involved, having the jurisdiction over movable and immovable property valued up to RM5,000,000 and covering approximately sixty-five percent of the total applications for estate distribution in the country (Ibrahim et al., 2024).

As such, with estate disputes becoming commonplace and persistently affecting estate administration, there is a need to address the issue in a way that would not prolong the process any further, especially with the number of cases the Estate Distribution Division covers every day. Mediation is already recognised as an effective tool in resolving various kinds of disputes, including family and probate (Badrul Hisham et al., 2025). Thus, the objective of this paper is to explore the possibility of implementing mediation in the Estate Distribution Division in order to resolve the estate disputes that may disrupt the process of estate administration if left unaddressed.

METHODOLOGY

This paper adopts a library-based approach by referencing published articles and statutes, namely the Small Estates (Distribution) Act 1995, which provide key provisions relevant to the discussion of the Estate Distribution Division. The Mediation Act 2012 is also referred to in order to give a better understanding on the concept of mediation.

RESULTS AND DISCUSSION

Estate Distribution Division

The Estate Distribution Division is one of the four main administrative bodies involved in the process of estate administration in Malaysia. In its amendment in 2022, the maximum threshold for the value of small estates that the Division had jurisdiction over was increased from RM2,500,000 to RM5,000,000, allowing the Division to take on more cases from its counterparts in Amanah Raya Berhad and the Civil High Court. Furthermore, the Division no longer hears applications strictly limited to immovable property, with its scope now expanded to include movable property as well. As mentioned earlier, the Division handles approximately sixty five percent of the total estate distribution applications in the country, equivalent to 60,000 cases annually (Ibrahim et al., 2024).

When the deceased’s family submits the relevant documents and their applications are processed, the Division will verify the value of the estate’s assets with the Valuation and Property Services Department. This is to ensure that the assets that are sought to be distributed do not exceed the maximum threshold set out in the Small Estates (Distribution) Act 1955. If the answer is negative, then the Division will issue a notice to attend a hearing which both the applicant and other heirs to the estate’s assets are mandated to attend. If all affairs are in order, the assets will be distributed. The Division will distribute the estate according to *Faraid* or Section 6 of the Distribution Act 1958 respective to whether

the deceased was Muslim or non-Muslim (Benjamin Tham & Co, 2021). It should be noted that the Division does not have the jurisdiction to hear applications for testate estates.

Mediation

Mediation is recognised as an effective tool to resolve disputes in Malaysia and is an alternative to litigation. The implementation of mediation is already well-practised in Malaysia as seen by its implementation in various institutions such as both the Civil and Syariah courts in the forms of court-annexed mediation and *sulh* respectively. Section 3 of the Mediation Act 2012 defines mediation as “*a voluntary process in which a mediator facilitates communication and negotiation between parties to assist the parties in reaching an agreement regarding a dispute.*”

Mediation carries many advantages which makes it a suitable dispute resolution method as compared to litigation, especially in regards to family or inheritance disputes. Mediation is preferred to other alternative dispute resolution methods as it is the most well-known and easily understood, especially in regards to family disputes (Badrul Hisham et al., 2025). The nature of mediation makes it flexible and allows more autonomy to the parties to agree on a settlement between themselves, rather than allowing a third-party to impose a decision on the parties. This allows for more creative solutions which are tailored to the parties’ respective interests than those strictly provided under the law (Kamarudin & Ab Aziz, 2014). Furthermore, it is more cost and time-effective as compared to litigation (Drs Nasrul et. al, 2022), as the courts are already faced with a high number of cases which often suffer from procedural delays that prolong the disputes. Additionally, mediation provides the space to navigate emotional turmoil and tension more so than the courtrooms. This makes mediation a fitting avenue to resolve family and inheritance disputes which are often fraught with high emotional tension and stress.

Generally, the process of mediation begins with the mediator’s introduction where the mediator provides an overview of the session and the principles of mediation. This is followed by the disputing parties’ opening statements, where each party explains their respective positions in the dispute. Then, a joint discussion session is held wherein the parties explain the issues in depth. A joint negotiation session is then held to brainstorm potential solutions that the parties may be open to. Last but not least, the session ends with the settlement of the dispute if the parties can resolve their differences. Should the session require so per the mediator’s view that the parties would be more open to sharing information privately in a one-on-one session, among other reasons, a private session between each party and the mediator known as a caucus will be held (Drs Nasrul et al., 2019).

The above process is flexible and simple enough to be implemented in the process of estate administration in the Division. The authors of this paper propose that after the applicant and the deceased’s heirs are issued the notification of hearing and should a dispute arise during the hearing, the parties shall be presented with the option to refer their dispute to mediation. Should they refuse, their dispute remains unresolved without the help of a neutral and impartial third-party mediator which may jeopardise the process of administering the deceased’s estate down the line. However, should the parties agree to refer their dispute to mediation, the general process of mediation would apply. At the end of the mediation session, if the parties successfully resolve their dispute, the Estate Distribution Officer will draft a mediation agreement which the parties will review and sign if the contents of the agreement

are satisfactory. This agreement will be binding upon both parties. The signing and release of the agreement marks the conclusion of the hearing, after which the Estate Distribution Officer will issue a Letter of Administration or Distribution Order. This process can be summarised as follows:

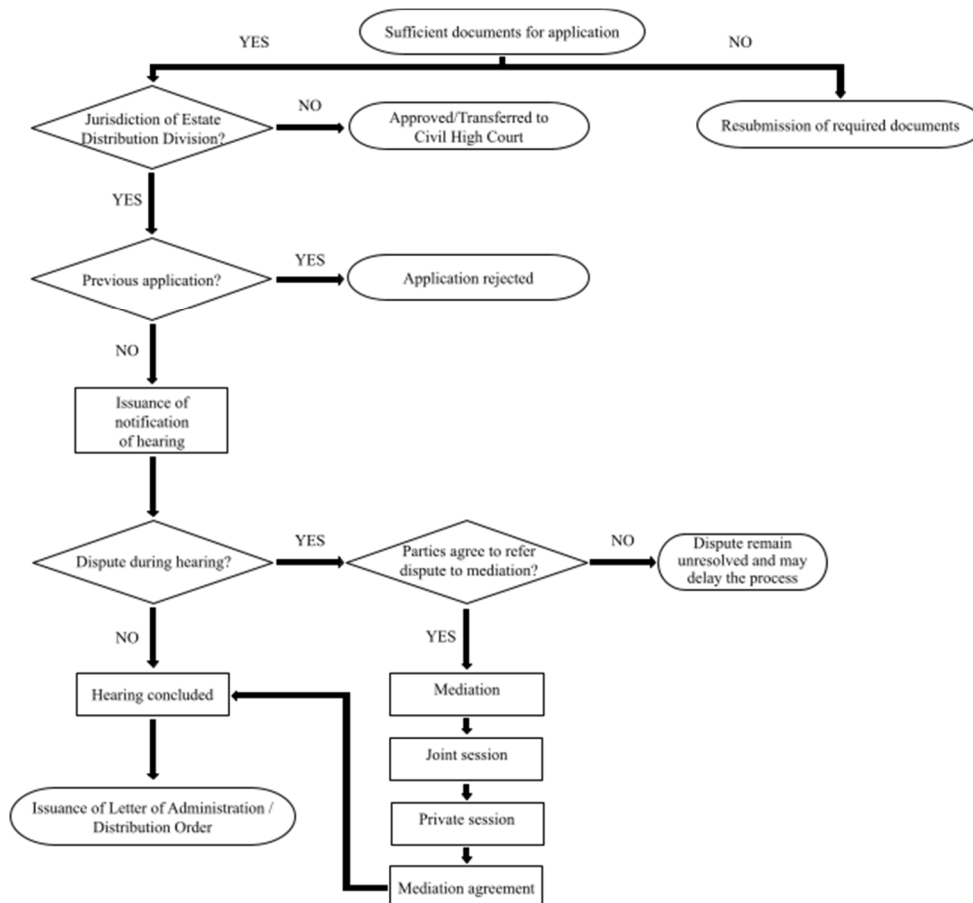


Figure 1.: Flowchart on the proposed implementation of mediation in the Estate Distribution Division

The addition of mediation into the process of estate distribution in the Division is not expected to incur significant cost except for the training of the Estate Distribution Officers in the skill of mediation that is required of them. Furthermore, the jurisdiction of the Division is only limited to intestate cases which means that should disputes arise as to the contents or validity of the deceased’s will, the parties would still need to refer their dispute to the courts.

CONCLUSION

Understanding the importance of mediation in the overall process of estate administration can help parties make informed decisions when they are faced with financial or emotional difficulties to

manage the deceased's assets following their loved one's death. All in all, the findings of this paper indicates that by implementing mediation in the administrative bodies such as the Estate Distribution Division, estate disputes are more effectively resolved before adverse implications such as delay and incomplete estate administration could take root. Without the need to refer estate disputes to the courts, it is hoped that the implementation of mediation in the Estate Distribution Division will lessen the burden on the deceased's family and provide them a seamless process to distribute the deceased's assets to the rightful heirs, in addition to preserving the harmony of the family institution.

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INNOVATIVE USE OF SAGO PITH WASTE IN CEMENT BRICKS: A SUSTAINABLE APPROACH TO SAND REPLACEMENT

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ABSTRACT

The increasing demand for cement bricks in large-scale construction has intensified the reliance on sand, raising environmental concerns. This study explores the incorporation of Sago Pith Waste (SPW), an agricultural by-product, as a partial replacement for sand in cement brick production to address pollution and promote sustainable waste management. Brick specimens were prepared with 0%, 3%, and 10% SPW content, maintaining a cement-sand ratio of 1:3 and a cement-water ratio of 1:2. After 28 days of curing, the bricks were tested for compressive strength, water absorption, and density. Results revealed that as the percentage of SPW increased, compressive strength and density decreased, while water absorption increased. Despite the decreased mechanical properties, all bricks-maintained water absorption levels below 20% of their dry weight, indicating acceptable structural performance. The study demonstrates that SPW can be effectively utilized in cement bricks, supporting Sustainable Development Goals (SDGs) by creating eco-friendly building materials and contributing to environmental conservation.

Keywords: *Sago Pith Waste (SPW), Sand replacement, Compressive strength test, Sustainable Development Goals (SDGs), Waste utilization*

INTRODUCTION

The construction industry is growing rapidly, especially in developing countries like Malaysia. Cement bricks are commonly used for their strength, durability, and suitability for the local climate. They are made from cement, water, and fine aggregates like sand. However, high sand demand has caused environmental issues, as sand mining can damage rivers, harm aquatic life, and destroy natural habitats. The production of cement bricks hurts the environment as the use of sand disrupts the ecosystem and habitat (Koehnken, 2018). According to Inemesit (2024), it also causes water pollution. It increases the risk of flooding, which would reduce the natural barriers against flooding and storm surges, as it exacerbates vulnerabilities to climate change.

The sago industry, common in Malaysia, Indonesia, and Papua New Guinea, generates a lot of waste. Sago is a starch from the sago palm, and after extraction, the leftover material, known as Sago Pith Waste (SPW), is usually discarded. This waste includes bark and fibre; when not properly managed, it can pollute rivers and cause health problems since tons of SPW are thrown into the river daily (Amin et al., 2019).

To reduce sand mining and agricultural waste, this study explores a new idea using SPW to replace sand in cement bricks. SPW is lighter in weight and can help reduce the overall weight of the bricks. Adnan et al. (2024) prove that this could also make the bricks weigh less than the original cement bricks. Utilizing this waste material can help reduce pollution, protect natural resources, and create a more sustainable way to produce building materials.

METHODOLOGY

The process included experimental laboratory work and the preparation of raw materials, the preparation of brick samples, and testing. The methods followed the guidelines outlined in ASTM C67 (Test Methods for Sampling and Testing Brick and Structural Clay Tile, 2021).

Materials

Ordinary Portland Cement (OPC), fine aggregate (sand), and SPW produced the brick. The OPC is the most crucial component in producing cement bricks, where the density of OPC used is 2085 kg/m³. The cement was obtained locally at the concrete laboratory of UiTM Sarawak. The fine aggregate used in this study was natural sand that would mix with the raw SPW in a certain percentage.

Raw Sago Pith Waste (SPW)

Raw SPW used in this study was from the supplier of the sago mill in Mukah, Sarawak. The conditions of raw SPW before use were that it must be used in dry conditions and would replace the sand in the cement bricks. So, the most important part of this methodology was drying out the raw SPW. Wahab et al. (2024) stated that the method of drying wet SPW is sun drying. Thus, SPW was dried under direct sunlight for at least 18 hours in this project, depending on the weather conditions. The replacement

volume of dried and raw SPW used are 0%, 3%, and 10%.

Preparation of Brick Samples

The total number of bricks that need to be produced is 24 samples, each batch of which has eight samples, and only 18 sample bricks will be tested in the compressive strength test and water absorption. Those samples will be divided for some tests, including density, compressive strength, and absorption. The mold of the sample brick was molded using wood with dimensions of 210 mm (length) x 100 mm (width) x 65 mm (height). Three batches of SPW cement bricks must be produced using a 1:3 cement and sand ratio. Brick preparation has been done manually (hand mixing), and the materials are made according to the mix's design. The bricks have been stored for dry curing at room temperature for 28 days before being tested in the laboratory.

Testing

In this study, several tests, such as compressive strength, density, and water absorption, were conducted at the concrete laboratory of UiTM Cawangan Sarawak. A Compression Test Machine (CTM) is used in this project to evaluate the compressive strength of the SPW cement bricks. Three bricks from each batch were tested to define the cement bricks, record the data, and calculate the average strength of the cement bricks.

After 28 days of maturing the cement bricks, a density and water absorption test were performed, and nine samples of cement bricks were tested. This test has been carried out according to BS 6073 (Precast Concrete Masonry Units, Part 1: Specification for Precast Concrete Masonry Units, 1981), given that the brick volume is 0.001365 m^3 . The formula used is Eq. 1 for the density test and Eq. 2 for the water absorption test.

$$\text{Brick density (kg/m}^3\text{)} = \text{Weight of sample(kg)} / \text{Volume of the brick (m}^3\text{)} \quad \text{Eq. 1}$$

$$\text{Brick Water Absorption} = [(W_w - W_d) / W_d] \times 100\% \quad \text{Eq. 2}$$

Where W_w = dry weight of specimen, and W_d = wet weight.

RESULTS AND DISCUSSION

Density

As shown in Figure 1, the density of cement bricks decreases with higher SPW content. The 10% SPW bricks have the lowest density at 1496.7 kg/m^3 , while the 0% SPW bricks have the highest at 2040.29 kg/m^3 , followed by the 3% SPW bricks at 1761.17 kg/m^3 . This reduction is due to the low specific gravity of SPW, which results in lighter bricks. Therefore, increasing SPW in cement bricks shows potential for producing lightweight bricks.

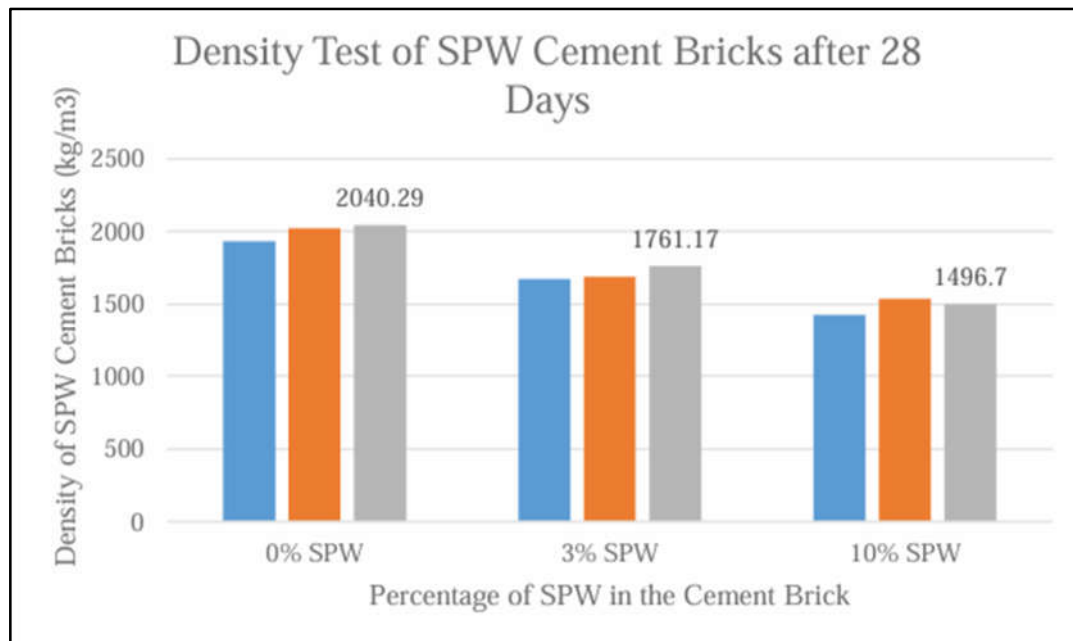


Figure 1.: Graph of Density Test of SPW Cement Bricks after 28 Days

In this study, the average density of cement bricks in 0% and 3% of SPW is 1197.31 kg/m^3 and 1691.23 kg/m^3 respectively. It is slightly different from Adnan et al. (2024), which showed 2250 kg/m^3 and 1850 kg/m^3 for 0% and 3% of SFW.

Water Absorption

It is important to determine the percentage of water absorption in SPW Cement Bricks to identify the bricks' class and whether it is more or less than 20% by dry weight (Mishra, 2025). If the bricks have less than 20% water absorption, they are first-class bricks and have a strength suitable for construction in various conditions (Pal, 2025). During soaking, bubble absorption rates differed across batches. The 0% SPW bricks absorbed bubbles the slowest, followed by 3% and 10% SPW bricks. The 10% SPW batch took over 17 times longer than the others. Regarding water absorption, 0% SPW bricks had the lowest at 5.5%, followed by 3% (10.3%) and 10% (18.8%). Based on standards, all batches qualify as first-class bricks except the 10% SPW batch, which slightly exceeds the 20% water absorption limit at 20.9% as shown in Figure 2.

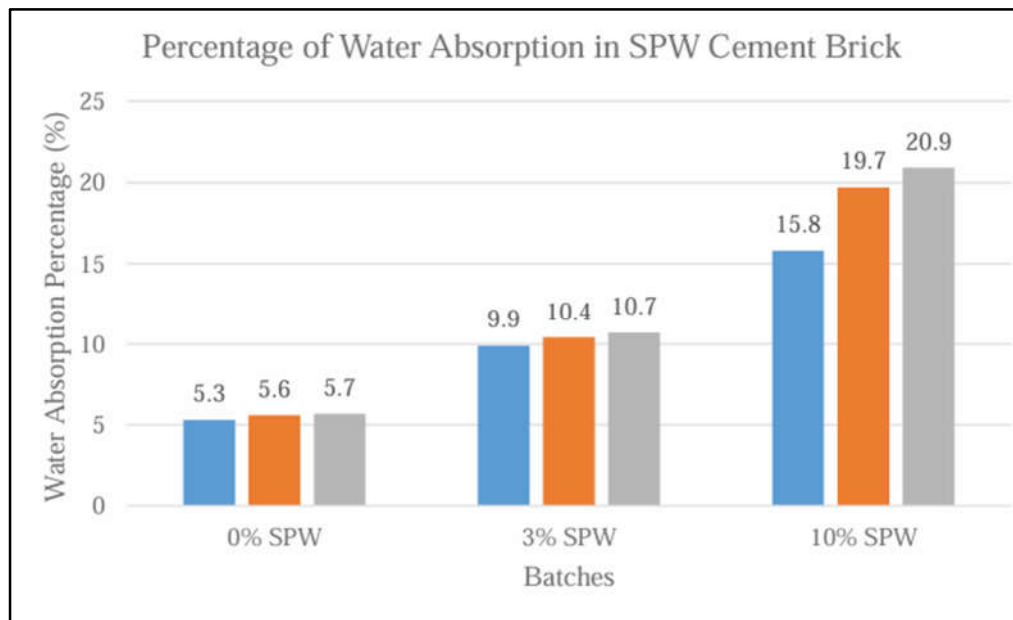


Figure 2. Graph Analysis of Water Absorption in SPW Cement Bricks

Compressive Strength Test

A compressive strength test was done after 28 days, and the results of the raw SPW cement bricks are shown in Table 1. The result shows that the highest strength value is 0% SPW, which has an average of 22.4MPa, and the lowest strength is brick containing 10% SPW, which has an average of 2.4MPa. The result also shows that the strength of sample 2 of 0% SPW brick has reached 36.9MPa. As for the 3%, the average strength is 6.83 MPa.

Thus, it can be used as a load-bearing wall, as the minimum strength for a load-bearing wall according to Kabiru Ayagi et al. (2022) is from 3.5 MPa to 15 MPa, depending on the type of brick and its intended use. However, 10% SPW cement bricks are unsuitable for load-bearing walls as the average strength is 2.4MPa.

Table 1. Compressive strength test result

Sample	Test 1		Test 2		Test 3		Average	
	(N)	(Mpa)	(N)	(Mpa)	(N)	(Mpa)	(N)	(Mpa)
0%	0.122	11.6	0.388	36.9	0.197	18.7	0.236	22.4
3%	0.092	8.7	0.07	6.6	0.055	5.2	0.072	6.83
10%	0.028	2.6	0.025	2.4	0.022	2.1	0.025	2.4

A comparison was made between the compressive strength of using raw SPW and Sago Fine Waste (SFW) from the study by Wahab et al. (2024), as shown in Table 2. It can be seen that using SFW gives a stronger compressive strength towards the brick than raw SPW. From Table 2, 10% SFW have the strength of 5.46MPa, whereas 10% SPW have the strength of 2.4 MPa. This project shows that 3% SPW has a strength of 6.83 MPa and the 5%SFW has a strength of 12.47MPa, which shows a significant difference in the compressive strength. It can be concluded that the raw SPW cement brick has a weaker strength than the SFW cement brick.

Table 2.: Compressive strength test data (Wahab et al., 2024)

Percentage of SFW (%)	Compressive strength (MPa)
0	17.85
5	12.47
10	5.46

CONCLUSION

In conclusion, this study examined using SPW as a partial sand replacement in cement bricks to promote sustainability by reducing sand use and agricultural waste. Results showed that SPW lowers brick density, making them lighter, but excessive amounts reduce structural strength. Bricks with 3% SPW achieved the best balance, with a density of 1691.23 kg/m³ and water absorption of 10.3%, meeting first-class standards. However, compressive strength dropped sharply from 22.4 MPa (0% SPW) to 2.4 MPa (10% SPW). Overall, SPW shows promise as a sustainable material, but should be limited to about 3% for safe and durable bricks.

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INTEGRATING DEEPSEEK INTO RURAL ELDERLY SERVICES: OPPORTUNITIES, CHALLENGES, AND ADAPTATION STRATEGIES IN JILIN PROVINCE, CHINA

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ABSTRACT

Given China's aging population and rural revitalization, artificial intelligence has provided a new approach to addressing the shortage of rural old-age resources. This study focuses on a village in Jilin Province, from the perspective of village cadres and township civil affairs cadres. By employing qualitative methods, including interviews with key informants (2 individuals) and focus groups (2 groups with a total of 10 participants), it investigates the process of implementing policies related to the DeepSeek system in old-age services. The study finds that grassroots managers believe DeepSeek enhances the understandability of policies through voice interaction to provide "plain language interpretation" of old-age subsidies and other policies; it precisely analyzes the needs of the elderly to improve service targeting; and it links county and township medical resources to conduct remote consultations, thereby strengthening resource integration. The challenges are mainly reflected in four contradictions: the elderly's insufficient digital literacy and limitations in dialect recognition; unstable village-level networks and the absence of a mechanism for sharing technical maintenance costs; the elderly's emotional aversion to "robot butlers" and privacy concerns; and the lack of effective standards to measure the improvement of service quality. In response to these challenges, it is suggested to develop dialect voice libraries to enhance technological inclusiveness; strengthen policy training for grassroots managers; establish resource integration mechanisms to deepen technological integration; customize technological functions based on rural needs; and build a scientific service quality evaluation system. The study shows that by advancing both technological adaptation and institutional innovation, DeepSeek can be effectively integrated into the rural old-age system, injecting new momentum into the old-age cause in Jilin Province.

Keywords: Separated Application of DeepSeek technology, Rural old-age services, Policy implementation process

INTRODUCTION

Improving rural elderly care services is an inherent requirement of China's rural revitalization strategy. In 2024, the aging rate in Jilin Province (the proportion of people aged 60 and above) was approximately 28.2% (J. P. B. o. Statistics, 2025), significantly higher than the national average of 22% (N. B. o. Statistics, 2025). Meanwhile, according to Jilin J. P. B. o. Statistics (2025), the proportion of empty-nest elderly in rural areas of Jilin Province has exceeded 60%. This presents a "double pressure" of deep aging and a weak foundation for elderly care security.

The "Internet +" technology builds a network platform for old-age services, which can strengthen institutional construction and provide more comprehensive protection for the elderly population in rural areas (Wu, 2017). With the development of Internet + old-age services, the construction research of smart old-age services has also gradually developed (Pang et al., 2017). DeepSeek's generative artificial intelligence embedded in old-age services has brought new opportunities to contemporary rural old-age issues. At the same time, the risks existing in terms of technology and ethics cannot be ignored.

The DeepSeek series of conversational artificial intelligence, especially the DeepSeek-R1 model, possesses large-scale language understanding capabilities and multi-task processing capabilities, and has demonstrated application potential in several industries in China. The application of DeepSeek-R1 in rural old-age scenarios mainly focuses on policy interpretation, health consultation, emotional companionship, and emergency response.

However, in an aging society, it is inherently challenging for the elderly to bridge the digital divide (Wang & Zhang, 2021). Especially in Jilin Province, the educational attainment of the rural population is relatively low and the infrastructure is weak. Therefore, effectively integrating the DeepSeek system into the rural old-age service system faces considerable challenges. This study aims to enrich theoretical research on smart old-age in China's rural areas, expand the application boundaries of conversational AI in low-resource regions, and provide valuable experience for rural areas like Jilin Province to draw on.

METHOD

This study adopts a qualitative research approach, aiming to gain an in-depth understanding of the application path, adaptation obstacles, and localization strategies of DeepSeek conversational artificial intelligence in the rural old-age system of Jilin Province. The in-depth interview subjects of this study are two village committee cadres, who play a key role in decision-making and promotion in the old-age service planning and governance of their respective villages. The interview content mainly focuses on the current situation and bottlenecks of elderly care services in the village; their cognition and attitude towards the DeepSeek system; the feasibility of introducing artificial intelligence technology, institutional obstacles, and resource issues; and their ideas and suggestions for localization promotion.

Simultaneously collect policy documents and industry reports on rural old-age, smart village construction, and the application of artificial intelligence technology at both the provincial and national

levels in Jilin Province. Since 2020, the State Council of China has formulated policy documents every year specifically aimed at ensuring the development of smart old-age services. Policies such as the "Opinions on Promoting Economic Development to Enhance the Well-being of the Elderly (Guo Ban Fa [2024] No. 1)" and the "Opinions on Promoting the Construction of the Basic Elderly Care Service System" all point out that the development of smart elderly care should be cultivated. Policy documents are used to assist interview materials in context analysis and application evaluation.

RESULTS AND DISCUSSION

The interviews with two village committee officials provided a crucial perspective from the front line. One interviewee pointed out that AI-based elderly care is a novelty for rural seniors. But it would be a great thing if one could remind the elderly not to forget to take their medicine and talk to relieve their boredom. Modern family structures are smaller and have fewer children. Rural elderly people have a less entertaining life. Smart elderly care can help the needs of the elderly receive more attention and solutions (Zhang & Zhang, 2023). Another interviewee emphasized that a portion of the elderly population is not adept at using smartphones. Although the convenience of integrating the DeepSeek system into the old-age model is foreseeable, the reality is that a significant amount of manpower is required to teach the elderly how to use it. This includes village committee officials themselves, who also need time to learn and enhance their digital and intelligent literacy.

Through interviews and analysis with two village committee cadres, this study found that the DeepSeek system has the potential to alleviate the insufficiency of grassroots service capabilities and increase service coverage. However, in its actual promotion, it is still limited by realistic conditions such as human resource allocation, cognitive acceptance and financial mechanisms; The attitude and ability of village committee cadres directly affect the implementation effect of the system. They are the key hub force for achieving "human-machine collaboration".

The future integration of DeepSeek into the rural old-age system is highly forward-looking. The key lies in how to leverage the power of artificial intelligence to boost the development of rural old-age services (LIANG, 2025). This includes optimizing dialect recognition, simplifying interaction processes; customizing functions based on local living habits and emotional communication styles; and improving financial support, digital literacy, and training mechanisms (Zhu, 2024). Additionally, establishing an "AI + human service" hybrid mechanism (such as having village doctors assist with system startup and explaining system responses) will be a crucial approach to enhancing the acceptance of artificial intelligence among rural elderly people during the transitional period.

The limitation of this study lies in the small sample size and the fact that the data mainly come from villages in Jilin Province. Subsequent research should combine multi-group interviews and long-term tracking to further verify the application effectiveness and behavioral change path of the AI elderly care system.

CONCLUSION

This study explores the opportunities, challenges and localization paths of DeepSeek conversational artificial intelligence in rural old-age services through qualitative methods. The conclusion drawn is that conversational artificial intelligence has the potential to alleviate the "service gap" problem in rural old age, but it needs to address three major practical issues: technological accessibility, cognitive impairment, and fiscal sustainability. Village-level cadres play a core driving role in the promotion of the system, and "human-machine collaboration" is the most feasible application approach at present. Technology promotion must be accompanied by infrastructure construction, service personnel training and cultural localization strategies to achieve efficient integration.

It is suggested that in the future, the conversational DeepSeek be included in the policy support list for "Smart Villages", with priority given to deeply aging regions such as Northeast China. At the same time, the position of "AI service provider" should be added, or the scope of business services for rural new media cadres should be expanded. Promote the integration of artificial intelligence services with the basic public service information system to achieve data sharing and coordinated management. And encourage the collaboration among industry, academia and research to carry out customized product design of artificial intelligence for elderly care, to enhance the supply capacity of old-age services in rural China.

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INTEGRATING ECONOMICS LESSONS INTO SNAKE AND LADDER GAME: AN INNOVATION APPROACH TO SUSTAINABLE EDUCATION

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ABSTRACT

The integration of sustainable education through game-based learning strategies, such as the traditional Snake and Ladder game into the economics lessons has shown promising results in enhancing student engagement and understanding. This study explores the application of the Snake and Ladder game as an interactive pedagogical tool to facilitate the innovation of learning economic concepts among students. The game is adapted to include questions and challenges related to theories of economics, such as supply and demand, cost and production, market structures, and other core economic topics. The integration of this game into classroom instruction has shown significant positive impacts on students' learning experience. It makes the learning process more fun and enjoyable, captures students' attention, and reduces classroom boredom. Furthermore, it encourages active participation and collaborative learning and improves students' motivation and interest in the subject. The findings indicate that this method not only enhances understanding and retention of knowledge but also creates a lively and student-centred classroom environment. In conclusion, the Snake and Ladder game proves to be an effective and engaging pedagogical approach in making the subject of economics more accessible and less intimidating for learners. This innovation points out the importance of gamification as a tool for advancing sustainable education and improving learning outcomes in economics lessons.

Keywords: *Economic subject, fun learning, educational games, sustainable education*

INTRODUCTION

In the changing field of education, innovative teaching strategies are important to encourage active learning and long-term knowledge retention. Many students find economics courses to be both difficult and boring. They perceive economics as abstract and difficult, struggling to connect theoretical concepts in studies. Studies have consistently reported that many learners struggle with grasping theoretical concepts, applying quantitative analyses, and linking economic principles to practical situations (Watts & Becker, 2008; Becker, 2004).

Addressing these issues requires innovative pedagogical approaches, including active learning strategies and the integration of sustainability themes, to make economics education more engaging, relevant, and significant. This indicates that active learning strategies, like educational games, can improve retention rates by up to 20 percent over traditional methods (Freeman et al., 2014). In economics, integrating sustainability concepts and interactive teaching makes learning more meaningful and relevant for today's world (Lozano et al., 2021; Brundiers et al., 2021).

Game-based learning in economics is a powerful tool that enhances student engagement and interest in the subject. Traditional lecture-based teaching can lead to passive learning environments, reducing student motivation and engagement that, lastly, will hinder the development of essential skills like critical thinking and problem-solving (Emerson & Taylor, 2004; Lozano et. al., 2021; Watts & Becker, 2008).

Furthermore, game-based learning can improve student understanding and equip students with key competencies needed in class for understanding and applying economic knowledge in real-world contexts (Brundiers et al., 2021; Molthan-Hill et al., 2022). In the learning process, using games makes it enjoyable and memorable for students; as a result, they are more likely to remember and apply what they have learnt.

Active and innovative teaching methods, including the integration of sustainability, are needed to make economics education more accessible and relevant (Lozano et. al., 2021; Brundiers et al., 2021). The integration of economics into games is in line with the concepts of Sustainable Development Goal 4: Quality Education, which promotes inclusive and innovative learning experiences. It also prioritizes learner-centred, participatory approaches that promote better knowledge.

This study presents a novel method for sustainable teaching by using game-based learning and integrating economics lessons into a modified traditional Snake and Ladder game. By fusing important economic principles into a comfortable and entertaining format, the game can be an educational tool and a platform for experiential learning. With this method, students can foster critical thinking, decision-making, and teamwork skills. It also brings sustainable education to life in a way that's engaging, effective, and fun in learning economics.

METHODS

Student engagement and participation are important for making economics classes more interesting and ultimately increasing students' understanding of basic economic principles. With that in mind, the researchers used a modified Snakes and Ladders game that was combined with basic economic concepts and calculation exercises to make studying economics more interesting and student-centered. This game-based method was created to provide students with a more participatory understanding of key concepts while also using games to strengthen their critical-thinking and problem-solving abilities. Students had to properly answer economic questions on certain squares on the modified Snake and Ladder board to move forward.

The study was conducted during the academic semester from March to August 2025 and involved a total of 75 students enrolled in the diploma and degree programs, including several: a Bachelor in Business Economics (Honours), a Diploma in Office Management and Technology, a Diploma in Public Administration, and a Diploma in Mathematical Sciences. Based on Roscoe's (1975) guideline, sample sizes between 30 and 500 are considered appropriate for most educational research, making this sample size suitable for the study. The instruments used included a set of economics questions incorporated into the Snake and Ladder game and a student feedback survey intended to gather opinions on how effectively the game improved their understanding.

To advance on the board during tutorial sessions, students had to respond to related topics, such as demand and supply, elasticity, monopoly, and perfect competition, while playing the game in small groups. Lastly, students had to fill out an online survey after participating in the game to evaluate their learning experience, level of engagement, and perceived benefits of the game-based method.

RESULTS AND DISCUSSION

This section focuses on the findings of the study, which aimed to evaluate the impact of game-based learning tools, specifically the snake and ladder game, on students' experiences in learning economics. The data was collected through a survey instrument using Likert-scale responses. The results address how this game can contribute to the reduction of boredom, the effectiveness of games in learning economics, and students' perceptions regarding the sustainability of educational practices.

Table 1.: Boredom reduction in economics

	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
I usually find economics boring, but this activity changed my view.	1.33	1.33	20	28	49.33
I enjoyed this session more than a normal classroom lesson	0	1.33	14.67	40	44
I would like more activities like this to reduce boredom in class.	0	1.33	8	42.67	48
I understand the concept of economics.	0	1.33	8	48	42.67
I felt more motivated to learn economics through this method.	0	1.33	9.33	41.33	48
I felt less bored learning economics through this activity	0	0	8	42.67	49.33

Table 1 shows student responses regarding their levels of boredom in learning economics before and after participating in the gamified learning session. Most students agreed that the game activity reduced boredom in the economics classroom. For instance, 49.33% strongly agreed and 28% agreed that their perception of economics changed positively after the activity. Similarly, 90.67% of students expressed a desire for more activities like this to reduce boredom in class. Notably, 49.33% strongly agreed and 42.67% agreed that they felt less bored, and over 80% felt more motivated and understood what they had learnt. These results suggest that incorporating interactive and game-based strategies in economics lessons can greatly increase students' motivation and interest.

Table 2.: Effectiveness of games in economics

	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
This game made economics more interesting.	0	0	12	45.33	42.67
The game helped me see economics in a fun and creative way.	0	0	6.67	42.67	50.67
The game helped reinforce what I learned in class.	0	0	8	38.67	53.33
I understood the topic better through this game.	0	1.33	9.33	42.67	46.67
I am confident in applying economics to real-life situations	0	0	16	40	44
I enjoy learning when interactive games are used in class.	0	0	12	38.67	49.33

Table 2 assesses the effectiveness of this game in facilitating students' understanding and engagement. The majority of respondents rated their experience positively, with over 95% saying or strongly agreeing that the games made economics more interesting and helped reinforce what they learnt. For instance, 53.33% strongly agreed that the game reinforced their learning, and 50.67% strongly agreed that it allowed students to learn economics in a creative and enjoyable way. These responses highlight the educational benefits of games in making economic concepts more accessible and enjoyable.

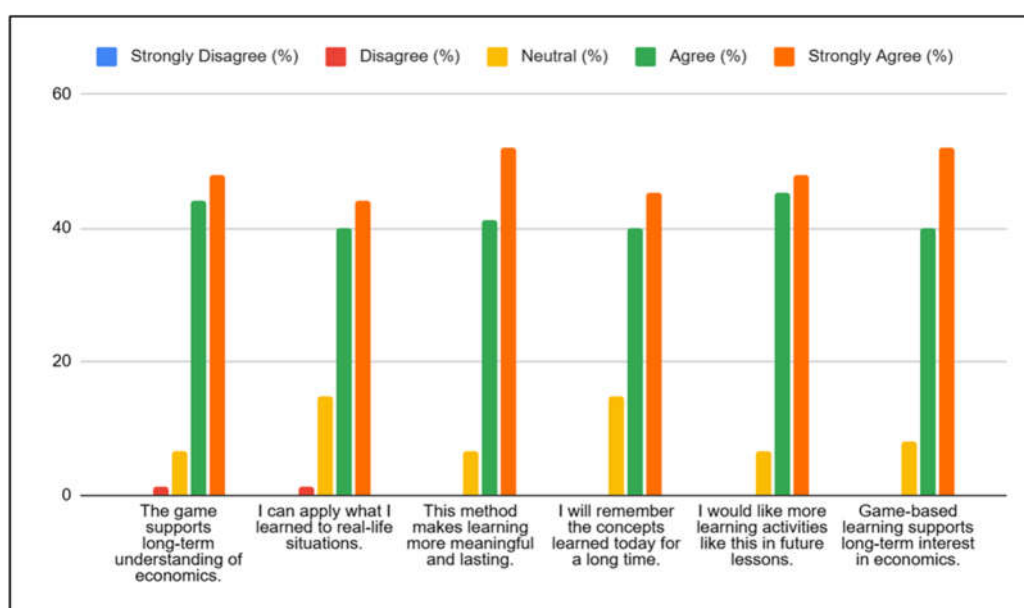


Figure 1.: Sustainability in education

Figure 1 illustrates students' perceptions of sustainability in education following the implementation of game-based learning tools. Based on the figure, the students responded positively to the integration of sustainable and engaging teaching practices. More than 85% agree and strongly agree that the game support long-term understanding of economics and game-based learning supports long-term interest in economics. Students also agree that by applying games in this subject, they can remember the concepts learnt for a long time. Besides, 40% and 44% strongly agree that students can apply what they have learnt to real-life situations. The visual likely reflects how interactive methods support long-term learning goals, promote continuous student interest, and encourage the development of 21st-century learning skills.

CONCLUSION

The integration of the Snake and Ladder game into economics lesson plans is an innovative and captivating way to improve student understanding and participation. The game helps maintain students' attention and strengthens their understanding of basic concepts by actively engaging them and transforming complex ideas into an enjoyable learning experience. This method encourages peer collaboration and critical thinking in addition to making learning enjoyable. To accommodate different

learning styles and vary their teaching methodologies, educators are urged to use more game-based and physical approaches. Future studies can examine how other game tools can be modified for instructional purposes and the effects these strategies have on student performance, motivation, and commitment at various academic levels and disciplines.

ACKNOWLEDGEMENTS

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INTEGRATING GREEN NANOTECHNOLOGY RESEARCH INTO ENGINEERING EDUCATION USING PALM-OIL-BASED TRANSFORMER NANOFLUIDS

Muhammad Zaki Bin Amiruddin & Ir. Ts. Dr. Nik Hakimi Nik Ali

ABSTRACT

This paper outlines an educational innovation that involves incorporating sustainable engineering research by developing graphene and hematite (Fe_2O_3) doped palm oil based transformer nanofluids as a green substitute for traditional mineral oil. The work addresses environmental and learning objectives by allowing real world problem solving in research. In this research nanofluids were synthesized with 6 grams of hematite and 2%, 4%, and 6% concentration of graphene in refined, bleached, and deodorized palm olein (RBDPO). Structural characterization was performed through X-ray diffraction (XRD), while electrical performance was tested through AC breakdown voltage testing in accordance with ASTM D1816. The results showed that the 6g hematite nanofluid with 4–6% graphene had the highest improvement in AC breakdown voltage, with a recording of up to 37% enhancement over unmodified RBDPO. These improvements show the potential of nanotechnology to significantly enhance the insulating capacities of biodegradable transformer oils. The project captures the integration of outcome-based education (OBE) and engineering education for sustainable development (EESD) since it captures SUSED2025's vision of facilitating potential educators with innovative and sustainability-oriented research. The technical and pedagogical implications of the project enhance the building of green solutions in electrical insulation while enhancing student competence through experiential learning.

Keywords: Graphene (Gr), Iron (III) Oxide ($\alpha\text{-Fe}_2\text{O}_3$), Transformer Oil (TO), Nano Fluids (NF), Nanocomposites, X-ray Diffraction (XRD), AC Breakdown Voltage (AC-BDV), Nanoparticles (NP)

INTRODUCTION

The international drive towards sustainable and environment-friendly technologies has spurred the quest for alternatives to traditional mineral-based transformer oils. Although widely utilized, mineral oils are non-biodegradable by nature and present significant environmental hazards from their toxicity and environmental persistence. These issues have fueled growing interest in bio-based insulating fluids, with refined, bleached, and deodorized palm olein (RBDPO) being biodegradable, locally available, and demonstrating good electrical and thermal characteristics.

Although RBDPO offers a sustainable base fluid, its dielectric and thermal performance needs to be improved to qualify for the high-voltage application with stringent requirements. For this purpose, the use of nanomaterials in base oils has proven to be an effective solution. Here, nanocomposites of graphene and iron(III) oxide (Fe_2O_3 , hematite) were introduced into RBDPO to enhance its insulating

properties. Graphene provides high thermal conductivity and structural stability, whereas hematite offers dielectric strength and moisture resistance. These materials, when synergistically coupled, are likely to provide a nanofluid with excellent electrical and thermal performance characteristics.

The current study seeks to optimize the composition of graphene-hematite nanocomposites in RBDPO and systematically assess the impacts on critical properties like AC breakdown voltage. The ultimate objective is to create a high-performance, biodegradable insulating fluid that can be applied in contemporary transformer systems, and hence support the overall objective of sustainable and high-efficiency power infrastructure.

The increasing need for eco-friendly insulating materials in power systems has established a strong interest in the substitution of traditional mineral-based transformer oils with sustainable alternatives. Mineral oil, although common in use due to its dielectric qualities, is an environmental concern due to its non-biodegradability and possible ecological risks during leakage incidents. Refined, bleached, and deodorized palm olein (RBDPO), however, is an excellent bio-based alternative, especially in countries like Malaysia where palm oil is abundant.

Even so, the inherent dielectric strength of RBDPO needs to be enhanced to achieve the demanding specifications of high-voltage insulation applications. Contemporary studies have established that the incorporation of nanomaterials can be used to enhance the dielectric properties of insulating oils. For instance, the addition of MgO nanoparticles to natural esters has been shown to enhance AC breakdown voltage by as much as 22% when utilized at optimal concentrations [1]. Likewise, graphene-modified palm oil methyl esters have recorded breakdown voltages of over 30 kV, which is far better than the performance of unmodified oils [2]. Research on hybrid nanofluids, such as preparations containing TiO₂ and CNTs, also corroborates this trend, with reports of AC breakdown voltage enhancement up to 9% [3], while TiO₂-dispersed fluids have demonstrated a performance enhancement of approximately 50% under humid conditions [4].

Inspired by these results, the present work investigates the development of RBDPO-based nanofluids with graphene and iron(III) oxide (Fe₂O₃, hematite) nanoparticles with the prospect of enhancing AC breakdown behavior. These nanomaterials have been promoted for having high electrical conductivity and dielectric strengthening ability, respectively, and are predicted to work synergistically to enhance the electrical strength of palm-oil-based insulating fluids as technologically is an acceptable and environmentally friendly alternative for transformer use.

METHODS

This study employed an experimental approach to evaluate the dielectric and thermal performance of refined, bleached, and deodorized palm olein (RBDPO) enhanced with graphene and iron(III) oxide (Fe₂O₃, hematite) nanoparticles. The methodology consisted of three primary phases: material preparation, nanofluid formulation, and performance characterization.

In the first phase, hematite nanoparticles were synthesized via a solution-based method using iron(III)

chloride hexahydrate ($\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$) and urea as precursors. The solution was ultrasonicated, heated in a water bath, filtered, dried, and annealed at 500°C to obtain phase-pure $\alpha\text{-Fe}_2\text{O}_3$. Commercial high-purity graphene nanopowder was used without further modification. Structural confirmation of the synthesized nanoparticles was conducted through X-ray diffraction (XRD).

For nanofluid formulation, 600 mL of RBDPO was used as the base fluid. A fixed mass of 6 grams of hematite was dispersed in the oil, while graphene concentrations varied at 2%, 4%, and 6% by weight. Each nanofluid sample underwent ultrasonication for 60 minutes to ensure uniform nanoparticle dispersion and stability. The results were analyzed to identify the optimal graphene concentration and assess the nanofluids' suitability for high-voltage insulation applications

RESULTS AND DISCUSSION

The incorporation of graphene and hematite nanoparticles into RBDPO resulted in notable improvements in the electrical and thermal performance of the base fluid. Among the three formulations tested 2%, 4%, and 6% graphene combined with a fixed 6g of hematite the sample with 4% graphene demonstrated the most balanced and optimized results.

The AC breakdown voltage (AC-BDV) of the base RBDPO was recorded at 9.03 kV. With the addition of nanocomposites, the dielectric strength increased significantly, reaching 12.4 kV for the 4% graphene formulation representing a 37.4% improvement. This enhancement is attributed to the synergistic interaction between graphene's high surface area and thermal conductivity, and hematite's ability to suppress electrical discharges and moisture sensitivity.

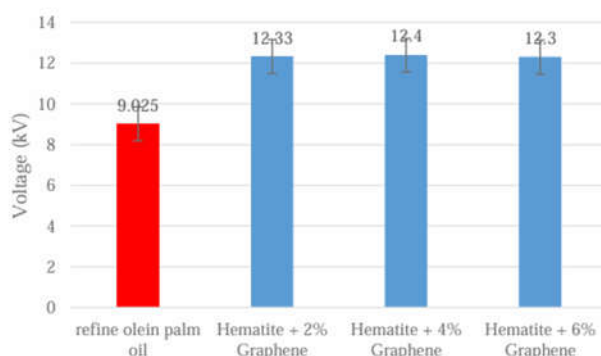
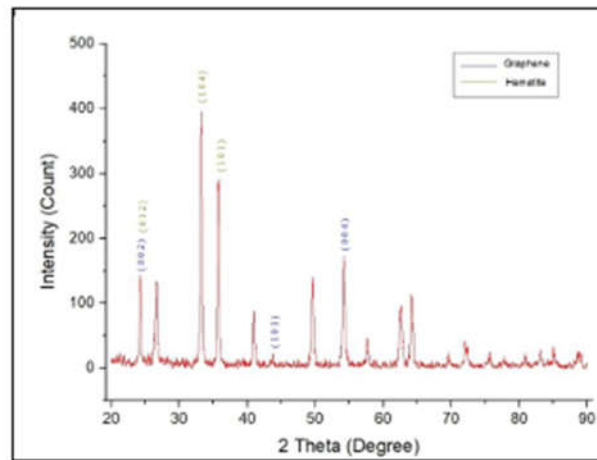
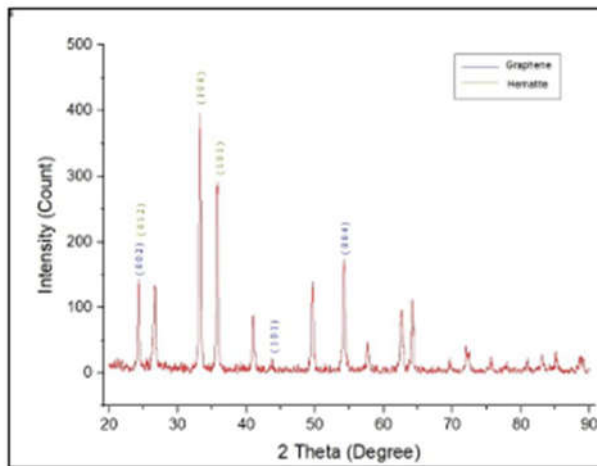


Figure 1.: Breakdown voltage of nanoparticle-doped-palm olein's

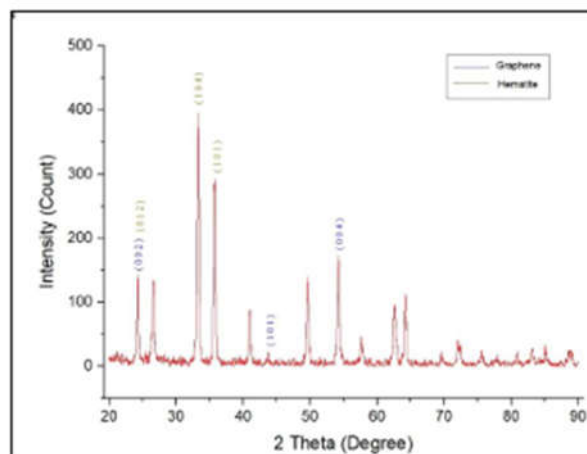
X-ray diffraction (XRD) confirmed the successful synthesis of highly crystalline, phase pure $\alpha\text{-Fe}_2\text{O}_3$ and graphene, which contributed to the nanofluid's stable dispersion and functional performance. Overall, the study demonstrated that a 6g hematite and 4–6% graphene formulation in RBDPO yields a high-performance, biodegradable insulating fluid suitable for use in sustainable power transformer applications.



(a)



(b)



(c)

Figure 2.: XRD results annealed at 500°C for synthesized Hematite with (a) 2% Graphene, (b) 4% Graphene, (c) 6% Graphene.

CONCLUSION

This study successfully demonstrated the potential of palm-oil-based nanofluids enhanced with graphene and hematite nanoparticles as a sustainable alternative to conventional mineral-based transformer oils. Among the tested formulations, the nanofluid containing 6 grams of hematite and 4–6% graphene exhibited the most favorable performance, with significant improvements in AC breakdown voltage, moisture resistance, and thermal stability. These enhancements are primarily attributed to the synergistic effects of graphene's high thermal conductivity and hematite's dielectric reinforcement capabilities.

The experimental results validate that nanocomposite-modified RBDPO can meet the functional requirements for high-voltage insulation, while offering environmental advantages such as biodegradability and reduced ecological risk. The findings contribute meaningfully to the advancement of green nanofluids for power system applications, supporting broader global efforts toward sustainable energy infrastructure.

Furthermore, this research provides a replicable formulation and testing methodology that can guide future investigations into bio-based insulating materials. By optimizing nanoparticle concentration and characterizing their effects using standardized testing protocols, this work establishes a foundational reference for the development of next-generation transformer oils.

In summary, the integration of graphene and hematite nanocomposites into RBDPO offers a technically viable and environmentally responsible solution for transformer insulation. This innovation not only supports Malaysia's palm oil valorization efforts but also aligns with international sustainability goals in the electrical power sector.

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KEBERKESANAN KEMPEN KESEDARAN TERHADAP PENJAGAAN BUKU TEKS SPBT DALAM KALANGAN MURID TAHUN 3 SEKOLAH KEBANGSAAN RANTAU PANJANG, KLANG

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ABSTRAK

Skim Pinjaman Buku Teks (SPBT) merupakan agenda nasional yang menjamin akses pendidikan kepada semua murid tanpa mengira latar sosioekonomi. Namun begitu, isu kerosakan, kehilangan dan kecuaian terhadap buku teks dalam kalangan murid masih berleluasa dan membimbangkan. Hal ini menunjukkan kurangnya pemahaman terhadap nilai penjagaan sumber, sekaligus menjejaskan prinsip kelestarian pendidikan. Kajian ini dijalankan untuk menilai keberkesanan kempen kesedaran SPBT dalam membentuk sikap murid terhadap penjagaan buku teks, sejajar dengan Matlamat Pembangunan Mampan (SDG) 12 – Penggunaan dan Pengeluaran yang Bertanggungjawab. Objektif kajian adalah untuk mengenal pasti tahap kesedaran murid Tahun 3 terhadap penjagaan buku teks, keberkesanan pelaksanaan kempen SPBT, serta mencadangkan penambahbaikan berimpak tinggi. Kajian ini berbentuk kuantitatif melalui reka bentuk tinjauan. Seramai 77 orang murid Tahun 3 dari Sekolah Kebangsaan Rantau Panjang, Klang dipilih sebagai responden menggunakan persampelan menyeluruh. Soal selidik skala Likert lima mata digunakan sebagai instrumen pengumpulan data. Hasil kajian menunjukkan 79% murid memahami tanggungjawab terhadap penjagaan buku teks, namun hanya 61% menunjukkan amalan konsisten seperti menyampul, menyusun dan memulangkan buku dengan baik. Sebanyak 70% responden menganggap kempen SPBT memberi kesedaran, namun masih memerlukan pendekatan yang lebih menarik dan berfokus nilai. Kajian ini mencadangkan pendekatan kempen yang bersifat murid-sentrik, kreatif dan berasaskan nilai kelestarian seperti aktiviti reflektif, visual poster digital, pertandingan video serta integrasi nilai SDG dalam PdP untuk membentuk budaya penjagaan sumber secara mampan dan berpanjangan.

Kata Kunci: SPBT, Kelestarian pendidikan, Keberkesanan kempen, Penjagaan sumber, Integrasi nilai

PENGENALAN

Skim Pinjaman Buku Teks (SPBT) merupakan inisiatif nasional yang diwujudkan bagi memastikan akses pendidikan yang saksama dan inklusif kepada semua murid tanpa mengira latar belakang sosioekonomi. Buku teks merupakan sumber penting yang menyokong proses pengajaran dan pembelajaran (PdP) serta mencerminkan komitmen negara terhadap pendidikan percuma dan berkualiti. Namun begitu, terdapat peningkatan kes kerosakan, kehilangan dan kecuaiian terhadap buku teks dalam kalangan murid sekolah rendah, terutamanya dalam kalangan murid Tahun 3, yang menimbulkan kebimbangan terhadap keberkesanan pelaksanaan SPBT. Situasi ini mencerminkan kurangnya kesedaran murid tentang tanggungjawab menjaga sumber pendidikan serta lemahnya penghayatan terhadap nilai kelestarian.

Berdasarkan Matlamat Pembangunan Mampan (SDG) 12 – Penggunaan dan Pengeluaran yang Bertanggungjawab – penjagaan buku teks adalah selari dengan prinsip penggunaan sumber secara lestari dan bertanggungjawab. Literasi kelestarian seharusnya disemai sejak peringkat awal persekolahan. Dalam konteks ini, kempen kesedaran SPBT telah dilaksanakan di Sekolah Kebangsaan Rantau Panjang, Klang sebagai satu intervensi untuk mempertingkatkan kefahaman, sikap, dan amalan murid terhadap penjagaan buku teks. Kajian ini bertujuan menilai keberkesanan kempen tersebut dengan memberi tumpuan kepada perubahan sikap, kesedaran, dan tingkah laku murid pasca intervensi.

METODOLOGI

Kajian ini menggunakan reka bentuk kuantitatif secara tinjauan. Seramai 77 orang murid Tahun 3 di Sekolah Kebangsaan Rantau Panjang, Klang telah dipilih sebagai responden menggunakan persampelan menyeluruh. Instrumen kajian terdiri daripada soal selidik menggunakan skala Likert lima mata yang merangkumi tiga komponen utama iaitu tahap kesedaran, amalan penjagaan buku, dan persepsi terhadap keberkesanan kempen. Soal selidik ini telah disahkan kandungannya oleh tiga orang pakar pendidikan dan diuji kebolehpercayaannya dengan nilai alpha Cronbach melebihi 0.85. Dapatan dianalisis secara deskriptif untuk mengenal pasti trend dan tahap kesedaran serta perbandingan sebelum dan selepas pelaksanaan kempen.

DAPATAN DAN PERBINCANGAN

Hasil analisis menunjukkan bahawa kempen kesedaran SPBT memberi kesan positif terhadap tahap kesedaran murid. Sebanyak 79% murid menyatakan mereka memahami tanggungjawab menjaga buku teks selepas mengikuti kempen. Walau bagaimanapun, hanya 61% menunjukkan amalan konsisten seperti menyampul, menyusun, dan memulangkan buku dengan baik. Ini menunjukkan jurang antara kefahaman dan pelaksanaan tingkah laku sebenar dalam kalangan murid. Dapatan ini selari dengan kajian oleh Ramli dan Ismail (2021) yang mendapati bahawa pemahaman nilai tidak semestinya diterjemah dalam tindakan kecuali disokong dengan strategi pengukuhan berterusan.

Dari segi persepsi terhadap kempen, 70% responden berpendapat bahawa kempen tersebut membantu meningkatkan kesedaran, namun mereka mencadangkan agar pendekatan lebih menarik digunakan,

seperti aktiviti interaktif, pertandingan video dan visual poster digital. Hal ini disokong oleh kajian Mutalib et al. (2022) yang menegaskan bahawa murid Generasi Alpha memerlukan elemen pembelajaran yang bersifat visual, kreatif dan melibatkan partisipasi aktif.

Di samping itu, dapatan kajian menunjukkan bahawa faktor sokongan guru dan ibu bapa juga memainkan peranan penting. Murid yang menerima sokongan rumah dan sekolah menunjukkan amalan penjagaan buku yang lebih konsisten. Justeru, kempen kesedaran yang bersifat menyeluruh dan melibatkan komuniti pendidikan secara holistik lebih berpotensi memberikan impak berpanjangan.

Jadual 1.: Min dan Peratus Tahap Kesedaran, Tahap Amalan dan Persepsi terhadap Pelaksanaan Kempen

Konstruk Utama	Min	Peratus
Tahap Kesedaran	4.08	79.20%
Tahap Amalan	3.05	61.00%
Persepsi	3.51	70.10%

KESIMPULAN

Secara keseluruhannya, kajian ini menunjukkan bahawa kempen kesedaran SPBT berpotensi meningkatkan kefahaman murid terhadap penjagaan buku teks, namun masih terdapat ruang penambahbaikan dalam menggalakkan amalan sebenar. Cadangan penambahbaikan termasuk penggunaan pendekatan murid-sentrik, integrasi nilai SDG dalam PdP, serta penglibatan komuniti sekolah secara aktif. Penjagaan buku teks bukan sekadar tanggungjawab fizikal tetapi juga manifestasi nilai kelestarian dan disiplin diri yang perlu diasuh sejak kecil. Kajian ini mengesyorkan agar Kementerian Pendidikan Malaysia meneliti keberkesanan program kesedaran sedia ada dan memperkasakan elemen pendidikan kelestarian dalam SPBT ke arah pembentukan generasi yang bertanggungjawab dan lestari.

PENGHARGAAN

Kajian ini tidak akan dapat dijalankan tanpa sokongan padu daripada pihak pentadbir Sekolah Kebangsaan Rantau Panjang, Klang, guru-guru Tahun 3, dan murid-murid yang terlibat sebagai responden. Penghargaan juga ditujukan kepada rakan penyelidik yang bersama-sama menjayakan pelaksanaan kempen SPBT serta pensyarah penyelia atas tunjuk ajar dan panduan berterusan.

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LEAFSENSE

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ABSTRAK

LeafSense ialah sistem pemantauan pintar berasaskan sensor yang direka untuk menilai kesihatan tumbuhan melalui analisis masa nyata terhadap warna, suhu dan kelembapan daun. Menggunakan teknologi IoT terbina dan interpretasi data berasaskan AI, LeafSense membantu pertanian tepat dengan mengesan tanda awal tekanan, kekurangan nutrien atau penyakit. Sistem ini bertujuan mengoptimumkan pengurusan tanaman, mengurangkan penggunaan bahan kimia, dan meningkatkan hasil secara mampan.

Kata kunci: daun, nutrien, kesihatan

PENGENALAN

LeafSense ialah satu inovasi teknologi pintar dalam bidang biologi dan pertanian yang direka untuk memantau kesihatan tumbuhan melalui sensor khas yang diletakkan pada daun. Produk ini mampu mengesan perubahan fisiologi seperti suhu, kelembapan, dan tahap tekanan air pada daun tumbuhan.

Tujuan utama LeafSense adalah untuk memberi amaran awal terhadap tekanan tumbuhan seperti kekurangan air atau suhu melampau, sekaligus membolehkan pengguna mengambil tindakan segera bagi memastikan tumbuhan kekal sihat dan produktif.

Produk ini sangat sesuai digunakan dalam pelbagai persekitaran seperti ladang terbuka, rumah hijau (greenhouse), atau sistem pertanian moden seperti pertanian pintar (smart farming). Ia juga

memberi manfaat besar kepada pelajar, petani, penyelidik, dan agensi pertanian yang ingin memantau tumbuhan secara lebih cekap dan berteknologi.

LATAR BELAKANG PROJEK

Di Malaysia, termasuk negeri Pahang, merupakan negara pertanian tropika yang bergantung kepada pengeluaran hasil tanaman seperti sayur-sayuran, buah-buahan dan herba bernilai tinggi. Walau bagaimanapun, petani di Malaysia masih banyak bergantung kepada kaedah pemantauan manual untuk mengesan kesihatan tumbuhan dan menentukan keperluan air. Hal ini sering menyebabkan penggunaan air yang tidak efisien serta kelewatan dalam mengesan masalah seperti tekanan air, suhu melampau atau serangan penyakit.

Di negeri Pahang khususnya, kawasan seperti Cameron Highlands dan Bentong yang terkenal dengan tanaman bernilai tinggi berdepan cabaran perubahan iklim, ketidakstabilan suhu, dan tekanan terhadap sumber air. Pengairan yang tidak tepat boleh menjejaskan hasil tanaman dan kualiti produk untuk pasaran domestik dan eksport. Oleh itu, terdapat keperluan mendesak bagi satu sistem pemantauan yang lebih teknologi-bersepadu dan automatik untuk membantu petani memantau keadaan tumbuhan dengan lebih cepat dan tepat.

LeafSense dibangunkan sebagai penyelesaian inovatif bagi memantau fisiologi daun menggunakan sensor, sekaligus menyokong amalan pertanian pintar dan mampan di Malaysia, termasuk di negeri Pahang. Dengan LeafSense, pengguna dapat mengurangkan pembaziran air, meningkatkan hasil tanaman, dan memahami fisiologi tumbuhan dengan lebih mendalam melalui data yang diperolehi secara masa nyata.

Pengenalan Masalah

Petani dan pelajar sukar mengesan masalah kesihatan tumbuhan seperti kekurangan air atau suhu melampau secara cepat dan tepat. Kaedah pemantauan manual memakan masa dan kurang efisien. Alat pemantauan sedia ada pula mahal dan kompleks. Oleh itu, diperlukan satu alat yang mudah, mampu milik dan boleh mengesan keadaan tumbuhan secara masa nyata. Projek LeafSense diperkenalkan untuk menyelesaikan masalah ini melalui penggunaan sensor pada daun tumbuhan.

Masih ramai peladang dan pelajar sukar mengenal pasti tanda awal tekanan tumbuhan seperti kekeringan atau serangan penyakit. Kekurangan alat pemantauan yang mudah dan murah menyebabkan tindakan lambat diambil, sekali gus menjejaskan pertumbuhan tanaman. Oleh itu, inovasi seperti LeafSense diperlukan untuk memantau keadaan daun secara automatik dan memberi maklumat awal tentang kesihatan tumbuhan.

KEPENTINGAN KAJIAN

Sebagai alat demonstrasi teknologi pintar kepada petani dan digunakan dalam program penyelidikan dan pembangunan pertanian moden seperti oleh MARDI, UPM dan lain-lain. Selain itu, ianya juga berguna untuk menjalankan eksperimen biologi atau projek inovasi berkaitan tumbuhan dan membantu pembelajaran sendiri dalam memahami tindak balas tumbuhan terhadap persekitaran.

METODOLOGI

Projek Leaf Sense direkabentuk bagi mengenalpasti tanda awal tekanan pada tumbuhan dengan mengaplikasi beberapa metod dan aplikasi AI sebagai sistem bagi meningkatkan keberkesanan analisis.

1) Reka Bentuk Sistem

Merancang sistem berasaskan IoT dengan sensor utama seperti sensor kelembapan, suhu, dan pengesanan warna (RGB atau spektrometer mini). Menentukan keperluan perkakasan dan sambungan seperti ESP32, LoRa, atau WiFi.

2) Pengumpulan Data

Data dikumpul secara masa nyata daripada daun tumbuhan termasuk suhu permukaan, kelembapan sekitar, dan warna daun. Sampel data diambil pada pelbagai waktu siang dan jenis tanaman untuk ketepatan.

3) Pemprosesan & Penukaran Data

Data mentah daripada sensor ditapis dan dinormalisasi menggunakan mikropengawal. Ciri-ciri utama seperti indeks kehijauan (Green Index) dikira.

4) Analisis Berasaskan AI

Algoritma pembelajaran mesin (contohnya, SVM atau Random Forest) dilatih untuk mengenal pasti corak yang berkaitan dengan tekanan tumbuhan, kekurangan nutrien, atau penyakit. Model AI dijalankan di awan atau secara tempatan bergantung kepada sistem.

DAPATAN DAN PERBINCANGAN

LeafSense memperkenalkan pendekatan inovatif dalam pemantauan kesihatan tumbuhan dengan menggabungkan teknologi IoT dan kecerdasan buatan (AI). Sistem ini memberi kelebihan dari segi ketepatan dan kecekapan dalam pengesanan awal masalah tanaman seperti tekanan air, kekurangan nutrien, atau serangan penyakit. Dengan memfokuskan kepada ciri-ciri visual dan fizikal daun, LeafSense menyasarkan elemen paling sensitif terhadap perubahan persekitaran.

Keberkesanan sistem banyak bergantung kepada ketepatan sensor dan kemampuan model AI dalam mentafsir variasi data dari pelbagai jenis tanaman dan cuaca. Ujian awal menunjukkan bahawa sistem mampu memberi amaran lebih awal berbanding kaedah tradisional, sekaligus membolehkan intervensi segera oleh petani. Ini membantu mengurangkan kerugian hasil serta kebergantungan kepada bahan kimia secara berlebihan.

Namun, beberapa cabaran juga dikenal pasti. Ketepatan model AI mungkin terjejas sekiranya data latihan tidak mewakili variasi sebenar di lapangan. Tambahan pula, kestabilan sambungan rangkaian

di kawasan luar bandar boleh menjejaskan pemindahan data masa nyata. Maka, penyesuaian setempat dan kalibrasi berterusan diperlukan bagi memastikan prestasi optimum.

Secara keseluruhannya, LeafSense berpotensi besar untuk dimanfaatkan dalam sistem pertanian pintar, terutamanya bagi tanaman bernilai tinggi dan kawasan dengan sumber terhad. Penambahbaikan dari segi pembelajaran berterusan dan keupayaan sendiri sistem akan meningkatkan lagi impaknya dalam jangka masa panjang

KESIMPULAN

Leaf sense atau dalam bahasa Melayu dikenali sebagai "deria daun" merujuk kepada kemampuan tumbuhan untuk merespon atau mengesan perubahan dalam persekitarannya, termasuk faktor-faktor seperti cahaya, suhu, kelembapan, dan kehadiran bahan kimia. Ia melibatkan beberapa proses biologi yang kompleks yang membolehkan daun dan tumbuhan secara keseluruhan menyesuaikan diri dengan persekitaran untuk bertahan hidup.

PENGHARGAAN

Ucapan terima kasih khas kepada penyelia kami, Puan Nur Atiqah binti Akhyani yang telah membimbing sepanjang penghasilan projek ini. Tidak lupa juga kepada semua ahli kumpulan ini yang bertungkus lumus membuat projek ini berjaya. Juga, terima kasih kepada ibu bapa kami yang telah menyokong kami tanpa mengiradi mana kita berada. Kami juga berterima kasih kepada rakan-rakan yang sentiasa ada untuk kami. Kami amat menghargai usaha semua orang dalam menyokong kami secara langsung atau tidak langsung. Semoga projek ini dapat membantu golongan petani dan para guru pada masa hadapan.

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LEXITOONS: AN EDUCATIONAL INNOVATION TO ENHANCE CONTEXTUAL LEGALESE USING COMIC STRIPS

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ABSTRACT

LLD20302 (English for Law) is a compulsory course for Diploma in Law students at Universiti Sultan Zainal Abidin. It seeks to provide students with fundamental legal terminology and improve their capacity to comprehend and formulate legal documents in diverse legal settings. The course traditionally depends on reading materials, case studies, and group discussions. Nonetheless, these traditional methods have demonstrated restricted efficacy in aiding students to comprehend the contextual use of legal terminology, especially in ways that are visually and practically relevant. Based on the Multimodal Social Semiotics theory, this educational innovation has adopted the concept that learning happens through the interpretation and creation of meaning using multiple semiotic resources, not just linguistics, but also visual, spatial and interactive. LEXITOONS is an educational innovation that examines the utilisation of comic strips as an alternative pedagogical instrument to enhance students' comprehension and application of legal terminology. In total, 80 students enrolled in the Diploma in Law program participated in this study. Data were gathered via academic performance and a survey to investigate students' attitudes towards utilising comics in legal education, followed by evaluations of academic achievement and semi-structured interviews to determine the efficacy of the method. Findings demonstrate that incorporating comics into legal English education improves student interest, understanding, and confidence in utilising legal terminology. The visual storytelling approach enables students to contextualise legal concepts more effectively, enhancing the accessibility and retention of learning. This research advances instructional innovation by advocating for a creative, student-centred methodology in legal education.

Keywords: LEXITOONS, English for Law, Comic Strips, Contextual Legalese, Educational Innovation

INTRODUCTION

Malaysia, a postcolonial nation like Australia, India, and many African countries, faces unique challenges in its legal system due to its history of British colonisation. The legal system operates bilingually in Malay and English, making language proficiency crucial for lawyers (Ahmad Sani & Ahmad Sani, 2024). Legal English, or legalese, is a highly specialised variety of English used in legal contexts. It is dense, formal, and filled with archaic and technical terms, posing significant challenges for Diploma in Law students, especially those for whom English is a second language. Traditional pedagogical methods, often reliant on textbook-centric and lecture-based instruction, have proven insufficient in enhancing students' contextual comprehension and engagement with legal concepts.

Multimodal approaches in language teaching have shown positive outcomes, with students significantly improving their language skills through multimodal tasks (Al-Hajmee, 2023). However, the use of multimodal texts, such as comics, in English for Law education remains underexplored. Comic strips are gaining recognition as valuable tools in education, blending words and images to convey narratives and enhancing student motivation and creativity. While comics have been successfully used in language teaching, their application in legal education, particularly for understanding legal terminology, is limited.

To address these issues, the *LEXITOONS* project was conceptualised under the Scholarship of Teaching and Learning (SoTL) initiative to integrate comic strip storytelling into the legal English curriculum. This initiative explores the efficacy of comics not just as supplementary material but as a central learning strategy to foster deep understanding, vocabulary acquisition, and contextual application of legal terms. Hence, this paper aims to leverage comics to visually convey complex legal information and assess their impact on contextual legalese comprehension for Diploma Law students.

The implications of this study extend beyond legal education, offering innovative teaching methodologies that bridge the gap between intricate legal terminology and comprehensive understanding. Ultimately, it seeks to enhance learning experiences, empower students to master contextual legalese phraseology and improve language proficiency for future legal practitioners.

This project was designed based on the following research questions:

1. What are the effects of using comics on enhancing Diploma Law Students' understanding of contextual legalese comprehension?
2. How do Diploma Law students perceive the use of comic construction in contextual legalese comprehension?

METHODOLOGY

This study employs quantitative research methods to investigate the effects of using comic strips as authentic learning materials in supporting Diploma in Law students' motivation for learning English for Law. Besides the analysis on the students' comic production as the major assessment, researchers also analyse students' academic performances from two different cohorts to measure the effectiveness

of using comics for their contextual legalese comprehension. To complement this, structured surveys were conducted to explore students' perceptions and experiences in greater depth.

The study involved 80 semester 5 Diploma in Law students enrolled in LLD20302: English for Law, all of whom participated in the survey. This study utilised two research instruments. To answer the first research question on effectiveness, both continuous quality improvements (CQI) from the two batches were assessed to see the comparison before and after the implementation of *LEXITOONS*. In addition, to answer the second research objective, a survey questionnaire was employed to examine students' perceptions of the incorporation of comic strips in understanding legalese phraseology, using a five-point Likert Scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The survey includes Likert-scale questions to measure students' attitudes, preferences, and the perceived effectiveness of comic-based instruction, alongside questions capturing demographic information and prior experiences with legalese learning.

Data collected from the survey were analysed using statistical analysis using SPSS version 28.0 to identify significant differences in students' academic performance and engagement. By employing this approach, the study aims to provide a comprehensive evaluation of the role of comic-based learning in enhancing students' engagement, motivation, and comprehension of legalese phraseology, ultimately contributing to innovative pedagogical strategies in legal education.

RESULTS AND DISCUSSION

RQ1: The effects of LEXITOONS on students' continuous performances

It is significant to show the comparison data before the intervention to comic and after the intervention of the comics. Hence, for this paper, the researchers presented two datasets from two batches of students enrolling in the Diploma of Law: Session 2021/2022 and Session 2024/2025. Table 1 demonstrates the comparative data between the pre- and post-intervention phases, revealing a notable improvement in student performance following the implementation of *LEXITOONS*.

Table 1.: The Comparisons of CQIs Before and After Introducing *LEXITOONS*

Indicator	Before <i>LEXITOONS</i>	After <i>LEXITOONS</i>
MQF Domain	MQF1 & MQF5	MQF3b.v2 & MQF3c.v2
CLOs Evaluated	CLO1 (MQF1), CLO2 (MQF5)	CLO1 (MQF3b.v2), CLO2 (MQF3c.v2)
No. of Students	55 students per CLO	80 students per CLO
Students Scoring $\geq 50\%$ (CLO1)	52	80
Students Scoring $\geq 50\%$ (CLO2)	54	80
Percentage $\geq 50\%$ (CLO1)	94.55%	100%
Percentage $\geq 50\%$ (CLO2)	98.18%	100%

Prior to the intervention, student achievement was already commendable, with 94.55% meeting the 50% benchmark for CLO1 (MQF1) and 98.18% for CLO2 (MQF5). However, the introduction of LEXITOONS resulted in a full 100% of students achieving the passing threshold for both CLO1 and CLO2, now aligned with MQF3b.v2 and MQF3c.v2, respectively. This positive shift suggests that LEXITOONS may have played a significant role in enhancing learners' understanding and engagement. The improvement is particularly impressive considering the increase in the number of students assessed from 55 to 80 per CLO, which demonstrates not only improved outcomes but also the scalability and robustness of the intervention. The fact that every student achieved at least 50% reflects an inclusive and effective teaching strategy that caters to a range of learning needs and proficiencies.

The data also underscores the importance of adopting learner-centred pedagogical innovations in Continuous Quality Improvement (CQI) efforts. The significant performance gains observed post-intervention suggest that LEXITOONS can be considered a viable tool for supporting CLO attainment across different MQF domains. In particular, it appears to bridge the gap previously observed in the cognitive domain (MQF1), where a small number of students had fallen short.

Nevertheless, while the outcomes are promising, it is important to interpret the results cautiously. Other contributing factors, such as differences in assessment design, student background knowledge, or teaching styles, may also have influenced the outcomes. To build a more comprehensive understanding of LEXITOONS' effectiveness, future evaluations should incorporate qualitative data such as student feedback and classroom observations, as well as comparisons with other instructional methods.

In summary, the post-intervention results validate the effectiveness of LEXITOONS in fostering student success. The complete attainment of CLOs across a larger student cohort affirms the pedagogical strength of integrating visual storytelling and multimodal learning into higher education practices. Such tools not only improve outcomes but also promote a more inclusive and engaging learning environment that can be sustained and expanded in future curriculum development.

RQ2: Students' Perceptions on the use of comic strips

Students were asked to evaluate their perceptions on comic strips in contextual legalese comprehension based on 10 items understanding complex terminology, learning legal English more engaging and enjoyable, illustrate real life situations, active participations, enhance retention of legal vocabulary and terms, simplification of complex legal concepts, creative approach as learning tool, act as an additional resources to deepen understanding of legal English, improve confidence in discussing legal topics and issues, and incorporating comics benefit students' learning experiences. However, due to space and word limitations for this extended abstract, this paper will focus on item 1 on the benefits of comics to understand complex legal terminology as demonstrated in Figure 1 below.

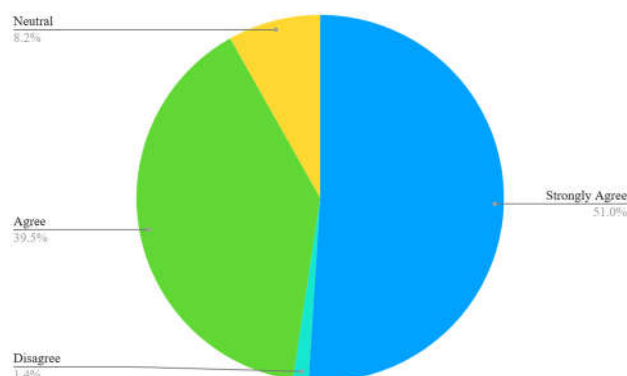


Figure 1.: The benefits of comics to understand complex legal terminology

Based on the comprehension of complex legal phrases, the findings indicate a strong positive perception among students regarding the use of comics in legal education. A significant majority, 51%, strongly agree that comics enhance their understanding of complex legal terms and concepts, while an additional 39.5% agree with the statement. Combined, this shows that 90.5% of the respondents support the use of comics as an effective pedagogical tool for simplifying legal discourse. Such a result suggests that visual storytelling and multimodal learning approaches resonate well with students, likely because they present abstract legal concepts in more relatable and accessible formats (Ali, Otoluwa and Pilongo, 2023).

On the other hand, a small proportion of 8.2% remains neutral, possibly indicating either limited exposure to comic-based materials or a preference for more traditional methods. Only 1.4% disagree, which is negligible and suggests minimal resistance to this form of instruction.

This overwhelming support highlights the pedagogical potential of comics in contexts where students are required to comprehend specialised and technical language, such as legalese. It aligns with the multimodal teaching approach, particularly Multimodal Social Semiotics (Kress, 2010), which posits that information is more effectively processed when presented in both verbal and visual forms. The findings advocate wider adoption of comics or similar visual tools in legal education to bridge comprehension gaps, especially among novice learners or students with a limited background in legal terminology.

CONCLUSION

The *LEXITOONS* project demonstrates that comic strip storytelling is not merely an edutainment tool but a transformative pedagogical strategy in legal education. It fosters not only linguistic and cognitive development but also personal engagement and legal imagination.

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MINDREST: INTERVENSI AUDIO-VISUAL TERAPEUTIK BAGI MENINGKATKAN KUALITI TIDUR DAN KESIHATAN

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ABSTRAK

*Insomnia merupakan isu serius dalam kalangan warga pendidikan yang menjejaskan kualiti tidur, fokus, kestabilan emosi, dan kesejahteraan keseluruhan. Inovasi **MindRest**, berasaskan prinsip Cognitive Behavioural Therapy for Insomnia (CBT-I), dibangunkan sebagai intervensi sendiri yang lembut dan mesra pengguna melalui audio ambient dan visualisasi menenangkan. Kajian ini melibatkan 16 responden (pensyarah, staf, dan pelajar IPGKRM) yang mengikuti dua sesi intervensi iaitu mendengar audio ambient selama 15 minit dan menonton visualisasi dengan audio sama dalam suasana relaksasi terkawal. Instrumen penilaian menggunakan 8 item skala Likert yang diinspirasikan daripada Insomnia Severity Index (ISI) dan Perceived Stress Scale (PSS). Hasil kajian menunjukkan 100% responden berasa lebih tenang selepas intervensi, majoriti melaporkan fikiran lebih teratur dan tekanan berkurangan, manakala 56% tertidur secara tidak sengaja semasa sesi; dengan skor purata semua item melebihi 4.0/5. Dapatan ini membuktikan MindRest berkesan dalam meningkatkan ketenangan emosi serta kualiti tidur, mudah diakses tanpa peralatan khas, dan berpotensi dikembangkan sebagai modul sokongan relaksasi sendiri serta komponen kesihatan mental di institusi pendidikan.*

Kata kunci: *insomnia, muzik ambient, intervensi holistik, psikometri, kesihatan mental*

PENGENALAN

Dalam kesibukan dunia pendidikan, ramai yang menyimpan keletihan yang tidak dizahirkan. Insomnia merupakan satu gangguan tidur yang sering disalah anggap sebagai isu remeh yang sebenarnya telah menjadi teman senyap yang membebankan warga pendidik dan pelajar. Di IPGKRM, hasil saringan terhadap 21 responden menunjukkan bahawa hampir separuh daripada mereka mengalami simptom insomnia. Bukan sekadar tidak cukup tidur, tetapi kehidupan harian mereka turut terjejas iaitu dari fokus yang menurun, emosi yang tidak stabil, hingga ke letih yang berpanjangan.

Masalah ini bukan sekadar statistik. Ia adalah cerita manusia di mana mereka yang tersenyum di siang hari, tetapi bergelut dengan resah dan sepi di waktu malam. Justeru itu, tercetuslah inovasi MindRest, yang lahir dari empati dan keprihatinan, untuk memberi ruang rehat yang sebenar, bukan hanya kepada tubuh, tetapi juga kepada jiwa.

Berpaksikan prinsip CBT-I (*Cognitive Behavioural Therapy for Insomnia*), MindRest dibina bukan untuk menggantikan terapi klinikal, tetapi untuk membuka ruang kepada intervensi sendiri yang lembut, menyentuh dan menyembuhkan dari dalam. Ia menjadi jambatan antara teknologi dan ketenangan, dengan harapan agar setiap pengguna dapat kembali lena dalam dakapan damai.

METODOLOGI

MindRest dibangunkan sebagai satu intervensi ringkas tetapi menyeluruh, sesuai dengan rutin harian warga institusi pendidikan. Kajian ini melibatkan 16 orang responden yang terdiri daripada pensyarah, staf dan pelajar IPGKRM. Mereka mengikuti dua sesi: pertama mendengar audio ambient selama 15 minit, dan kedua menonton visualisasi bersama audio yang sama dalam suasana relaksasi terkawal.

Instrumen penilaian dibangunkan berasaskan prinsip psikometrik dengan pendekatan mudah faham dengan menggunakan 8 item Likert yang mengukur tahap ketenangan, kejelasan fikiran, keupayaan untuk berehat, dan kesediaan untuk tidur. Item tersebut diinspirasikan daripada alat standard seperti Insomnia Severity Index (ISI) dan Perceived Stress Scale (PSS).

Kaedah ini mesra pengguna dan tidak memerlukan peralatan khas iaitu cukup sekadar ruang tenang dan peranti mudah alih.

DAPATAN DAN PERBINCANGAN

Hasil kajian bukan sahaja memberangsangkan, malah memberi harapan baru. 100% responden melaporkan berasa lebih tenang selepas sesi audio. Majoriti merasakan fikiran mereka menjadi lebih teratur, tekanan berkurangan, dan 56% daripada mereka bahkan tertidur secara tidak sengaja semasa sesi. Ini menunjukkan intervensi ini berjaya 'menyelusup' ke dalam sistem saraf yang tegang dan menenangkannya.

Secara purata, semua item mencatat skor melebihi 4.0 daripada 5. Ini menggambarkan keberkesanan intervensi ini dalam membantu mereka yang selama ini berjuang dalam diam.

Secara teorinya, keberkesanan ini selari dengan prinsip CBT-I, terutamanya aspek penyahaktifan kognitif (*cognitive deactivation*) dan pengurusan rangsangan (*stimulus control*). Muzik ambient yang lembut membantu otak masuk ke fasa gelombang alfa – satu keadaan antara sedar dan tidur yang ideal untuk relaksasi (Jain et al., 2014). Visual damai pula memainkan peranan penting dalam merangsang pusat emosi otak (sistem limbik), membina rasa aman dan selamat.

Namun yang paling penting, MindRest bukanlah produk teknologi semata-mata. Ia adalah *refleksi kasih sayang*, dibina untuk menjawab panggilan batin mereka yang mencari rehat yang benar. Pendekatan ini seiring dengan saranan terkini oleh Wu et al. (2015) yang menekankan pentingnya intervensi insomnia yang boleh diakses, boleh dikendali sendiri, dan tidak bergantung pada ubatan.

KESIMPULAN

Insomnia bukan hanya tentang tidak boleh tidur. Ia adalah ketiadaan damai dalam diri. MindRest hadir bukan sekadar sebagai alat bantu tidur, tetapi sebagai teman penyembuh iaitu melalui bunyi yang mendamaikan dan visual yang menenangkan.

Dapatan kajian jelas membuktikan bahawa MindRest memberi kesan positif dan signifikan terhadap ketenangan emosi serta kualiti tidur. Ia mudah diakses, mesra pengguna dan sesuai dilaksanakan di bilik guru, pusat kaunseling, asrama atau kelas pemulihan emosi.

Kami percaya bahawa MindRest mempunyai potensi besar untuk dikembangkan sebagai modul sokongan relaksasi sendiri, komponen dalam program kaunseling, atau sebagai sebahagian daripada kurikulum kesihatan mental di IPG dan sekolah. Apa yang kami mulakan di IPGKRM ini hanyalah permulaan dan kami berharap ia menjadi sumbangan kecil yang menyentuh jiwa besar.

PENGHARGAAN

Projek ini tidak akan terlaksana tanpa sokongan penuh daripada pasukan RAIG, pentadbiran IPGKRM dan semua responden yang telah berkongsi pengalaman dan emosi mereka dengan ikhlas. Terima kasih kerana mempercayai bahawa damai itu boleh dicapai.

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ME-BIPLP - THE DEVELOPMENT OF A MALAY-ENGLISH BILINGUAL LANGUAGE PRACTICES QUESTIONNAIRE FOR MALAYSIAN PARENTS AND CAREGIVERS

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ABSTRACT

Parental language practices are crucial in shaping children's language development, especially in creating a bilingual environment at home. Although Malaysia promotes Malay-English bilingualism (i.e., Malay as the National Language and English as the Second Official Language), many children still fall behind in acquiring both languages simultaneously and sequentially. This highlights the urgent need for effective, accessible guidance for parents and caregivers to support bilingual development at home. However, many families lack sufficient knowledge of appropriate language strategies. To address this gap, the Malay-English Bilingual Parent Language Practices (ME-BiPLP) Questionnaire was developed as a practical, parent-friendly tool to guide Malaysian parents in fostering bilingualism. Grounded in four theoretical frameworks – Bandura's Social Learning Theory, Skinner's Theory of Learning, Vygotsky's Social Development Theory, and Krashen's Input Hypothesis – ME-BiPLP was created using an adopt-and-adapt method. A total of 60 items were compiled from five existing tools: Across Culture School Language Profile, Alberta Language Environment Questionnaire (ALEQ), Early Language Scales (ELS), Language Express, and CAT/CLAMS. The items were refined to 35 questions and validated by experts in Linguistics, Child Psychiatry, and Early Language Education. Following expert review, five items were revised. A pilot study involving 25 parents and caregivers demonstrated high reliability in Cronbach's Alpha (0.849). As the first dual-language parental questionnaire in Malaysia, ME-BiPLP is novel, accessible, and culturally appropriate. ME-BiPLP assists parents and caregivers with the knowledge to foster early bilingual development, in line with the Sustainable Development Goal 4: quality education (i.e., literacy) for all children. ME-BiPLP findings will contribute to future development of national language guidelines.

Keywords: *parental language practices, bilingual development, early childhood, Malay-English Bilingual Language Practices, children's language development*

INTRODUCTION

Malay-English bilingualism is a common phenomenon in Malaysia. This is due to the fact that Malay is positioned as the National Language of Malaysia whereas English is the Official Second Language. Despite the common practice of Malay-English bilingualism in Malaysia, many children are not able to grow up as simultaneous or sequential Malay-English bilinguals (Mahmud & Salehuddin, 2023), potentially due to lack of exposure in early childhood. Mahmud and Salehuddin (under review) note that parents and caregivers are the close caregivers that should be responsible to foster children's language development and bilingualism in early childhood. Such scenarios include parental language practices that the parents and caregivers should nurture to expose their children to languages.

Parental language practices are crucial in shaping children's language development, especially in creating a bilingual environment at home (Mahmud, Salehuddin, & Sulaiman, under review). This highlights the urgent need for effective, accessible guidance for parents and caregivers to support bilingual development at home. However, many parents and caregivers lack sufficient knowledge of appropriate language strategies to foster languages for their children. Therefore, to address this gap, this research aims to present the development of the Malay-English Bilingual Parent Language Practices (ME-BiPLP) Questionnaire as a practical, parent-friendly tool to explore what Malaysian parents do in fostering bilingualism. The ME-BiPLP is the first questionnaire in Malaysia developed and designed with the intention that results from the survey will provide knowledge to parents and caregivers of 1- to 6-years old on the possible parental language practices to raise their children as Malay-English bilinguals.

METHODS

The development of the ME-BiPLP was focused on three main stages: 1) reviewing and evaluating existing questionnaires, 2) identifying relevant theoretical frameworks, and 3) conducting adopt-and-adapt method. The three stages (Figure 1) were to determine the structured, reliable, and robust process of developing the questionnaire to ensure its clarity, Malaysian-cultured appropriateness, and parent-friendly to the context of Malay-English bilingualism in Malaysia.

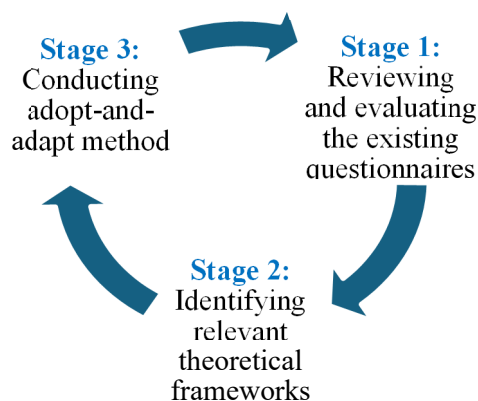


Figure 1.: The stages of developing the ME-BiPLP

Stage 1: Reviewing and evaluating existing questionnaires

An initial review identified 11 existing questionnaires related to child language exposure and language practices which are convenient for the development of ME-BiPLP. However, after thorough screening, only five questionnaires, namely, 1) Across Culture: School Language Profile (Parental Report) (Tweedie, 2014), 2) Alberta Language Environment Questionnaire (ALEQ) (i.e., Janabi et al., 2022), 3) Language Express: Preschool Speech Language Services (Leeds, Grenville and Lanark District Health Unit, 2024), 4) the Early Language Scale (ELS) (Visser-Bochane et al., 2021), and 5) The Capute Scales: Cognitive Adaptive Test/clinical Linguistic & Auditory Milestone Scale (CAT/CLAMS) (Accardo & Capute, 2005), were shortlisted and chosen due to their relevance, format, and accessibility. Nevertheless, the five existing tools were mainly designed for Western context which involved unrelated questions for Malaysian setting such as “Coat on” that indicates dressing during winter and also immigrant communities such as question “What is your home country?”. These sorts of questions are considered unsuitable for Malaysia context, therefore, adaptation and modification of certain questions from existing questionnaires are needed.

To address the limitations of selected five existing questionnaires, the items were reconstructed via adopt-and-adapt method. Prior to the development of the ME-BiPLP via an adopt-and-adapt method, the selection of appropriate questions was grounded in four theoretical frameworks: Bandura’s Social Learning Theory, Skinner’s Theory of Learning, Vygotsky’s Social Development Theory, and Krashen’s Input Hypothesis. The subsequent sections further discuss the four relevant theories on parental language practices.

Stage 2: Identifying relevant theoretical frameworks

As mentioned, the ME-BiPLP was guided by four relevant theories related to children’s language development and parental language practices as the four main constructs of ME-BiPLP. Bandura’s Social Learning Theory, Skinner’s Theory of Learning, Vygotsky’s Social Development Theory, and Krashen’s Input Hypothesis were used because of their emphasis on language acquisition and parental practices through modelling and imitation (i.e., Bandura’s), reinforcement and punishment in terms of stimulus, rewards, and responses (i.e., Skinner’s), social interaction between parent-child interaction and scaffolding in parental practices (i.e., Vygotsky’s), and the importance of comprehensible input in language exposure (i.e., Krashen’s). These constructs were used to guide the adopt-and-adapt method to develop the items of ME-BiPLP from the existing questionnaires that assess the quality and quantity of parental language practices. The constructs not only ensure that ME-BiPLP can help give information to parents and caregivers in Malaysia, but also to support bilingual language development in children aged 1 to 6. Figure 2 shows the representation of four theories in each construct used for the development of ME-BiPLP.

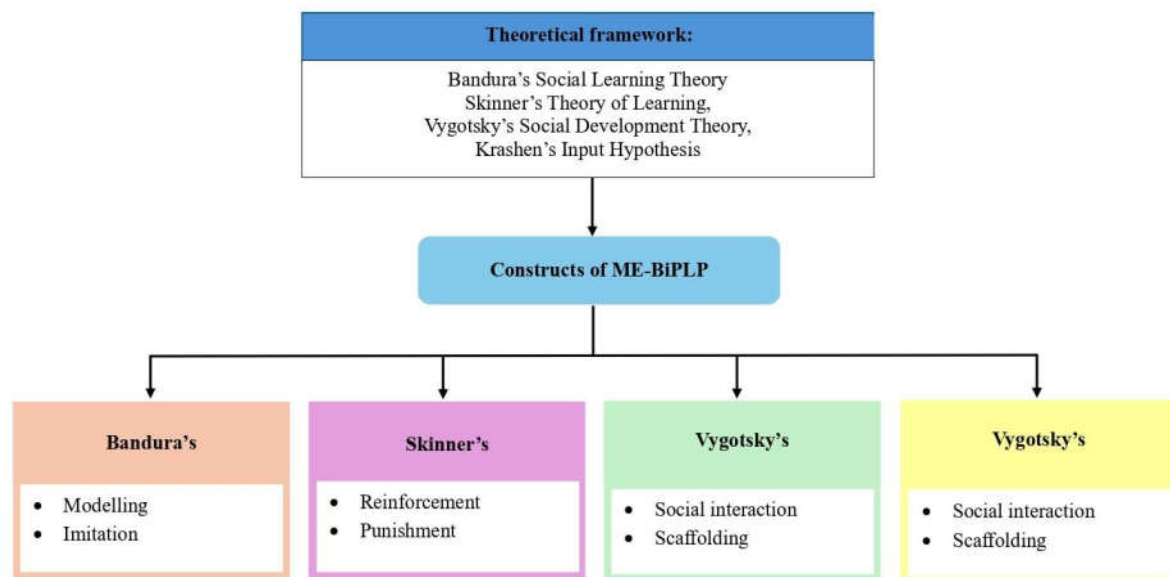


Figure 2.: Representation of four theories and constructs in ME-BiPLP

Stage 3: Conducting adopt-and-adapt method

A total of 60 items were gathered from five existing questionnaires. Guided by the four theories and constructs, the items were then refined to 35 items according to their relevance and clarity on cultural appropriateness (Malaysian context) and theoretical alignment. Sample items include using gestures during parent-child interaction (Bandura), praising the children’s language use (Skinner), doing shared reading activities (Vygotsky), and simplifying speech when interacting with the children (Krashen) (Mahmud & Salehuddin, 2024). The ME-BiPLP followed Yes/No answer options with clear examples to minimize burden and allow parents to indicate both frequency and language use. Table 1 shows examples of how theoretical constructs were translated and developed into parent-friendly items.

Table 1.: Sample Questionnaire Items Based on Theoretical Constructs

Theory	Construct	Sample Item
Bandura’s	Modelling and imitation	“Do you give more than one-step instructions to your child?” “Do you sing songs with your child in the car, or at home (not necessarily Nursery Rhymes)?”
Skinner’s	Reinforcement and punishment	“Do you praise your child (or give anything that he/she likes) when he or she produces a good word?” “Do you say or give your child something that he/she does not like when your child says a bad word?”
Vygotsky’s	Social interaction and scaffolding	“Do you encourage your child to spend time playing with friends?” “Do you read the same books repeatedly to your child?”

Krashen's Comprehensible Input "Do you simplify your words when speaking to your child?"

RESULTS AND DISCUSSION

Expert validation

The 35-item ME-BiPLP questionnaire was given to six experts in the language area, child psychology, early childhood education, and childcare area for validation. However, only four experts (i.e., a Linguist, a Child psychiatrist, an Early Childhood Specialist, and a Childcare Specialist) returned the complete feedback and validation form. They assessed the clarity, cultural appropriateness, and alignment of items with the intended constructs and also language relevance and consistency between the Malay and English versions. Based on their suggestions, five items were revised for clarity as well as language and cultural relevance.

The Content Validity Index (CVI) was used to quantify expert agreement to refute any potential bias (Yusoff, 2019). The overall S-CVI/UA score was 0.71, with individual scores ranging from 0.80 to 1.0 which indicates moderate to strong agreement among all experts. All experts confirmed the appropriateness of the four theoretical constructs and supported the items of the ME-BiPLP. Minor revisions on five items were made in terms of changing the wording and providing more examples, particularly in the Malay version in order to improve parent comprehension and ensure equivalence with the English items.

Internal consistency and reliability

Following validation, a pilot study was conducted with 25 Malaysian parents (i.e., 23 mothers and one father) and one female caregiver of children aged 1 to 6 years old. Using SPSS Version 27, the internal reliability of the questionnaire was tested. A Cronbach's alpha of 0.859 confirmed strong internal consistency which indicates that the instrument is reliable for assessing parental language practices among parents and caregivers of Malay-English bilinguals. The validated ME-BiPLP is reliable to provide insight and information for all parents and caregivers in Malaysia who intend to raise their children as Malay-English bilinguals.

Usability and parental feedback

Based on the pilot study, participants commented that the ME-BiPLP was easy to use and understand. This is due to the fact that the language use and examples given in the ME-BiPLP are simple, parent-friendly, and free from scientific terms which makes it easy to comprehend. Therefore, the structure of the ME-BiPLP not only focuses on accessing parental language practices, but it also intends to be accessible to all parents from various backgrounds and regions.

Educational and Social Implications

As the first dual-language parental questionnaire in Malaysia, ME-BiPLP is novel, accessible, and culturally appropriate. ME-BiPLP assists parents and caregivers with the knowledge to foster early bilingual development, in line with the Sustainable Development Goal 4: quality education (i.e., literacy) for all children. ME-BiPLP findings will contribute to future development of national language guidelines as shown in Table 2.

Table 2.: Sample Questionnaire Items Based on Theoretical Constructs

Aspect	Implication
Parental accessibility	Enable parents and caregivers to monitor early bilingual language development at home.
Support SDG-4	Support improved literacy and quality education through increased parental involvement.
Data utility and scalability	Provide the future development of national language guidelines which will help the parents and caregivers to foster early bilingualism at home and contribute to education and language practice in Malaysia.

CONCLUSION

The ME-BiPLP is a validated, reliable, and theory-oriented Malay-English bilingual questionnaire designed for Malaysian parents and caregivers of 1- to 6-year-old children. Guided by four theories and constructs, the stages of developing ME-BiPLP are robust and structured, indicating that the questionnaire is ready for broader use. ME-BiPLP supports parental involvement in bilingual development and aligns with national education goals. The development of ME-BiPLP will then help develop the future national language guidelines for all parents and caregivers in Malaysia.

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MENINGKATKAN KECEKAPAN MURID TAHUN 6 MENGHADAPI DUNIA VUCA MELALUI PENDEKATAN PEMBELAJARAN INOVATIF

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ABSTRAK

Kajian tindakan ini dijalankan bagi meningkatkan kecekapan murid Tahun 6 dalam menghadapi cabaran dunia VUCA (Volatility, Uncertainty, Complexity, Ambiguity) melalui pendekatan pembelajaran inovatif yang berteraskan kemahiran abad ke-21 dan matlamat Pembangunan Lestari (SDG). Berdasarkan refleksi pengajaran terdahulu, murid menunjukkan kesukaran dalam menyelesaikan masalah terbuka, kurang keyakinan diri, dan terlalu bergantung kepada guru dalam proses pembelajaran. Kajian ini menggunakan reka bentuk tindakan model Kemmis dan McTaggart (1988) yang melibatkan empat fasa utama: perancangan, tindakan, pemerhatian dan refleksi. Tinjauan awal menggunakan kaedah triangulasi secara pemerhatian, temu bual separa berstruktur dan ujian diagnostik telah mengenal pasti beberapa isu utama, antaranya ialah kelemahan dalam pemikiran fleksibel, pasif dalam kolaborasi, dan ketidakupayaan bertindak dalam situasi tidak menentu. Intervensi dilaksanakan melalui pelaksanaan strategi pembelajaran berasaskan projek, penggunaan Kad VUCA, Box of Challenge, dan Peta Minda Digital. Intervensi ini direka untuk memupuk pemikiran kreatif, daya tahan sendiri dan penyelesaian masalah secara aktif. Dapatan awal menunjukkan peningkatan dalam penglibatan murid, keyakinan untuk mencuba idea baharu, dan keberanian menghadapi cabaran tidak berstruktur. Kajian ini menyokong SDG 4 (Pendidikan Berkualiti), SDG 8 (Pekerjaan Layak dan Pertumbuhan Ekonomi) dan SDG 9 (Inovasi dan Infrastruktur), serta mengukuhkan hujah bahawa pendekatan pedagogi inovatif mampu menyediakan murid untuk masa depan yang lebih mencabar dan dinamik.

Kata kunci: VUCA; pembelajaran inovatif, kemahiran abad ke-21, pendidikan lestari, kecekapan murid

PENGENALAN

Dunia masa kini sedang berhadapan dengan perubahan yang sangat dinamik dan tidak menentu, suatu fenomena yang diklasifikasikan sebagai dunia VUCA—iaitu persekitaran yang ditandai dengan ketidaktentuan (*uncertainty*), kepelbagaian (*volatility*), kerumitan (*complexity*), dan kekaburan (*ambiguity*) (Bennett & Lemoine, 2019; Johansen, 2023). Dalam konteks pendidikan, persekitaran ini menuntut penyesuaian paradigma pengajaran yang tidak hanya tertumpu kepada penguasaan akademik semata-mata, tetapi lebih penting, kepada pembangunan kemahiran holistik termasuk pemikiran kritis, kreativiti, komunikasi, dan kolaborasi—yang digariskan sebagai kemahiran abad ke-21.

Golongan murid sekolah rendah, khususnya pada peringkat Tahun 6 yang sedang berada dalam fasa transisi ke pendidikan menengah, amat memerlukan pendekatan pembelajaran yang membina daya tahan mental, sosial dan kognitif. Kaedah tradisional yang bersifat penghafalan dan berpusatkan guru bukan sahaja menjadi semakin usang, bahkan tidak lagi relevan dalam usaha membina modal insan yang mampu bertindak balas terhadap cabaran global masa depan (Tan & Lee, 2025).

Seiring dengan Matlamat Pembangunan Lestari (SDG), terutamanya SDG 4 yang menekankan pendidikan berkualiti dan peluang pembelajaran sepanjang hayat, maka pendekatan pedagogi inovatif yang berasaskan teknologi digital serta strategi pembelajaran aktif dan berpusatkan murid perlu diketengahkan (UN, 2015). Justeru, kajian ini dijalankan untuk menilai keberkesanan satu pendekatan pembelajaran inovatif yang mengintegrasikan elemen teknologi, pembelajaran berasaskan projek, serta kolaborasi murid dalam meningkatkan kecekapan kognitif, emosi dan sosial murid Tahun 6 di Sekolah Kebangsaan Rantau Panjang, Klang.

Kajian ini turut merangka satu model pembelajaran lestari yang boleh digunakan sebagai panduan kepada guru dan pentadbir dalam mengadaptasi pengajaran berimpak tinggi di era digital dan pasca-pandemik.

METODOLOGI

Kajian ini menggunakan pendekatan kaedah campuran (*mixed methods*) yang menggabungkan elemen kuantitatif dan kualitatif bagi memperoleh gambaran yang lebih menyeluruh dan mendalam tentang keberkesanan intervensi yang dijalankan. Pendekatan ini dipilih bagi tujuan triangulasi data, yang membolehkan dapatan dikukuhkan melalui pelbagai sumber dan kaedah pengumpulan data. Reka bentuk kajian tindakan telah digunakan kerana sifatnya yang reflektif, berasaskan amalan, dan bersesuaian dengan konteks bilik darjah sebenar. Pendekatan ini juga membolehkan guru berperanan sebagai penyelidik dalam usaha menambah baik strategi pengajaran dan pembelajaran secara berterusan.

Sampel kajian terdiri daripada 60 orang murid Tahun 6 dari Sekolah Kebangsaan Rantau Panjang, Klang yang telah dipilih secara rawak bagi memastikan perwakilan sampel dan mengurangkan bias pemilihan. Intervensi dilaksanakan dalam tempoh enam bulan, merangkumi empat fasa utama iaitu

perancangan, pelaksanaan, pemerhatian dan refleksi, sejajar dengan model kitaran kajian tindakan yang dicadangkan oleh Kemmis dan McTaggart (1988).

Bagi tujuan pengumpulan data, tiga instrumen utama telah digunakan. Pertama, ujian prestasi dibangunkan untuk menilai tahap penguasaan akademik dan kemahiran kognitif murid sebelum dan selepas intervensi. Ujian ini membolehkan penilaian terhadap pencapaian akademik secara objektif berdasarkan perubahan skor pra dan pasca intervensi.

Kedua, soal selidik psikometrik digunakan untuk mengukur aspek perkembangan emosi dan sosial murid, khususnya dalam domain daya tahan (resilience), kerjasama (collaboration) dan kemahiran komunikasi interpersonal. Instrumen ini telah disemak dari segi kesahan kandungan dan kebolehpercayaan untuk memastikan ketepatan pengukuran aspek psikososial murid yang berkait rapat dengan pembelajaran holistik.

Ketiga, temu bual separa berstruktur dilaksanakan ke atas guru dan murid terlibat bagi mendapatkan maklumat kualitatif yang lebih mendalam berkenaan persepsi, motivasi serta pengalaman mereka sepanjang pelaksanaan intervensi. Data kualitatif ini memberi konteks yang lebih kaya kepada dapatan kuantitatif dan membolehkan penafsiran yang lebih bermakna terhadap kesan intervensi dalam persekitaran pembelajaran sebenar.

Pendekatan pembelajaran inovatif yang diterapkan dalam intervensi ini merangkumi tiga komponen utama, iaitu:

1. Pembelajaran Berasaskan Projek (PBP) yang menggalakkan murid meneroka isu dunia sebenar secara aktif dan mengaplikasikan pemikiran aras tinggi dalam penyelesaian masalah.
2. Integrasi teknologi digital, termasuk penggunaan platform interaktif, simulasi serta penilaian sendiri digital, bagi merangsang penglibatan dan pembelajaran sendiri.
3. Aktiviti kolaboratif berpusatkan murid, yang menekankan interaksi sosial dan pembelajaran koperatif melalui perbincangan kumpulan serta pembentangan hasil projek.

Data kuantitatif dianalisis menggunakan perisian SPSS versi 27, melalui ujian t berpasangan (paired-sample t-test) dan statistik deskriptif bagi menilai perbezaan skor sebelum dan selepas intervensi. Manakala, data kualitatif dianalisis melalui pendekatan analisis tematik yang melibatkan pengekodan data dan pengecaman tema utama berkaitan impak intervensi terhadap perkembangan murid dari sudut kognitif, emosi dan sosial.

KEPUTUSAN DAN PERBINCANGAN

Dapatan kajian menunjukkan perubahan yang signifikan dalam pelbagai domain perkembangan murid selepas pelaksanaan intervensi.

Dari sudut kognitif, skor ujian prestasi menunjukkan peningkatan purata sebanyak 18% berbanding skor praujian, dan perbezaan ini signifikan secara statistik ($p < 0.05$). Ini membuktikan bahawa

pembelajaran berasaskan projek dan penggunaan teknologi dapat memperkukuh pemahaman konsep dan kemahiran aplikasi dalam kalangan murid. Dapatan ini menyokong dapatan Sullivan (2024) dan Tan dan Lee (2025) yang menegaskan keberkesanan pedagogi aktif terhadap peningkatan pencapaian akademik murid.

Dari segi emosi dan sosial, soal selidik menunjukkan peningkatan dalam aspek pengurusan tekanan, keupayaan bekerjasama, dan keyakinan diri. Murid menunjukkan kematangan dalam membuat keputusan kumpulan, meluahkan pendapat, dan menghormati perbezaan. Temu bual menyatakan bahawa murid berasa lebih seronok belajar, berani mencuba, dan tidak takut untuk gagal. Guru pula menyatakan bahawa penggunaan aplikasi digital seperti *Kahoot*, *Padlet*, dan *Google Classroom* menjadikan pembelajaran lebih fleksibel dan menarik.

Analisis tematik menghasilkan tiga tema utama:

1. Keterlibatan bermakna – murid lebih terlibat apabila pembelajaran berkait rapat dengan isu semasa dan dunia sebenar.
2. Pemerksaan suara murid – murid merasakan mereka mempunyai kawalan terhadap proses pembelajaran mereka sendiri.
3. Kesedaran kelestarian – projek yang dijalankan membangkitkan kesedaran terhadap peranan mereka sebagai agen perubahan.

Keberkesanan model ini sejajar dengan aspirasi SDG 4 dalam memastikan pendidikan yang inklusif dan relevan untuk masa depan yang tidak menentu. Dalam dunia VUCA, murid perlu lebih daripada sekadar literasi akademik; mereka memerlukan keupayaan untuk menyesuaikan diri, berfikir secara fleksibel, serta memupuk jati diri sebagai warganegara global.

KESIMPULAN

Kajian ini membuktikan bahawa pendekatan pembelajaran inovatif berasaskan teknologi, kolaborasi, dan penyelesaian masalah dunia sebenar berupaya meningkatkan kecekapan murid secara menyeluruh. Keberkesanan strategi ini bukan sahaja terbatas kepada peningkatan akademik, tetapi lebih luas meliputi kecekapan emosi dan sosial, yang kritikal dalam menghadapi persekitaran pembelajaran dan kehidupan yang kompleks.

Dapatan kajian ini menekankan bahawa reformasi pendidikan tidak seharusnya berlegar sekitar kandungan kurikulum semata-mata, tetapi harus melibatkan perubahan dalam pendekatan pedagogi, pemerksaan murid, dan penggunaan teknologi secara strategik. Keperluan untuk menjadikan sekolah sebagai ruang inovasi yang memperkasa murid dengan kemahiran masa depan adalah semakin mendesak.

Model pembelajaran lestari yang dibangunkan menerusi kajian ini boleh dijadikan asas kepada penggubalan dasar dan pelaksanaan program di peringkat sekolah dan daerah. Kajian lanjutan

dicadangkan untuk diteruskan dengan skop lebih luas dan tempoh yang lebih panjang bagi mengkaji impak jangka panjang terhadap pembangunan sendiri murid.

PENGHARGAAN

Setinggi-tinggi penghargaan ditujukan kepada pihak pentadbir dan guru-guru di Sekolah Kebangsaan Rantau Panjang, Klang serta murid-murid Tahun 6 yang telah menunjukkan komitmen tinggi sepanjang pelaksanaan kajian ini. Ucapan terima kasih juga dirakamkan kepada keluarga murid yang memberi sokongan penuh terhadap projek pembelajaran anak-anak mereka, serta pihak Pejabat Pendidikan Daerah Klang atas kepercayaan dan kelulusan kajian ini dijalankan. Akhir sekali, penghargaan tulus buat semua pihak yang terlibat secara langsung mahupun tidak langsung dalam memastikan kelancaran dan kejayaan kajian ini.

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MORI NORI

(*Moringa oleifera* INNOVATION INTO HEALTHY NORI SNACKS)

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ABSTRACT

Moringa leaves (Moringa oleifera) are known to the public as wild plants that were once less than optimally utilized, despite having very high nutritional content. Along with the development of public awareness about the importance of functional and healthy food, the benefits of moringa began to receive attention. Mori Nori products were introduced as a healthy food innovation based on moringa leaves produced without preservatives and MSG and processed through burning/roasting to preserve their original flavour and nutritional content. Then, it is processed into nori chips as an alternative to the conventional nori based on seaweed. By combining the distinctive flavour of moringa and the practical form of nori, Mori Nori aims to introduce moringa in a more modern, attractive, nutritious, natural, and edible form to the public, especially to the younger generation. The methods used include formulation of ingredient mixtures, drying and baking techniques, and organoleptic testing of taste, aroma, and texture. The results obtained show that Mori Nori has good organoleptic quality and nutritional content that is permanently preserved. This innovation is expected to be a major and successful contribution in the diversification of local foods as well as the development of high economic value products that will become healthy food solutions based on Indonesia's natural wealth.

Keywords: *Moringa, Food Innovation, Healthy Product*

INTRODUCTION

Indonesia is a country with a tropical climate. Various types of plants that grow have the potential to provide benefits for human life, one of which is moringa. People usually use moringa leaves as a complement in daily cooking, not a few make moringa plants only as ornamental plants that grow on house terraces, even in some regions in Indonesia, the use of moringa leaves is more for bathing the corpses, to shed amulets, and as animal feed (Marhaeni, 2021). Moringa leaves have a high content of antioxidant, vitamin A, and vitamin C (Hastuty et al., 2022). Moringa leaves are also considered to have the potential to overcome malnutrition, hunger, and prevent various diseases in the world (Angelina et al., 2021). Therefore, efforts need to diversify food products to increase the added value of moringa leaves, extend the shelf life of moringa leaf products and to attract enthusiasts from various ages, including being processed into nori (Bulotio et al., 2019).

METHODS

Processing begins with the preparation of raw materials, namely fresh moringa leaves washed and sorted to choose the leaves with the best quality. Then, to produce an ideal mixture between moringa leaves and other additional ingredients, experiments with various compositions are carried out to produce the desired taste and texture. After that, the moringa leaves that have been formulated are processed through drying at high temperatures. The result is then formed into nori chips that are uniform in thickness and size.

Mori Nori products were organoleptically tested for taste, aroma, and texture. Testing was conducted by 20 trained panelists using a hedonic scale to assess product acceptability. The organoleptic test data were analyzed descriptively to determine product characteristics and consumer acceptance.

RESULTS AND DISCUSSION

The research results show that Mori Nori products are successfully developed with physical characteristics such as chips that resemble conventional nori, uniform thickness, and natural green color from moringa leaves. Made without artificial preservatives and MSG, this product is safe to consume and in accordance with healthy food trends. Organoleptic testing showed positive results for all three components. Mori Nori has a unique flavor and can be accepted by the panelists, with a moringa flavor that is felt but not too dominant. The characteristics of moringa that have been roasted with an attractive and non-stinging aroma are indicated in the aroma of the product. This product has a crispy texture and is easy to eat, similar to regular nori but has the characteristic of moringa leaves.

According to the analysis, the processing process of moringa leaves maintains its nutritional content well. Mori Nori products maintain the protein content, vitamins, and important minerals of moringa leaves. The development of Mori Nori products also shows great economic potential as a local food diversification product that can increase the added value of moringa leaves and provide people with healthy food choices.

Table 1.: Nutritional content of fresh and dried moringa leaves

Nutritional Components	Fresh Leaves	Dried Leaves
Water content (%)	94.01	4.09
Protein (%)	22.7	28.44
Fat (%)	4.65	2.74
Ash content	-	7.95
Carbohydrate (%)	51.66	57.01
Fiber (%)	7.92	12.63
Calcium (%)	350-550	1600-2200
Energy (Kcal/100g)	-	307.30

Source: Melo *et al* (2013); Shiriki *et al* (2015)

CONCLUSION

This study successfully developed the product "Mori Nori", which is a moringa-based healthy food innovation processed into nori chips. Taste, aroma, and texture test results showed good organoleptic quality. The roasting method can maintain the nutritional content of moringa leaves. This product is made without preservatives and MSG, making it safe for consumption. Nori can be a solution to introduce a more modern, practical, and attractive moringa to the public, especially the younger generation. This innovation has great potential to encourage local food diversification and the development of high economic value products derived from Indonesia's natural wealth.

Mori Nori can be a great way to introduce moringa to people, especially the younger generation, in a more practical, attractive and modern form. This innovation has great potential to encourage local food diversification and the development of high-value products based on Indonesia's natural resources. The Mori Nori product is expected to be the first step in optimally utilizing moringa leaves as a functional food, while helping food security and the health of the Indonesian people.

Table 2.: Results of organoleptic test of nori

Shape	Aroma	Taste	Color
Square, brittle	Moderate distinctive moringa leaf odor	Savory, weak distinctive moringa leaf flavor	Blackish green

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ATTACHMENT



The Image Above Is An Example Of Mori Nori Products Used In Making Sushi.

OPTIMIZATION OF TURBIDITY REMOVAL FROM WASTEWATER USING *CARICA PAPAYA* SEED EXTRACT VIA RESPONSE SURFACE METHODOLOGY

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ABSTRACT

This study focuses on optimizing turbidity removal from wastewater using Carica papaya seed extract as a natural coagulant. While conventional chemical coagulants such as alum and ferric chloride are effective, they produce toxic sludge that poses environmental and health concerns. In contrast, papaya seeds contain bioactive compounds such as cysteine protease, offering a biodegradable and eco-friendly alternative. Response Surface Methodology (RSM) was employed to evaluate the effects of coagulant dosage, stirring speed, and pH on treatment efficiency. A jar test was conducted to simulate the coagulation and flocculation process, with 13 experimental runs designed using Central Composite Design (CCD) through Design-Expert software. The papaya seed extract was prepared with sodium hydroxide to enhance the release of active compounds. Statistical modelling identified the optimum conditions at a coagulant dosage of 125 mg/L, stirring speed of 175 rpm, and pH 7.75. Under these conditions, the model predicted a turbidity removal efficiency of 84.18%, while the actual mean removal from validation experiments was 87.78%, indicating good agreement with a percentage deviation of 4.27%. These findings demonstrate the potential of papaya seed extract as a sustainable alternative to chemical coagulants, with reduced sludge production and improved environmental outcomes. This research supports Sustainable Development Goal 6 by promoting innovative and environmentally friendly approaches to wastewater treatment and clean water management

Keywords: Turbidity, Natural coagulant, Carica Papaya seed, Optimization, RSM

INTRODUCTION

Urbanization, industrial growth, and climate change have heightened global concerns over water quality and availability. In Malaysia, rising wastewater discharge from various sectors strains existing treatment systems. High turbidity in untreated wastewater reduces transparency, depletes dissolved oxygen, and threatens ecosystems and public health. Conventional chemical coagulants like aluminium sulphate and ferric chloride are effective for turbidity removal but pose environmental risks and generate toxic sludge.

Natural coagulants, such as *Carica papaya* seeds, offer a sustainable alternative (Cadena-Álava et al., 2024). Rich in water-soluble proteins like cysteine protease, they promote floc formation, are biodegradable, and reduce sludge and residual chemicals. However, their application in wastewater treatment is underexplored, particularly in terms of dosage, stirring speed, and pH. NaCl was used in this study as an extraction medium due to its pH stability, with the aim of improving coagulant performance.

This study investigates the optimal conditions for turbidity removal using papaya seed extract and models the effects of key variables through Response Surface Methodology (RSM). Laboratory tests were conducted to validate the model, with a focus on NaCl-based extraction and turbidity reduction due to time and material limitations. By addressing the drawbacks of chemical coagulants, this research supports sustainable water treatment solutions and contributes to SDG 6 and SDG 12 by promoting clean water access and responsible consumption.

METHODS

Sample Collection and Preparation

Wastewater samples were collected from the inlet of the wastewater treatment plant (WWTP) at Kolej Mawar, UiTM Shah Alam. After collection, the samples were stored in clean plastic bottles to preserve their original characteristics. Initial parameters such as turbidity and pH were then measured using calibrated instruments to establish baseline conditions.

Papaya Seed Extract Preparation

Papaya seeds were collected from MBG Fruits, Shah Alam. After thorough washing and removal of the surface membrane, seeds were oven-dried at 50°C for 24 hours, ground into powder, and sieved for uniform particle size. The resulting papaya seed powder is shown in Figure 3. The extraction solution involved dissolving 87.66 g NaCl into 1 L of distilled water, creating a 1.5 M solution. Subsequently, 10 g of seed powder was mixed with the NaCl solution, stirred for 15 minutes, allowed to settle for 5 hours, and filtered to obtain a concentrated extract.

Jar Test and Evaluation

Wastewater samples were prepared in batches, with each sample consisting of 1 litre of untreated wastewater placed into separate beakers. The pH levels were carefully adjusted within the range of 6.5 to 9 using either NaOH or HCl, as excessive amounts could compromise the integrity of the samples. Coagulant dosages ranged from 50-250 mg/L. Samples underwent rapid mixing (100-300 rpm for 3 minutes) and slow mixing (30 rpm for 15 minutes), followed by a settling period of 30 minutes.

- pH measurement: pH was measured before and after treatment using a calibrated pH meter, ensuring the values remained within the acceptable range of 6.5 to 9.0.
- Turbidity testing: Treated samples were analysed using a turbidimeter. The percentage of turbidity removal was calculated using following equation:

$$\% \text{ Turbidity Removal} = \left(\frac{\text{Initial Turbidity} - \text{Final Turbidity}}{\text{Initial Turbidity}} \right) \times 100$$

Optimization via Response Surface Methodology (RSM)

RSM with Central Composite Design (CCD) was used to optimize turbidity removal using *Carica papaya* seed extract. Implemented via Design of Experiments (DoE) software, this method efficiently evaluated the effects and interactions of three key parameters: coagulant dosage (50–200 mg/L), stirring speed (100–250 rpm), and pH (6.5–9). A total of 13 experimental runs were generated, providing comprehensive coverage across the variable ranges. The results were used to develop a predictive model and identify optimal conditions for maximum turbidity removal.

Validation of Optimal Conditions

To validate the RSM-identified optimal conditions, three replicate experiments were conducted. The actual mean results from validation experiments were compared to the RSM-predicted values. A percentage error below 5% was considered acceptable to confirm the reliability of the optimization model.

RESULTS AND DISCUSSION

ANOVA Analysis

The model's validity was evaluated through Analysis of Variance (ANOVA), as presented in Table 1. The model was statistically significant ($F = 9.67$, $p = 0.0440$), confirming that the input variables had a meaningful influence on turbidity removal. Significant terms included coagulant dosage (A), interaction

AB, and quadratic terms B^2 and C^2 , all with p -value < 0.05 . The lack-of-fit was not significant ($p = 0.3873$), indicating the model fits well. Model fit statistics indicate an R^2 of 0.9667, supporting its predictive capability. These findings highlight the importance of optimizing operational parameters for efficient treatment performance.

Table 1. ANOVA for Turbidity Removal

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	988.95	9	109.88	9.67	0.0440	significant
A - Coagulant Dosage	140.62	1	140.62	12.37	0.0390	
B - Stirring Speed	7.45	1	7.45	0.6556	0.4774	
C - pH	87.91	1	87.91	7.74	0.0689	
AB	121.93	1	121.93	10.73	0.0466	
AC	73.93	1	73.93	6.51	0.0839	
BC	94.51	1	94.51	8.32	0.0633	
A^2	0.2320	1	0.2320	0.0204	0.8954	
B^2	322.08	1	322.08	28.34	0.0129	
C^2	369.58	1	369.58	35.52	0.0107	
Residual	34.09	3	11.36			
Lack of Fit	12.80	1	12.80	1.20	0.3873	not significant
Pure Error	21.29	2	10.65			
Cor Total	1023.04	12				

Mathematical Modelling

A quadratic regression model was developed using RSM to describe the relationship between coagulant dosage (A), stirring speed (B), and pH (C) with turbidity removal efficiency. The resulting model equation is:

$$\begin{aligned} \% \text{ Turbidity Removal} = & + 84.18 + 5.93A + 1.36B - 4.69C - 7.91AB + 6.08AC + 6.87BC \\ & - 0.1847A^2 - 6.88B^2 \\ & - 7.37C^2 \end{aligned}$$

Among the variables, coagulant dosage and stirring speed had the strongest positive linear effect, while pH showed a negative influence. The interaction between dosage and stirring speed (AB) negatively impacted removal, suggesting excessive values may hinder performance. In contrast, AC and BC interactions were synergistic, enhancing efficiency. These findings indicate the need for a balanced combination of parameters to achieve optimal turbidity removal.

Response Surface Analysis

Graphical analysis using 3D response surface and 2D contour plots in Figure 1 showed that coagulant dosage and stirring speed significantly affected turbidity removal ($p < 0.05$). Removal efficiency increased with both variables, reaching 87–90% at 150–170 mg/L and 170–200 rpm, but only 50–70% at 50–80 mg/L and 100–130 rpm due to inadequate floc formation and mixing. These trends align with El Gaayda et al. (2022), who reported reduced removal at lower operational parameters. Coagulant dosage controls the availability of active compounds for colloid destabilisation, where underdosing causes incomplete floc formation and overdosing risks charge reversal or excess sludge (Dassanayake et al., 2022; Saritha et al., 2019). Stirring speed influences mixing: rapid mixing distributes coagulant and promotes collisions, while gentle flocculation mixing supports floc growth; overmixing breaks fragile flocs, reducing performance (Yu et al., 2011).

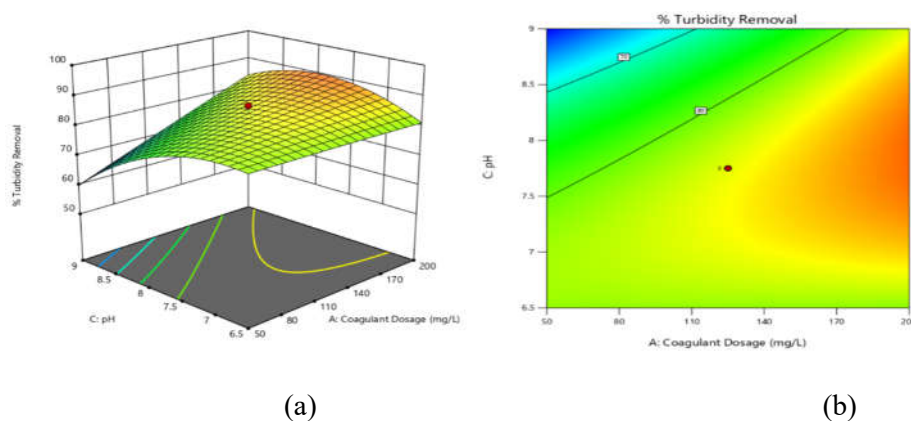


Figure 1.: Coagulant Dosage vs pH (a) 3D Response Surface Plot; (b) 2D Contour Plot

Optimization and Validation of Model Prediction

The optimized conditions in Table 2 show a dosage comparable to the 130 mg/L reported by Muda et al. (2020) for municipal wastewater treatment with natural coagulants. The stirring speed matches the 180–200 rpm range noted by Ahmad et al. (2022), while the slightly alkaline pH aligns with the 7–8 range reported by Nweke et al. (2022). These findings are consistent with parameters proven effective in related natural coagulant studies.

Table 2. Optimum condition for maximum turbidity removal

Parameter	Suggested Value
Coagulant Dosage (mg/L)	125
Stirring Speed (rpm)	175
pH	7.75

A validation experiment under the predicted optimal conditions achieved 87.78% turbidity removal, compared to the model's prediction of 84.18%, giving a 4.27% error as shown in Table 6. This discrepancy, well within the acceptable limit of 5 percent, demonstrates the high accuracy and reliability of the RSM model, confirming its validity and practical utility for optimizing natural coagulant performance in wastewater treatment (Kiew et al., 2013).

CONCLUSION

Carica papaya seed extract showed strong potential as a natural coagulant for turbidity removal. Using RSM, optimal conditions were identified at 125 mg/L dosage, 175 rpm stirring speed, and pH 7.75, achieving maximum turbidity reduction. A predictive quadratic model was developed to describe variable interactions, with strong statistical validation (ANOVA, residual and response plots, and high R^2). Laboratory tests under optimal conditions closely matched model predictions, with only 4.27% error, confirming the model's reliability. This study highlights RSM as an efficient, cost-effective tool for applying natural coagulants in wastewater treatment.

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PREDICTING FACTORS IN FINANCIAL LOSS AMONG MALAYSIAN SCAM VICTIMS USING MACHINE LEARNING

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ABSTRACT

This study presents an innovative educational approach to scam prevention by using logistic regression and decision tree models to identify key predictors of financial loss among 394 Malaysian scam victims. Emotional harm, age, and cybersecurity knowledge emerged as the most significant factors, with emotional harm being the strongest predictor of these factors. The decision tree model demonstrated superior accuracy and interpretability compared to logistic regression, making it a practical tool for educational use. By integrating data science with digital literacy, this research supports the development of targeted learning modules and public awareness strategies. The findings emphasize the use of machine learning to enhance risk education, empower self-assessment, and inform evidence-based interventions aimed at reducing scam victimization in Malaysia.

Keywords: Decision Tree, Financial Loss, Logistic Regression, Machine Learning Models, Malaysian Scam Victims

INTRODUCTION

The widespread adoption of the internet has significantly transformed communication, commerce, and daily routines, making it one of the most impactful innovations in modern history (Brooks, 2022). In Malaysia, internet usage continues to rise, increasing from 96.8% in 2021 to 97.4% in 2022 (DOSM). However, this growing digital connectivity has also increased exposure to cyber threats, particularly online scams. Although scams have existed long before the internet, their tactics have evolved to exploit psychological, social, and technological vulnerabilities (Hanoch & Wood, 2021; Whitty, 2020). In Malaysia, common scam types include love scams, Macau scams, parcel scams, job scams, and online loan scams. Between 2021 and April 2024, more than 95,000 online scam cases were reported, amounting to losses of RM3.18 billion (NSRC; Mahaizura, 2024). The actual figure is likely higher due to underreporting, highlighting the urgency of effective prevention strategies. These statistics emphasize the importance of improving educational initiatives that foster informed digital behavior and protect citizens, especially vulnerable groups, from becoming victims of online scams.

This study introduces an innovative, data-driven approach to enhancing scam awareness by using machine learning techniques to identify predictors of financial loss based on victims' demographic and knowledge-related attributes. By applying decision trees and logistic regression models, this research

reveals patterns that can inform the design of targeted educational programs and digital literacy modules. While earlier studies often focused on psychological or social aspects, few have explored how advanced analytics can contribute to public education and behavior change. This research aligns with the innovation in educational research by providing practical insights that support the development of evidence-based learning tools and awareness strategies to reduce scam victimization in Malaysia.

METHODS

Research Design

This study employed both descriptive and exploratory research designs to investigate the factors contributing to financial loss among scam victims in Malaysia, with a focus on educational relevance. The descriptive approach helped identify scam trends and financial impacts, while the exploratory design tested hypotheses based on cybersecurity education and behavioral outcomes. A cross-sectional design was used to capture data at a single point in time, offering insights into scam vulnerability for future digital education efforts.

Population and Sample

The study focused on Malaysian individuals aged 18 and above who had experienced online scams. As the total population of scam victims is unknown, Cochran's formula was applied to calculate a suitable sample size. With a 5% margin of error and 95% confidence level, a minimum of 384 responses was required. A total of 394 valid responses were collected, aligning with social science research standards and providing sufficient data for educational modeling.

Sampling Method

Due to the unavailability of a formal sampling frame, non-probability sampling was used. Participants were recruited through convenience sampling on social media platforms. While this method limits generalizability due to potential bias, it enables timely data collection from actual scam victims. This practical approach offered valuable insights into victim profiles, supporting the design of targeted digital safety education programs.

Data Collection Method

Primary data were gathered using a self-administered online questionnaire via Google Forms. The survey was distributed through Facebook, WhatsApp, Telegram, and Instagram over a two-month period. Ethical approval was granted by the UiTM Seremban 3 Research Ethics Committee. Continuous sharing of the survey link helped reach a broad audience of potential respondents. This online approach aligned with the study's emphasis on addressing digital behavior through educational strategies.

Research Instrument

The questionnaire included 29 items across three sections. Section A gathered demographic details such as age, gender, education level, internet usage, urbanity, and scam type. Section B measured internet safety knowledge and reporting behavior, incorporating 12 items from Okanlawon et al. (2015) and 3 adapted from Bijwaard (2020). Section C examined the negative impacts of scams, including financial, emotional, and behavioral effects. The instrument was designed to inform the development of education programs in digital literacy and emotional resilience.

Data Analysis

Descriptive statistics were used to identify risk patterns. Predictive models, including logistic regression and decision tree algorithms, were applied to determine factors influencing financial loss. The dataset was split 70:30 for training and testing. SPSS and SAS Enterprise Miner were used for analysis. The decision tree model provided better classification accuracy and interpretability, supporting its use in informing educational campaigns and intervention strategies.

RESULTS AND DISCUSSION

Descriptive Analysis

The demographic findings highlight patterns relevant to scam awareness education. While gender differences are slight, females appear more susceptible. Older adults (55+) and those with only primary or secondary education face higher risks of financial loss, underscoring the need for targeted literacy and prevention programs. Moderate internet users are also more vulnerable, possibly due to inconsistent online behavior. Additionally, urban residents face greater scam exposure, likely from increased digital activity. These insights support the development of age-, education-, and region-specific strategies to promote digital safety and responsible online behavior.

Figure 1 further illustrates the types of scams encountered by victims. Online sales scams are the most prevalent, accounting for the highest proportion of financial loss among respondents. SMS scams also show considerable impact, followed closely by Macau scams and job-related scams. Though African scams and business email compromise cases were less common, they remain areas of concern due to the significant financial damage they can cause. These findings point to the necessity of tailoring scam education programs by scam type. For instance, educational modules that focus on safe online shopping habits and how to recognize phishing attempts via SMS can directly address the most common threats.

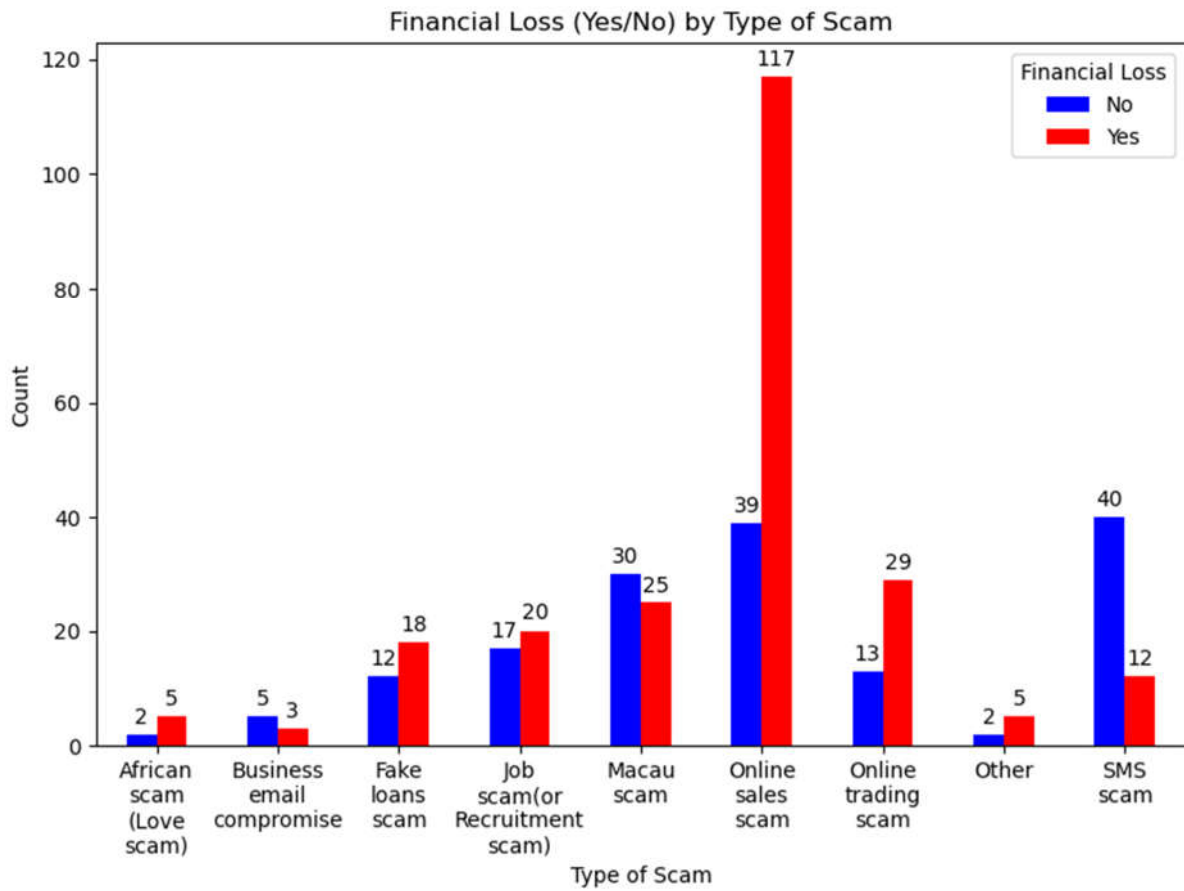


Figure 1.: Distribution of Scam Types by Financial Loss (Yes/No)

Predictive Model Performance

Table 1.: Model Performance Comparison

Comparison Metrics	Decision Tree - GINI	Logistic Regression - Main Effect
AUC	0.838	0.797
Accuracy	83.05%	72.88%
Sensitivity (Recall)	87.14%	72.86%
Specificity	72.92%	77.08%
F1 Score	85.92%	76.12%

As shown in Table 1, the decision tree model outperformed the logistic regression model across all key evaluation metrics in predicting financial loss among scam victims. The decision tree achieved an AUC value of 0.838 on the validation dataset, compared to 0.797 for logistic regression, suggesting better generalization to unseen data and stronger classification performance.

In terms of accuracy, the decision tree reached 83.05%, while logistic regression recorded 72.88%. The decision tree also showed higher sensitivity (87.14%) compared to logistic regression (72.86%), indicating superior ability to correctly identify individuals who experienced financial loss. Although logistic regression had slightly higher specificity (77.08% vs. 72.92%), the decision tree achieved a higher F1 score (85.92% vs. 76.12%), confirming its overall advantage in balancing precision and recall.

From an educational perspective, the decision tree model's interpretability and superior performance make it a practical tool for identifying high-risk individuals and guiding the development of evidence-based training programs. Its outputs can support educators, policy-makers, and digital literacy campaigners in recognizing key risk indicators and designing targeted awareness strategies accordingly.

Factors Influencing Financial Loss

Table 2.: Feature Importance

Variable	Importance Score
Emotional harm	1.0000
Knowledge score	0.5123
Age	0.3947
Gender	0.1730
Urbanity	0.1152
Level of education	0.0947
Internet usage	0.0821
Physical harm	0.0000

Table 2 shows the decision tree analysis results, highlighting the most influential factors in predicting financial loss. Emotional harm was the strongest predictor (importance = 1.0000), emphasizing the need to incorporate emotional resilience into scam prevention education. Internet safety knowledge ranked second (0.5123), reinforcing the role of digital literacy in reducing risk and the value of integrating it into learning programs.

Age followed as the third key factor (0.3947), with gender, urbanity, education level, and internet usage showing lesser influence but still relevant for tailored interventions. Physical harm had no predictive value in this context.

Overall, the results suggest that emotional vulnerability, online safety knowledge, and age are the most critical risk factors. Educational efforts should prioritize these areas to improve scam prevention, especially among high-risk groups.

CONCLUSION

This study identified emotional harm, internet safety knowledge, and age as key predictors of financial loss among scam victims in Malaysia. Among the models tested, the decision tree outperformed logistic regression, offering stronger predictive power and clearer insights into victim risk profiles.

These findings highlight the importance of data-driven approaches in educational research, particularly in designing targeted digital literacy and scam awareness programs. By focusing on emotional resilience and internet safety, educational interventions can be better tailored to vulnerable groups, especially older adults and those with lower education levels.

Overall, this research contributes to the growing field of educational innovation by demonstrating how predictive modeling can inform more effective, evidence-based learning strategies to prevent online scams.

ACKNOWLEDGEMENTS

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Gratitude is also given to the respondents, especially scam victims, for their honest participation in the online survey. Appreciation is further extended to the research supervisor, lecturers, peers, and family for their guidance and support throughout this research journey.

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PRESERVING MALAYSIA'S CULINARY HERITAGE: A BILINGUAL E-BOOK OF FESTIVE DISHES

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ABSTRACT

Preserving Malaysia's Culinary Heritage: A Bilingual eBook of Festive Dishes aims to preserve Malaysia's diverse culinary and cultural heritage by compiling festive dish recipes into a comprehensive e-book titled Festive Flavours of Malaysia. This e-book features recipes for festive dishes from celebrations such as Hari Raya Aidilfitri, Chinese New Year, Deepavali, and Gawai Dayak. These festivals are a testament to Malaysia's diversity and highlight the significance of food in bringing families and communities together during festive periods. To ensure accessibility and ease of understanding for a wider audience, this e-book is presented bilingually in English and Malay, enabling readers from diverse backgrounds to learn and appreciate these recipes with confidence. The e-book also features authentic recipes with clear instructions that make them accessible to a larger audience, including beginners. Along with the recipes, the e-book offers insights into the cultural and historical significance of each celebration, enhancing readers' understanding of Malaysia's traditions. In short, it serves to preserve Malaysia's culinary traditions and encourage their continued appreciation in kitchens today.

Keywords: Cultural heritage, Traditional cuisine, Malaysia, Recipe

INTRODUCTION

Traditional food has always been one of the key features of cultural festivals and serves as a bridge between tradition and society. Dishes served during festivals hold special significance in Malaysian hearts because they represent not only the country's diverse cultural backgrounds and rich heritage but also their unique flavours. Every dish has a story rooted in tradition and passed down through generations, symbolising unity and joy. These recipes connect families to their heritage, preserving cultural identity and creating shared memories.

However, this rich food culture of Malaysia is confronted with new challenges in today's fast-paced living and globalisation. The rising popularity of convenience foods and the change in modern lifestyle have been creating a gap between the young generation and traditional cooking practices. Globalisation introduces people to foreign influences that may overtake local traditions, while most have either no access to authentic recipes or will never find the time to learn them. As stated by Mohd Fisol et al. (2024), the eating habits of Malaysians are changing towards more convenient and fast food patterns because of globalisation and modernisation, which influence their lifestyle decisions. According to Kamaruzaman et al. (2022), these traditions and their origins are less understood; hence, it is becoming less of a concern even in Malaysia. Therefore, these culinary treasures and deeper meanings and traditions with them may be lost.

The goal of Preserving Malaysia's Culinary Heritage: A Bilingual E-Book of Festive Dishes is to preserve the culinary heritage of Malaysia by compiling a collection of festive dish recipes from cultural festivals like Hari Raya Aidilfitri, Chinese New Year, Deepavali, and Gawai Dayak in its e-book titled Festive Flavours of Malaysia. To promote inclusivity, reflecting Malaysia's multicultural society, they are written with instructions in English and Malay, step by step. This bilingual approach allows local communities such as Malay, Chinese, Indian, and Iban and global readers to appreciate Malaysia's rich traditions. This is because bilingual recipe books featuring Malay and English are not widely available, making this e-book a valuable resource for those who want to explore authentic Malaysian cuisine. The e-book also offers a journey through the cultural and historical significance behind each festival, giving you a better appreciation of Malaysia's rich heritage.

OBJECTIVES

Key Objectives:

- To compile and present 16 recipes that represent Malaysia's diverse culinary heritage.
- To provide a concise explanation of the cultural and historical importance of each festival in Malaysia.
- To make Malaysian food traditions accessible to a wider audience by presenting the recipes in Malay and English.

ENTREPRENEURIAL OPPORTUNITIES

The Festive Flavours of Malaysia recipe e-book offers several business opportunities. The first opportunity is to sell the e-book on various online platforms or via a personal website, thus allowing access to both local and international readers. According to Nurhayati and Abdurrahman (2019), websites can serve as a platform for everyone to be connected globally, anywhere, and anytime. This would enable the project to reach audiences who are interested in learning about Malaysian cuisine.

When Malaysia's cuisine is successfully introduced in other countries, it provides a chance to promote the culture and the country through its food (Abdullah et al., 2021). As people from other countries express interest in trying Malaysia's traditional dishes, local entrepreneurs have opportunities to grow their businesses by exporting Malaysian dishes and ingredients globally. Moreover, the e-book can be converted into a printed format, catering to those who prefer a physical recipe book.

In terms of partnerships, collaboration with local food bloggers or cultural organisations, such as Tourism Malaysia or Tourism Melaka, could help boost the promotion of the e-book. The e-book could also be marketed to international audiences through tourism or cultural exchange programs like YES (Youth Exchange and Study) or SUSI (Study of the U.S. Institutes) to further enhance its global reach. These entrepreneurial opportunities would not only help grow the project but also promote Malaysia's rich culinary traditions to a wider audience.

METHODOLOGY

Phase One: Planning and Concept Development

This project began by identifying the core issue, which was the gap in available resources, specifically the lack of bilingual recipe books featuring Malaysia's traditional dishes for cultural celebrations. The initial plan was to include four festivals celebrated in Malaysia: Hari Raya Aidilfitri, Chinese New Year, Deepavali, and *Pesta Kaamatan*, but due to certain limitations, *Pesta Kaamatan* was replaced with Gawai Dayak. A needs analysis survey was distributed to potential readers, gathering insight into their preferences and expectations.

Phase Two: Content Creation and Design

A variety of traditional dishes were chosen to represent the four festivals. To help readers understand the festivals better, explanations for each celebration were included, as well as recipes and dish descriptions. The recipes were sourced from family members. Drafting and translating the recipes into English took up to 4 weeks. To enhance the design and layout of the ebook, Canva Pro was subscribed to access more features. The e-book's layout was carefully designed to ensure an appealing and user-friendly experience. During this stage, the project's name was decided, and features like step-by-step photos, tips, ingredient substitution, and a glossary were added to improve the content. Initially, step-by-step pictures were not part of the plan, but after most respondents voted for them, it was decided to include them. The necessary ingredients were purchased to cook the dishes and to capture the step-by-step pictures.

Phase Three: Editing and Finalisation

Each section of the book was proofread for accuracy and consistency of language and formatting. Visual elements were reviewed to ensure they complemented the recipes. The layout was adjusted to ensure clarity and appeal. Sections like the glossary and ingredient substitutions were finalised, thus assuring the e-book was polished and ready for publication.

Phase Four: Publication and Promotion

After completing the e-book, an application for an e-ISBN was submitted. A social media account was set up to promote the e-book and interact with potential readers. This platform serves as an effective way to create awareness, advertise, and promote products or services (Mohaidin et al., 2022). Additionally, a website was developed to provide more insight into the book, showcase the book's preview, and offer an accessible platform for purchasing the e-book.

RESULTS AND DISCUSSION

An analysis survey was conducted to gather feedback from potential readers. Questions were asked to collect their thoughts and expectations regarding a bilingual recipe e-book featuring recipes in both English and Malay. The respondents are male and female, ranging in age from 18 to over 55. The insights gained from their responses will help shape the e-book to better align with their preferences and needs.

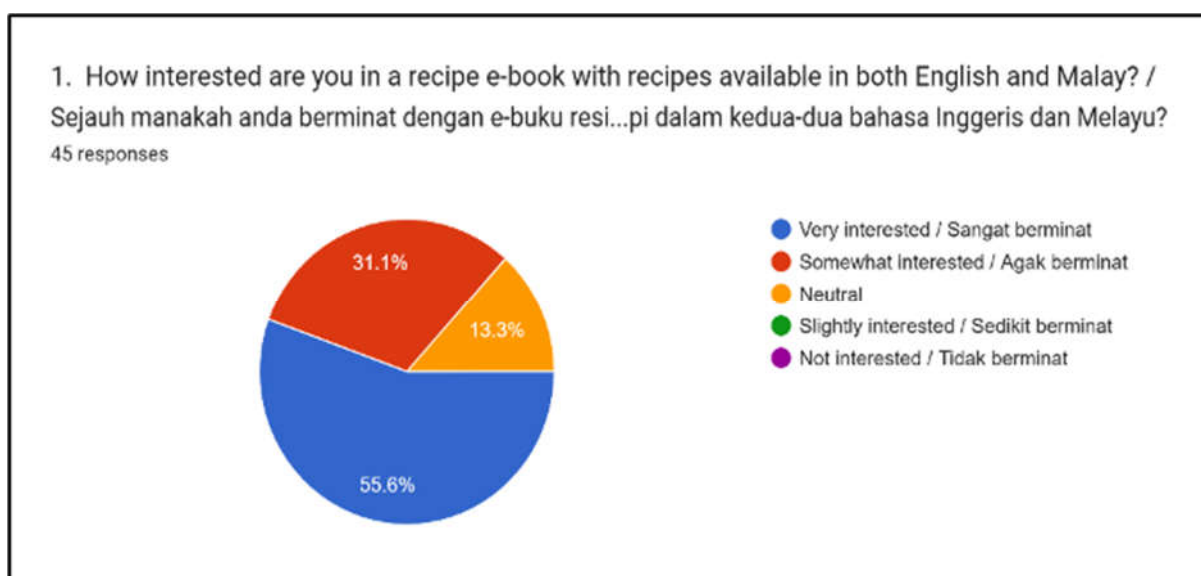


Figure 1.: Interest in Bilingual Recipes E-book (English and Malay)

According to the survey, there is strong interest in a bilingual recipe e-book, with 55.6% of respondents saying they are very interested and somewhat interested (31.1%) in recipe e-books in English and Malay. This indicates a promising market opportunity, as bilingual content can appeal to a diverse audience. Furthermore, the overall positive response suggests that providing recipes in both English and Malay may increase accessibility and appeal to a diverse range of readers.

When asked how useful the bilingual recipe e-book was for learning new cooking techniques and cultural dishes, 66.7% said it was very helpful, while 28.9% said it was moderately helpful. With the majority finding it either very or moderately helpful, it's clear that the idea is well-received by a wide audience. This suggests that offering recipes in both English and Malay could be a great way to help

people expand their cooking skills and knowledge.



Figure 2.: Preferred Feature in a Recipe E-book with Translations

The most requested feature from the respondents was step-by-step photos, with 84.4% of respondents highlighting their importance for visual guidance. Cooking tips were followed closely by 55.6%, which offer practical advice to improve results, while 42.2% valued ingredient substitutions for flexibility when certain items are unavailable. Additionally, 26.7% appreciated the idea of including a glossary to clarify unfamiliar terms. These findings highlight the need for both visual and practical guidance, emphasising the importance of making the recipes more accessible and adaptable. Incorporating these features into the e-book would enhance the user experience.

According to the survey, 85% of respondents agreed that a recipe e-book focusing on Malaysian festival dishes could play a crucial role in preserving and promoting the country’s rich food culture. This finding emphasises that the festive dishes e-books are more than just providing recipes, as they can help preserve culinary practices and share them with future generations.

Moreover, 86.7% of respondents expressed interest in including explanations about the festivals behind the dishes. This shows that readers are not just interested in learning how to cook traditional dishes but also in the cultural stories behind them. Including this information would make the e-book more engaging, providing readers with a deeper understanding and an engaging experience.

CONCLUSION

More than just a collection of recipes, this e-book reflects Malaysia’s diverse culinary traditions and cultural legacy. To make it accessible and encourage appreciation among local and global readers, the

recipes are presented in both English and Malay. The goal is to present traditional festive dishes while helping readers understand the profound cultural significance of these celebrations. The author anticipates that this e-book will spark interest in preserving and valuing Malaysia's unique food and language both locally and globally. In the future, she hopes to expand the project to feature more festive dishes from various cultural celebrations in Malaysia, collaborate with cultural organisations, and include engaging elements to allow Malaysia's unique food traditions to connect with a wider international audience.

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RATTAN WEAVING ART AS A CONCEPTUAL APPROACH TO STRESS REDUCTION

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ABSTRACT

This innovation looks at how rattan weaving, a traditional craft can help reduce stress. As more people face mental health challenges, there is growing interest in using cultural and hands-on activities to support well-being. Rattan weaving involves repeated calming movements that match with ideas like mindfulness, focus and relaxation that are used in therapy. It also helps people feel connected to their culture and community. Based on ideas from psychology, art therapy and culture, this innovation suggests that rattan weaving can be part of mental health support. A case study was done, and the data for thematic analysis from interviews showed that most participants had never tried rattan weaving before but found it new, interesting and enjoyable. They joined out of curiosity or a love for art. At first, some found it hard but later felt calm, focused and happy. Most of the sample studies said it helped them manage stress, stay focused and feel peaceful. Some even used metaphors like waves or building structures to describe their feelings. These findings show that rattan weaving can be a useful and meaningful way to reduce stress.

Keywords: weaving, stress, well-being, cultural

INTRODUCTION

Stress is increasingly affecting people across all ages and cultures, prompting interest in affordable, culturally rooted methods of relief. One promising approach is rattan weaving, a traditional Southeast Asian craft known for its repetitive and calming process, which supports psychological benefits like focus, relaxation and emotional balance (Malchiodi, 2013; Riley, 2001). The hands-on activity encourages a flow state (Csikszentmihalyi, 1990), helps reduce distressing thoughts (Berg & Mullaney, 2013) and activates the parasympathetic nervous system through sensory input (Wilcock, 2007; Pöllänen, 2015). Weaving also fosters mindfulness and emotional regulation (Moon, 2010; Kabat-Zinn, 1994; Garland et al., 2015), similar to outcomes found in art therapy (Reynolds, 2010; Collier, 2011).

Culturally, rattan weaving helps maintain identity, heritage and community connection, especially among Southeast Asian groups like the Orang Asli, Dayak and northern Thai communities (Rahman & Halim, 2020; Ahmad, 2017). It has been shown to support social bonds and well-being, particularly for the elderly and marginalised groups (Levine, 2008; Savin-Baden & Wimpenny, 2014). As a low-cost, accessible and adaptable activity, rattan weaving can be used in schools, community programs, and therapy settings (Deane et al., 2016; White & Epston, 1990). It also aligns with occupational and expressive arts therapy models (Kielhofner, 2008; McNiff, 2004) and encourages environmental awareness and psychological resilience through its use of natural materials (Clayton et al., 2017).

METHODS

Research Design

This study employed a qualitative case study design to explore the therapeutic effects of rattan weaving on individuals experiencing stress. A case study approach was chosen to gain in-depth insights into participants' lived experiences, perceptions and emotional responses throughout the intervention. This design allowed for a rich contextualised understanding of how a traditional cultural practice could contribute to stress management and emotional well-being.

Participants

A total of ten participants ($N = 10$) were selected using purposive sampling. All participants were identified as experiencing mild to moderate stress based on their responses to a brief stress screening tool adapted from the Depression Anxiety Stress Scale 21. Participants were adults aged between 20 and 50 years from diverse backgrounds and had no prior experience with rattan weaving or formal art therapy. The group included students and working professionals to ensure a varied representation of stress-related experiences.

Procedure

Participants took part in a guided rattan weaving session lasting approximately 2 hours, conducted in a calm and quiet environment. Before the session, participants were briefed on the purpose of the study and gave informed consent. The session began with a short mindfulness breathing activity to help participants settle. Participants were then introduced to the materials and basic weaving techniques. A facilitator was present to assist and observe, but participants were encouraged to weave at their own pace. After the session, participants were invited to reflect on their experience through a semi-structured interview.

Data Collection

Data were collected through individual semi-structured interviews conducted immediately after the weaving session. Interviews lasted between 20 to 30 minutes and were audio-recorded with permission. The interview protocol focused on participants' emotional states before, during and after the activity, their thoughts on the process and any perceived mental or emotional changes. Interview questions were designed to elicit responses on themes such as calmness, focus, emotional release, cultural connection and perceived stress relief.

Data Analysis

Thematic analysis was employed to analyse the interview data following a conceptual model adapted from Scorpio (2006), which values clarification, self-acceptance (characterised by openness and self-compassion), cognitive and behavioural flexibility and exposure to challenging experiences. Transcripts were read multiple times for accuracy and to identify emerging patterns. Codes were grouped into broader themes that reflected participants' shared experiences and individual insights regarding the therapeutic role of rattan weaving.

RESULTS AND DISCUSSION

This study explored the effectiveness of rattan weaving as a therapeutic activity for stress reduction through interviews with participants. Several key themes emerged from the thematic analysis. Under the theme of 'experience', many participants described rattan weaving as a completely new activity. They expressed excitement and curiosity, highlighting it as their first encounter with both weaving and art therapy. The activity was also perceived as interesting and enjoyable, with participants describing it as "fun," "very interesting," and "a very enjoyable experience." In the theme of 'motivation', curiosity played a central role. Participants were drawn to the activity due to its uniqueness and their desire to try something unfamiliar. Some participants also expressed personal interest in art and crafts, which made them more inclined to participate and engage with the process.

The 'emotion' theme revealed a range of feelings. While some initially found the activity challenging due to its unfamiliarity, this quickly shifted to feelings of joy, calmness and increased focus once they began weaving. The repetitive and rhythmic nature of the activity was reported to induce a calming effect, with several participants noting that it helped them feel more peaceful and focused. Under the 'process' theme, participants shared how the act of weaving improved their concentration and allowed them to block out distractions. They also noted a sense of control over their thoughts and emotions, suggesting that the activity supported self-regulation and mental clarity.

The theme of 'emotional effects' highlighted the therapeutic benefits of calmness. Participants consistently reported that weaving helped them feel relaxed and mentally still, often describing the experience as meditative. The structured process seemed to ease emotional tension and bring about a sense of inner peace. In the 'therapy role theme', participants described how rattan weaving demanded attention and precision, which in turn fostered mindfulness and emotional grounding. The tactile interaction with the materials was also cited as therapeutic, supporting a deeper connection between physical activity and emotional regulation.

Participants also viewed 'weaving as therapy', expressing that it helped them manage overthinking, stabilise emotions and focus on themselves. They found it to be a meaningful form of therapy that encouraged creativity and provided relief from mental stress. Finally, the theme of 'metaphors' revealed the symbolic significance participants attached to the activity. Many used nature-based metaphors such as waves or clouds to describe the peaceful atmosphere. Others likened it to building structures, tying knots, or weaving dreams, highlighting patience, emotional effort and the deeper meaning behind the act of weaving.

CONCLUSION

In summary, participants experienced rattan weaving as a calming, enjoyable and meaningful activity that promoted emotional regulation, concentration and a sense of cultural and personal connection. These findings support its potential use as a culturally relevant and non-clinical therapeutic method for stress reduction.

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REDUCTION OF POLLUTANTS IN BRINE EFFLUENT USING ELECTROCOAGULATION

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ABSTRACT

Brine effluent generated from industrial processes contains high levels of suspended solids, organic pollutants, and heavy metals, posing significant environmental and health risks if discharged untreated. Conventional treatment methods are often costly and ineffective in handling high salinity content. This study aims to evaluate the effectiveness of electrocoagulation using aluminium electrodes in removing key pollutants such as suspended solids (turbidity), organic load (COD), pH, and heavy metals (aluminium and zinc) from brine effluent. The electrocoagulation process was conducted in a batch setup with varying treatment durations (30 to 150 minutes). Water quality parameters were measured before and after treatment, and the results were analyzed using one-way ANOVA to determine statistical significance. The results showed a significant improvement in water quality: pH increased from 5.11 to 7.41, COD decreased from 26 mg/L to 2 mg/L, and turbidity increased initially due to floc formation but was managed through settling. Aluminium concentration dropped from 0.380 mg/L to 0.019 mg/L, while zinc reduced from 0.33 mg/L to 0.26 mg/L. The ANOVA analysis verified that all parameters show statistically significant differences ($p < 0.05$) throughout treatment durations. These results suggest that electrocoagulation is environmentally friendly, cost-effective, and efficient for treating brine wastewater. This innovation outcome is to promote sustainable wastewater management practices and offer a practical solution for industries that attempt to comply with environmental discharge standards.

Keywords: Brine effluent, Pollutants, Electrocoagulation, Aluminium

INTRODUCTION

The global increase in water shortage as a result of climate change, urbanization, and population growth has reinforced the reliance on alternative water sources, such as aquaculture and desalination. However, these processes produce a significant amount of brine effluent, a highly concentrated discharge that contains a complex mixture of contaminants and a high salinity. The direct discharge of untreated brine into the environment has the potential to severely damage aquatic ecosystems, reduce dissolved oxygen levels, and increase salinity in the recipient waters.

Brine effluent frequently contains contaminants with suspended particulates, turbidity, elevated COD, and heavy metals, all of which cause serious dangers to the ecosystem and water quality. Current treatment technologies, including membrane filtration, chemical coagulation, and biological treatment, have limitations. Chemical methods require costly chemicals and generate significant amounts of sediment, while biological processes involve extended retention periods and are susceptible to salinity (Nishat et al., 2023).

Electrocoagulation (EC) has been recognized as a promising method within alternative technologies due to its simple operation, high degree of removal efficiency, and minimal chemical input. The in-situ generation of coagulants through the dissolution of sacrificial electrodes, typically aluminium, under an applied electric field is the process of electrochemical coagulation (Das et al., 2022).

However, there is a limitation of research that has specifically evaluated the utilization of aluminium electrodes and does not investigate the impact of alternative materials, such as iron or hybrid configurations. Other parameters that are significant in electrocoagulation, including electrode spacing, current density, applied voltage, and conductivity, are maintained consistently and not thoroughly assessed as the study is in short duration. This creates a gap in the literature, especially if the treatment time is limited. Therefore, the objective of this investigation is to determine characteristics of brine effluent in terms of several pollutants before and after electrocoagulation treatment, as well as to evaluate the effectiveness of electrocoagulation in reducing pollutants in brine effluent.

METHODS

Materials and Sample Preparation

The brine effluent was collected from seawater desalination plant at Kota Bharu, Kelantan.

Experimental Setup

The electrocoagulation procedure (Figure 1) was conducted in a 10 liter acrylic batch reactor that was equipped with 10 aluminium plate electrodes. The electrodes were connected to a DC power supply. In order to assess the efficiency of removal that varies depending on time, treatment durations were adjusted from 30 to 150 minutes.



Figure 1.: Experimental Setup

Analytical Parameters

Post-treatment, the effluent was analyzed for the following parameters:

- pH – measured using a calibrated digital pH meter.
- COD – determined via the closed reflux colorimetric method (APHA 5220D).
- Turbidity – assessed with a nephelometric turbidity meter (APHA 2130B).
- Aluminium– analyzed using a spectrophotometer.

RESULTS AND DISCUSSION

Table 1 summarizes the removal efficiency for all parameters. COD and aluminium showed the highest reductions (>90%), while pH was successfully neutralized. However, turbidity increased due to lack of sedimentation.

Table 1.: Removal efficiency of pollutants after 150 min of electrocoagulation

Parameter	Initial Value	Final Value	Change / Removal (%)
COD	26.00 mg/L	2.00 mg/L	92.31% (↓)
Aluminium	0.380 mg/L	0.019 mg/L	95.00% (↓)
Turbidity	0.43 NTU	5.95 NTU	+1283.72% (↑)
pH	5.11	7.41	+2.30 units

CONCLUSION

The purpose of this study was to evaluate the effectiveness of electrocoagulation (EC) as a treatment method and to determine the characteristics of brine effluent in terms of several pollutants before and after electrocoagulation treatment. These results confirm the effectiveness of EC in the treatment of organic and metallic contaminants in brine effluent. The importance of improving operational conditions and incorporating post-treatment filtration to improve turbidity control is emphasized by the study. Future research should focus on the improvement of heavy metal removal efficiency, the investigation of alternative electrode materials, and verification of results at the experimental scale in order to facilitate industrial-scale applications.

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RePlasPro CARBON TRACKER

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ABSTRAK

Masalah pencemaran plastik semakin membimbangkan kerana menyumbang kepada pelepasan gas rumah kaca yang mempercepatkan perubahan iklim. Namun begitu, murid sekolah rendah masih kurang didedahkan kepada konsep jejak karbon dan kaitannya dengan sisa plastik harian. Bagi menangani isu ini, aplikasi digital RePlasPro Carbon Tracker telah dibangunkan bagi membantu pengguna merekod kutipan plastik dan mengira pengurangan jejak karbon dalam unit karbon dioksida bersamaan (CO_2e). Kajian ini bertujuan untuk menilai tahap kebolehgunaan aplikasi di kalangan murid tahun 4-6 dan guru di SK Rantau Panjang dengan menggunakan instrumen System Usability Scale (SUS). Seramai 200 orang responden telah terlibat selama 6 bulan. Proses penilaian dijalankan selepas murid menggunakan aplikasi dalam aktiviti pengumpulan dan pelaporan data kitar semula plastik. Dapatan menunjukkan min skor SUS ialah 94.3, yang berada dalam kategori tahap kebolehgunaan yang sangat baik. Responden menyatakan aplikasi ini berkesan, cekap, serta memenuhi keperluan pengguna. Ia juga relevan untuk meningkatkan kefahaman tentang kesan karbon dalam pendidikan alam sekitar. Kajian ini menyokong pelaksanaan Matlamat Pembangunan Mampan (SDG) 4: Pendidikan Berkualiti, SDG 12: Penggunaan dan Pengeluaran Bertanggungjawab, SDG 13: Tindakan terhadap Perubahan Iklim dan SDG 17: Perkongsian untuk Matlamat. Hasil kajian menunjukkan potensi aplikasi ini untuk dikembangkan penggunaannya dalam pendidikan karbon secara lebih sistematik dan berimpak.

Kata kunci: Karbon Dioksida Setara (CO_2e), Jejak Karbon, Kitar Semula, Aplikasi RePlasPro Carbon Tracker, System Usability Scale (SUS)

PENGENALAN

Penggunaan plastik yang meluas dan pengurusannya yang tidak mampan telah menjadi penyumbang utama kepada krisis alam sekitar dan perubahan iklim global. Menurut Our World in Data (2023), pengeluaran plastik menyumbang sekitar 5% daripada keseluruhan pelepasan gas rumah kaca (GHG) global, melebihi jumlah pelepasan daripada gabungan industri penerbangan dan perkapalan. Ini

menjadikan industri plastik antara sektor yang paling mencemarkan dan mengancam usaha global untuk mengekang kenaikan suhu bumi.

Sebagai tindak balas terhadap isu ini, aplikasi digital RePlasPro Carbon Tracker telah dibangunkan bagi membantu murid memahami hubungan antara sisa plastik dan pelepasan karbon. Aplikasi ini membolehkan pengguna merekod kutipan sisa plastik di sekolah, serta mengira pengurangan jejak karbon dalam unit CO₂e. Lebih menarik lagi, data akan ditafsirkan secara kontekstual kepada situasi kehidupan sebenar seperti jarak perjalanan yang berjaya dielakkan daripada pembakaran asap ekzos. Pendekatan ini memudahkan murid sekolah rendah memahami kesan sebenar usaha mereka terhadap alam sekitar.

Aplikasi ini dibangunkan berasaskan pendekatan pembelajaran berasaskan pengalaman (*experiential learning*) oleh David A. Kolb (1999), yang menekankan pembelajaran melalui tindakan, refleksi dan aplikasi semula dalam konteks sebenar. Melalui penyampaian data yang interaktif dan mudah difahami, RePlasPro Carbon Tracker diharap dapat memperkukuh pendidikan alam sekitar di sekolah dan menyokong Matlamat Pembangunan Mampan (SDG) seperti SDG 4: Pendidikan Berkualiti, SDG 12: Penggunaan dan Pengeluaran Bertanggungjawab, SDG 13: Tindakan terhadap Perubahan Iklim, serta SDG 17: Perkongsian untuk Matlamat melalui kerjasama strategik antara sekolah, komuniti dan rakan strategik.

Namun begitu, sebelum aplikasi ini diguna pakai secara meluas dalam pendidikan alam sekitar sekolah, tahap kebolegunaan aplikasi perlu dinilai secara empirikal untuk memastikan kesesuaian, kemudahan penggunaan dan keberkesanannya dalam menyampaikan maklumat kepada pengguna.

Objektif utama projek ini adalah untuk:

Menilai tahap kebolegunaan aplikasi RePlasPro Carbon Tracker dalam kalangan murid dan guru di SK Rantau Panjang.

Sub Objektif:

- 1.1 Menilai keberkesanan penggunaan aplikasi RePlasPro Carbon Tracker berdasarkan ketepatan dan kelengkapan pengguna dalam mencapai matlamat penggunaan.
- 1.2 Menilai kecekapan penggunaan aplikasi berdasarkan sumber yang digunakan (masa, usaha) dalam mencapai matlamat.
- 1.3 Menilai tahap kepuasan pengguna terhadap penggunaan aplikasi dari aspek keselesaan, keyakinan, dan penerimaan.

KAEDAH KAJIAN

Kajian ini dijalankan bertujuan untuk menilai tahap kebolehgunaan aplikasi RePlasPro Carbon Tracker dalam kalangan warga sekolah SK Rantau Panjang. Aplikasi ini dibangunkan untuk meningkatkan kesedaran murid tentang kesan karbon akibat sisa plastik melalui pengiraan jejak karbon yang dapat difahami dan ditindak balas secara langsung dalam konteks kehidupan seharian.

Reka bentuk kajian ini berbentuk kuantitatif deskriptif. Penilaian tertumpu kepada persepsi pengguna terhadap tahap kebolehgunaan aplikasi RePlasPro Carbon Tracker berdasarkan tiga dimensi utama iaitu keberkesanan (*efficiency*), kecekapan (*effectiveness*) dan kepuasan penggunaan (*satisfaction*).

Seramai 200 orang responden telah terlibat dalam kajian ini, terdiri daripada 150 murid Tahun 4 hingga Tahun 6 dan 50 orang guru. Pemilihan responden dibuat secara persampelan bertujuan melibatkan pengguna sebenar aplikasi yang telah menggunakan RePlasPro Carbon Tracker secara aktif semasa aktiviti kutipan sisa plastik sekolah.

Instrumen utama yang digunakan ialah *System Usability Scale* (SUS) yang dibangunkan oleh Brooke (1996). Ia merupakan satu alat penilaian standard antarabangsa yang terdiri daripada 10 item soal selidik dengan skala Likert 5 mata. Justin Mifsud (2011), Sauro menyarankan kaedah ini kerana ia terbukti memberikan hasil yang sangat tepat dalam mengukur kepuasan terhadap perisian, perkakasan dan peranti mudah alih. SUS juga sesuai digunakan bagi skala yang mudah serta ringkas untuk ditadbir kepada responden. Ini menjadikannya sesuai untuk digunakan walaupun dengan saiz sampel yang kecil.

Tempoh kajian adalah selama enam bulan dan merangkumi tiga fasa utama. Fasa pertama melibatkan pembangunan aplikasi RePlasPro Carbon Tracker yang direka khusus untuk menyokong pemantauan amalan kitar semula dan pengiraan jejak karbon. Fasa kedua ialah pelaksanaan penggunaan aplikasi dalam kalangan murid dan guru di sekolah. Seterusnya, fasa ketiga melibatkan penilaian tahap kebolehgunaan aplikasi tersebut dengan menggunakan instrumen *System Usability Scale* (SUS) bagi menilai keberkesanan, kecekapan dan tahap kepuasan pengguna terhadap aplikasi.

Data dikumpulkan selepas dua bulan penggunaan aplikasi. Soal selidik diedarkan secara berkumpulan di bawah bimbingan guru. Skor bagi setiap responden dianalisis secara deskriptif. Item-item negatif dibalikkan sebelum pengiraan jumlah keseluruhan dilakukan mengikut prosedur standard SUS. Skor keseluruhan ditukarkan kepada skala 0 hingga 100 dan ditafsirkan menggunakan julat kebolehgunaan: sangat lemah (0–50), sederhana (51–68), baik (69–84) dan sangat baik (85–100).

Kajian ini menyokong usaha mencapai Matlamat Pembangunan Mampan (SDG) terutamanya SDG 4, SDG 12, SDG 13 dan SDG 17.

DAPATAN DAN PERBINCANGAN

Kajian ini dijalankan bagi menilai tahap kebolegunaan aplikasi RePlasPro Carbon Tracker dalam kalangan murid dan guru dengan menggunakan instrumen *System Usability Scale* (SUS). Seramai 200 orang responden telah terlibat, terdiri daripada 50 murid setiap tahun dari Tahun 4 hingga Tahun 6 serta 50 guru yang telah menggunakan aplikasi ini semasa aktiviti kutipan dan pelaporan sisa plastik di sekolah.

Perincian skor purata bagi setiap item ditunjukkan dalam Jadual 1 di bawah:

Jadual 1.: Skor Setiap Item SUS bagi Aplikasi RePlasPro Carbon Tracker

Bil	Pernyataan Item SUS	Min Skor	Sisihan Piawai (SP)
1	Saya ingin menggunakan aplikasi ini dengan kerap.	4.9	0.3
2	Aplikasi ini terlalu rumit untuk digunakan. (<i>songsang</i>)	1.3	0.5
3	Aplikasi ini mudah digunakan.	4.9	0.2
4	Saya memerlukan bantuan teknikal untuk menggunakan aplikasi ini. (<i>songsang</i>)	1.5	0.6
5	Fungsi aplikasi ini disusun dengan baik dan mudah difahami.	4.8	0.3
6	Terdapat banyak ketidakselarasan dalam aplikasi ini. (<i>songsang</i>)	1.2	0.4
7	Kebanyakan pengguna akan dapat belajar menggunakan aplikasi ini dengan cepat.	4.9	0.2
8	Aplikasi ini terasa sukar digunakan. (<i>songsang</i>)	1.4	0.5
9	Saya yakin menggunakan aplikasi ini.	4.8	0.3
10	Saya perlu banyak belajar sebelum boleh menggunakan aplikasi ini dengan lancar. (<i>songsang</i>)	1.6	0.6
Skor Min SUS Keseluruhan (darab 2.5)		94.3	—

Jadual di atas menunjukkan skor min bagi setiap item dalam *System Usability Scale* (SUS) yang digunakan untuk menilai tahap kebolegunaan aplikasi *RePlasPro Carbon Tracker*. Semua item positif mencatatkan skor min yang sangat tinggi (melebihi 4.8), manakala item *songsang* menunjukkan skor min yang rendah seperti dijangkakan, menandakan pengguna tidak bersetuju bahawa aplikasi ini rumit atau memerlukan bantuan teknikal.

Dapatan menunjukkan keberkesanan penggunaan aplikasi adalah tinggi, dengan min skor 4.83. Dari aspek kecekapan, majoriti pengguna melaporkan aplikasi mudah digunakan dan tidak membebankan,

dengan min skor 4.47. Kepuasan pengguna turut berada pada tahap sangat tinggi, dibuktikan dengan min 4.87. Secara keseluruhan, skor ini membuktikan bahawa RePlasPro Carbon Tracker mempunyai kebolehgunaan yang sangat baik dan sesuai diterapkan.

Hasil kajian menunjukkan bahawa tahap kebolehgunaan aplikasi RePlasPro Carbon Tracker adalah sangat tinggi, berdasarkan skor keseluruhan *System Usability Scale* (SUS) iaitu 94.3 daripada maksimum 100. Skor ini menunjukkan bahawa aplikasi tersebut berada dalam kategori “*excellent to best imaginable usability*” mengikut tafsiran Bangor et al. (2009), sekali gus membuktikan keberkesanan dan penerimaan tinggi dalam kalangan pengguna.

KESIMPULAN

Kajian ini membuktikan bahawa aplikasi RePlasPro Carbon Tracker mempunyai tahap kebolehgunaan yang sangat tinggi, dengan skor purata SUS sebanyak 94.3. Aplikasi ini berjaya diterima oleh murid dan guru sebagai alat bantu pembelajaran yang mudah digunakan, bermakna, dan berimpak. Ia telah mengubah aktiviti kitar semula biasa kepada satu proses pembelajaran digital yang mendorong kesedaran alam sekitar berdasarkan data sebenar dan tindakan sebenar.

Kekuatan utama inovasi ini terletak pada keupayaannya untuk memperkenalkan konsep perubahan iklim dan jejak karbon kepada golongan murid sekolah rendah, satu kumpulan yang sebelum ini kurang didedahkan kepada dimensi karbon dalam pendidikan alam sekitar. Lebih penting, RePlasPro Carbon Tracker membuktikan bahawa pendidikan karbon boleh dilakukan di peringkat akar umbi, dengan pendekatan yang kos efektif, mudah dicapai dan mampu diskalakan. Sekolah di kawasan luar bandar juga boleh menjadi pencetus perubahan melalui penggunaan teknologi digital yang dibina khusus mengikut konteks tempatan tetapi menyentuh isu global.

Inovasi ini menyumbang secara langsung kepada pelaksanaan empat Matlamat Pembangunan Mampan (SDG) utama iaitu:

1. SDG 4 – Pendidikan Berkualiti: Memperkasa literasi alam sekitar melalui pembelajaran digital yang berasaskan pengalaman sebenar.
2. SDG 12 – Penggunaan dan Pengeluaran Bertanggungjawab: Mendorong budaya pengurusan sisa plastik yang bertanggungjawab dan berinformasi.
3. SDG 13 – Tindakan terhadap Perubahan Iklim: Mengurangkan pelepasan karbon melalui perubahan tingkah laku di peringkat komuniti sekolah.
4. SDG 17 – Perkongsian untuk Matlamat: Mengukuhkan kerjasama strategik antara sekolah, komuniti, industri dan agensi luar.

Dalam skala yang lebih besar, aplikasi ini menunjukkan potensi untuk menjadi sebahagian daripada ekosistem pendidikan kelestarian global. Ia boleh dijadikan model intervensi rendah kos yang memberi impak tinggi kepada kesedaran iklim generasi muda. Ini adalah satu langkah konkrit ke arah matlamat dunia untuk mencapai pelepasan karbon sifar bersih menjelang 2050. Justeru, RePlasPro Carbon

Tracker bukan sekadar inovasi teknologi pendidikan, tetapi satu manifestasi komitmen akar umbi terhadap agenda iklim global.

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RePlasPro SEBAGAI MODEL PEDAGOGI INOVATIF: MENGHUBUNGKAN PEMBELAJARAN MAKLUM STEM DENGAN PENGHASILAN PRODUK KITAR SEMULA

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ABSTRAK

Kajian ini meneroka keberkesanan RePlasPro, sebuah model pedagogi berasaskan pembelajaran projek (PBP), dalam mengintegrasikan elemen Sains, Teknologi, Kejuruteraan dan Matematik (STEM) dengan penghasilan produk kitar semula oleh murid sekolah rendah. Pendekatan ini menekankan aplikasi pengetahuan secara kontekstual, pemikiran kreatif, dan penyelesaian masalah dunia sebenar dalam isu pengurusan sisa plastik. Seramai 60 orang murid Tahun 6 dari Sekolah Kebangsaan Rantau Panjang, Klang, terlibat dalam kajian kuasi-eksperimental ini. Data dikumpul melalui instrumen soal selidik, pemerhatian dan portfolio tugasan, serta dianalisis menggunakan pendekatan deskriptif dan inferensi (uji-t berpasangan). Dapatan menunjukkan peningkatan signifikan dalam penguasaan kemahiran STEM, kemahiran insaniah seperti kerjasama dan kepimpinan, serta pembentukan sikap lestari terhadap alam sekitar. Selain memperkukuh pedagogi STEM yang bermakna dan relevan, kajian ini turut menyumbang kepada pencapaian Matlamat Pembangunan Mampan (SDG) terpilih iaitu SDG 4, SDG 9, SDG 11, SDG 12, SDG 13 dan SDG 17. Kajian ini mencadangkan bahawa RePlasPro berpotensi untuk diperluas sebagai kerangka pendidikan lestari dalam konteks sekolah rendah, selaras dengan aspirasi Pelan Pembangunan Pendidikan Malaysia dan SUSED 2025.

Kata kunci: Pengurusan sisa plastic, Pembelajaran STEM, Pedagogi berasaskan projek, Pendidikan lestari; RePlasPro

PENGENALAN

Isu pencemaran plastik merupakan cabaran global yang menuntut penyelesaian melalui pendidikan, khususnya pendidikan STEM yang berorientasikan nilai dan tindakan. Dalam era Revolusi Industri 4.0, pendekatan pengajaran yang menghubungkan kemahiran abad ke-21 dengan kesedaran kelestarian amat diperlukan. *RePlasPro* diperkenalkan sebagai intervensi pedagogi inovatif yang memberi peluang

kepada murid untuk meneroka isu sisa plastik melalui projek berasaskan kitar semula, seterusnya mengaplikasikan prinsip STEM secara konkrit dan bermakna.

KAEDAH KAJIAN

Kajian ini menggunakan reka bentuk kuasi-eksperimental dengan satu kumpulan (pre-post test). Seramai 60 orang murid Tahun 6 dari SK Rantau Panjang, Klang, dibahagikan kepada 30 kumpulan (2 orang setiap kumpulan) dan mengikuti intervensi RePlasPro selama enam minggu. Data dikumpul melalui:

- i) soal selidik penguasaan kemahiran STEM dan sikap terhadap alam sekitar,
- ii) pemerhatian semasa aktiviti projek, dan
- iii) portfolio produk akhir murid.

Data dianalisis menggunakan statistik deskriptif dan inferensi (uji-t berpasangan) bagi menilai keberkesanan intervensi sebelum dan selepas pelaksanaan.

DAPATAN DAN PERBINCANGAN

Analisis data menunjukkan peningkatan signifikan ($p < 0.05$) dalam penguasaan kemahiran STEM, kemahiran kolaboratif dan daya cipta murid selepas mengikuti program RePlasPro. Pemerhatian juga mendapati peningkatan ketara dalam keupayaan menyelesaikan masalah secara kreatif dan penggunaan semula bahan plastik secara inovatif. Portfolio murid mencerminkan pemahaman mendalam terhadap prinsip kejuruteraan asas dan reka bentuk berfungsi. Selain itu, wujud perubahan sikap positif terhadap kitar semula, kesedaran kelestarian dan tanggungjawab alam sekitar. Ini menunjukkan bahawa integrasi STEM melalui PBP dapat mengarusperdanakan nilai pendidikan lestari dalam kurikulum sekolah rendah, menyokong aspirasi SDG 4 (pendidikan berkualiti), SDG 12 (penggunaan dan pengeluaran bertanggungjawab), dan SDG 13 (tindakan iklim).

Jadual 1.: Perbandingan Min Skor Pra dan Pasca Program RePlasPro (*Kemahiran STEM, Kolaboratif, Daya Cipta*)

Aspek Dinilai	Min (Pra)	Min (Pasca)	Perbezaan Min	p-value	Keputusan
Kemahiran STEM	2.85	4.20	+1.35	0.001	Signifikan ($p < 0.05$)
Kemahiran Kolaboratif	3.10	4.35	+1.25	0.003	Signifikan ($p < 0.05$)
Daya Cipta	2.75	4.10	+1.35	0.002	Signifikan ($p < 0.05$)

Nota: Skala Likert 1–5 digunakan. Analisis menggunakan Ujian t berpasangan (Paired Sample t-Test)

KESIMPULAN

RePlasPro terbukti berkesan sebagai pendekatan pedagogi inovatif yang menggabungkan pemikiran saintifik, kreativiti, dan nilai kelestarian dalam pendidikan sekolah rendah. Ia bukan sahaja meningkatkan penguasaan STEM dan kemahiran insaniah, malah membentuk murid yang lebih peka terhadap cabaran persekitaran. Potensi perluasan RePlasPro ke sekolah lain dilihat selari dengan agenda kebangsaan pendidikan lestari dan Matlamat Pembangunan Mampan. Kajian ini mencadangkan agar RePlasPro dijadikan model rujukan untuk pendidikan STEM kontekstual dalam sistem pendidikan negara.

PENGHARGAAN

Setinggi-tinggi penghargaan diucapkan kepada pihak pentadbiran SK Rantau Panjang, murid-murid Tahun 6, guru pembimbing serta semua pihak yang telah terlibat menjayakan kajian ini secara langsung mahupun tidak langsung.

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SAHSIAH TRACKER: APLIKASI PEMANTAUAN SAHSIAH DAN PENGURUSAN DISIPLIN MURID TAHUN 6 SECARA BERSTRUKTUR

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ABSTRAK

Kajian tindakan ini bertujuan menangani peningkatan kes disiplin ringan dalam kalangan murid Tahun 6 di SK Rantau Panjang, Klang, melalui intervensi berstruktur menggunakan aplikasi 'Sahsiah Tracker'. Masalah kelewatan hadir, tidak menyiapkan tugas dan kurang fokus semasa pengajaran dan pembelajaran (PdP) dikenal pasti sebagai isu utama yang menjejaskan suasana bilik darjah dan pencapaian murid. Pelaksanaan intervensi ini melibatkan pemantauan tingkah laku secara harian, refleksi sendiri oleh murid, serta penglibatan aktif guru dan ibu bapa. Hasil kajian menunjukkan penurunan kadar kes disiplin ringan, peningkatan kesedaran sendiri murid, dan pengukuhan komunikasi rumah-sekolah. Secara tidak langsung, kajian ini menyokong Matlamat Pembangunan Lestari (SDG) ke-4: Pendidikan Berkualiti, khususnya sasaran 4.1 dan 4.7 yang menekankan akses kepada persekitaran pembelajaran yang selamat dan kondusif serta pembentukan nilai sejagat seperti tanggungjawab dan disiplin diri. Selain itu, pelibatan komuniti melalui kerjasama dengan ibu bapa mencerminkan sokongan terhadap SDG ke-17: Perkongsian untuk Mencapai Matlamat. Intervensi yang dijalankan membuktikan bahawa pemantauan sistematik berasaskan nilai mampu memupuk sahsiah murid secara konsisten dan holistik. Implikasinya, pendekatan berasaskan data dan kolaborasi pelbagai pihak ini berpotensi menyumbang ke arah sistem pendidikan yang lebih lestari dan berkesan, selaras dengan aspirasi Falsafah Pendidikan Kebangsaan dan agenda pendidikan global.

Kata kunci: Sahsiah murid, disiplin ringan, pengurusan bilik darjah, pemantauan berstruktur, pendidikan lestari

PENGENALAN

Isu disiplin ringan dalam kalangan murid sekolah rendah semakin mendapat perhatian bukan sahaja daripada guru tetapi juga dari perspektif pentadbiran pendidikan nasional. Dalam konteks bilik darjah, tingkah laku seperti kelewatan hadir, tidak menyiapkan tugas, dan gangguan kecil semasa PdP sering dilihat sebagai petanda awal terhadap cabaran dalam motivasi, kawalan sendiri dan sahsiah murid, yang

jika tidak ditangani, boleh mengganggu persekitaran pembelajaran secara menyeluruh (Abdul Rahman, 2019; Ibrahim & Mohd Nor, 2019). Sebagai contoh, kelewatan hadir bukan sahaja mengganggu perjalanan PdP tetapi juga memberi gambaran bahawa murid kurang mengambil berat terhadap komitmen pembelajaran.

Roslan (2020) mengingatkan bahawa tingkah laku sedemikian boleh memperlihatkan masalah asas dalam struktur nilai dan kerangka sokongan murid—seperti minat terhadap pelajaran, sokongan keluarga atau rangsangan bilik darjah. Ini menimbulkan keperluan kepada kaedah intervensi yang bersifat pencegahan, berstruktur dan berasaskan data, jauh lebih awal sebelum tingkah laku menjadi lebih serius dan sukar diatasi.

Kajian terdahulu oleh Kamarudin & Ismail (2021) mendapati bahawa penggunaan aplikasi digital dalam pemantauan disiplin dan sahsiah murid dapat meningkatkan kesedaran sendiri, manakala Mohamad & Salleh (2024) menekankan kaedah intervensi yang menyepadukan teknologi, data serta nilai sebagai lebih efektif. Oleh yang demikian, kajian ini memfokuskan kepada aplikasi *Sahsiah Tracker*, direka untuk memupuk sikap murid menerusi refleksi harian, pelaporan guru secara berkala, dan penglibatan secara aktif ibu bapa dalam membina karakter murid. Transformasi teknologi pendidikan ke arah sahsiah bukan sahaja selaras dengan aspirasi nasional, tetapi juga seiring dengan agenda global seperti SDG 4 (Pendidikan Berkualiti) dan SDG 17 (Perkongsian untuk Matlamat) serta Falsafah Pendidikan Kebangsaan.

METODOLOGI

Dalam menyusun rangka kajian ini, reka bentuk kajian tindakan model Kemmis & McTaggart (1988) dipilih kerana ia menggalakkan refleksi sistematik dan tindakan berulang dalam kalangan pendidik. Model ini memfokus kepada empat fasa utama: perancangan (planning), pelaksanaan (action), pemerhatian (observation) dan refleksi (reflection).

Seramai 502 orang murid Tahun 6 di SK Rantau Panjang telah dikenal pasti melalui saringan awal sebagai individu yang memiliki insiden disiplin ringan seperti kelewatan hadir, tidak menyiapkan tugas dan gangguan kecil. Peserta ini dipilih secara pensampelan bertujuan berdasarkan rekod tingkah laku sekolah selama satu semester.

Instrumen kajian merangkumi tiga komponen utama. Pertama, borang pemantauan tingkah laku harian yang digunakan oleh murid untuk mencatat kehadiran harian, status penyelesaian tugas, serta refleksi ringkas mengenai sikap dan tingkah laku mereka sepanjang hari. Kedua, jurnal refleksi murid yang diisi melalui aplikasi *Sahsiah Tracker* membolehkan murid menilai secara sendiri sebab di sebalik tindakan mereka serta mengenal pasti strategi penambahbaikan yang sesuai. Ketiga, borang maklum balas guru dan ibu bapa digunakan bagi menilai perubahan persepsi terhadap tingkah laku murid, tahap komunikasi di rumah dan sekolah, serta tahap penglibatan sepanjang tempoh pelaksanaan intervensi.

Prosedur

Pelaksanaan kajian ini merangkumi tiga fasa utama mengikut model tindakan Kemmis dan McTaggart (1988). Fasa perancangan melibatkan pembangunan modul aplikasi Sahsiah Tracker, penyediaan bahan intervensi, serta pelaksanaan sesi latihan kepada guru dan murid yang terlibat. Di samping itu, satu sesi orientasi telah dijalankan bersama ibu bapa bagi menjelaskan objektif intervensi serta peranan mereka dalam menyokong pelaksanaannya.

Fasa pelaksanaan, yang berlangsung selama enam minggu (minggu 1 hingga minggu 6), menyaksikan murid menjalankan catatan harian menggunakan aplikasi yang merangkumi kehadiran, penyempurnaan tugas dan refleksi sendiri. Guru pula melakukan semakan berkala terhadap data yang dikumpul dan memberikan maklum balas secara mingguan. Selain itu, pertemuan dua hala antara guru dan ibu bapa diadakan setiap dua minggu bagi membincangkan perkembangan murid serta merancang sokongan lanjutan.

Dalam fasa pemerhatian dan refleksi, data dikumpul dan dianalisis secara mingguan bagi menilai keberkesanan intervensi. Analisis ini membolehkan penyesuaian dibuat terhadap pelaksanaan, termasuk cadangan modifikasi seperti penambahan sesi motivasi atau penyesuaian terhadap kandungan modul refleksi berdasarkan keperluan murid yang dikenal pasti sepanjang kajian berlangsung.

Analisis Data

Analisis kuantitatif melibatkan pengiraan perubahan purata insiden disiplin sebelum dan selepas intervensi. Analisis kualitatif pula merujuk kepada temubual ringkas dengan 10 orang guru dan 10 pasangan ibu bapa untuk menilai pengalaman dan hasil persepsi.

KEPUTUSAN DAN PERBINCANGAN

Pelaksanaan intervensi melalui aplikasi *Sahsiah Tracker* menunjukkan kesan positif yang signifikan dalam mengurangkan insiden disiplin ringan dalam kalangan murid. Secara keseluruhan, berlaku penurunan sebanyak 60% dalam insiden disiplin ringan selepas tempoh enam minggu pelaksanaan. Peningkatan positif turut direkodkan dalam beberapa indikator utama, termasuk kehadiran tepat waktu yang meningkat daripada 65% kepada 92%, serta kadar penyelesaian tugas harian yang bertambah daripada 58% kepada 89%. Laporan gangguan di dalam bilik darjah juga mencatatkan penurunan sebanyak 72%, menandakan peningkatan dalam pengurusan sendiri dan fokus murid terhadap pengajaran.

Dapatan kualitatif yang diperoleh daripada refleksi harian murid menunjukkan bahawa mereka berasa lebih berdisiplin selepas mencatat tingkah laku dan melihat perkembangan diri secara visual melalui aplikasi. Proses ini membina kesedaran sendiri dan meningkatkan rasa tanggungjawab terhadap tingkah laku masing-masing. Guru melaporkan bahawa aplikasi ini memudahkan proses pemantauan kelas, mempercepatkan pengesanan awal isu disiplin, dan membolehkan tindakan susulan dijalankan dengan lebih berkesan. Manakala maklum balas daripada ibu bapa menunjukkan bahawa akses kepada laporan

harian memberi mereka peluang untuk terlibat secara lebih aktif, menghargai usaha anak dan mengukuhkan hubungan dengan pihak sekolah.

Secara teorinya, hasil kajian ini menyokong teori pembelajaran sosial Bandura (1977) yang menekankan peranan pemerhatian, peneguhan positif dan refleksi sendiri dalam pembentukan tingkah laku. Penggunaan aplikasi membolehkan murid memerhati corak tingkah laku sendiri secara berterusan dan menerima maklum balas segera, yang seterusnya menggalakkan perubahan tingkah laku secara berperingkat. Selain itu, kerjasama erat antara sekolah dan ibu bapa yang terbina melalui penggunaan aplikasi ini turut membuktikan relevansi Model Epstein (2011), yang menekankan kepentingan penglibatan rumah-sekolah dalam pembangunan sahsiah murid (Rosli & Rahman, 2022).

Implikasi kajian ini turut menyumbang kepada agenda pendidikan lestari, khususnya dalam menyokong Matlamat Pembangunan Lestari (SDG) 4.1 dan 4.7 yang menekankan kepentingan akses kepada persekitaran pembelajaran yang selamat dan kondusif serta pembentukan nilai sejagat seperti tanggungjawab dan disiplin diri. Tambahan pula, kolaborasi antara guru, ibu bapa dan teknologi dalam pelaksanaan intervensi ini mencerminkan prinsip SDG 17 yang memfokuskan kepada perkongsian strategik untuk mencapai matlamat bersama. Keseluruhannya, pendekatan yang dilaksanakan selari dengan aspirasi Falsafah Pendidikan Kebangsaan, iaitu membangunkan murid secara holistik melalui gabungan nilai, teknologi dan kerjasama komuniti pendidikan.

KESIMPULAN

Kajian tindakan ini telah menunjukkan bahawa penggunaan aplikasi *Sahsiah Tracker* memberikan kesan positif yang signifikan dalam menangani isu disiplin ringan dalam kalangan murid sekolah rendah. Keberkesanan intervensi ini terletak pada empat strategi utama, iaitu pemantauan berasaskan data yang dijalankan secara sistematik, pemerksaan sendiri murid melalui amalan refleksi harian, penglibatan aktif ibu bapa sebagai rakan pendidikan, serta penggunaan teknologi sebagai pemudah cara dalam pengurusan sahsiah. Keempat-empat komponen ini telah berperanan saling melengkapi dalam membina sistem sokongan yang menyeluruh dan holistik untuk murid. Justeru, keberhasilan intervensi ini memberi justifikasi kukuh bahawa inovasi pendidikan yang menggabungkan teknologi dan nilai mampu membentuk murid yang berintegriti, bertanggungjawab, dan berdaya saing. Di samping itu, dapatan kajian ini turut membuka ruang kepada intervensi seumpama ini untuk dijadikan model pembangunan pendidikan berasaskan sahsiah secara nasional, seiring dengan hasrat mewujudkan sekolah yang lestari dan berfokus kepada pembangunan insan secara menyeluruh.

Berdasarkan dapatan kajian ini, beberapa cadangan tindakan dikemukakan bagi memperkukuh keberkesanan intervensi dan menyokong peluasan pelaksanaannya dalam konteks pendidikan yang lebih luas. Pertama, intervensi ini wajar diskalakan ke sekolah-sekolah rendah lain melalui latihan dan bengkel kepada guru serta ibu bapa, agar kefahaman dan kecekapan pelaksanaan aplikasi dapat diselaraskan dengan konteks setempat. Kedua, nilai-nilai sahsiah yang diterapkan melalui aplikasi perlu diintegrasikan ke dalam sesi pengajaran dan pembelajaran harian sebagai sebahagian daripada rutin bilik darjah, sekali gus memupuk budaya nilai secara berterusan. Ketiga, Kementerian Pendidikan

Malaysia boleh mempertimbangkan untuk menginstitusikan penggunaan aplikasi atau modul serupa sebagai sebahagian daripada inisiatif dalam Pelan Pembangunan Pendidikan Malaysia pasca 2025, khususnya dalam komponen pembangunan sahsiah dan kesejahteraan murid. Akhir sekali, kerjasama penyelidikan lanjutan antara institusi pendidikan dan pihak berkepentingan lain amat digalakkan bagi meneroka keberkesanan jangka panjang intervensi ini, termasuk kesesuaiannya untuk diterapkan di peringkat sekolah menengah dan pelbagai konteks sekolah.

PENGHARGAAN

Kajian ini disokong oleh pentadbiran SK Rantau Panjang, guru-guru Tahun 6, ibu bapa murid, serta pihak Pejabat Pendidikan Daerah Klang.

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SIGNOVA: A SIGN LANGUAGE LEARNING REVOLUTION FOR STUDENTS WITH DISABILITIES

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ABSTRACT

SIGNova represents a purposeful leap forward in the design of mobile applications for education, crafted to accelerate sign language mastery among learners who are deaf or face speech challenges. Addressing the void of tailored digital teaching tools, the platform pairs interactive design with proven instructional science. Anchored in the Malay linguistic tradition, SIGNova embeds sign language instruction in lesson modules to elevate academic achievement, sharpen non-verbal communication, and spark sustained learner enthusiasm. A convergent-analysis trial with 141 participants showed a 197.51% upturn in academic outcomes against baseline instruction, and questionnaire data validated that mobile-assisted science notably raises both intrinsic motivation and communication efficacy. By orchestrating a highly interactive, inclusive teaching space, SIGNova widens the horizon of contemporary special education and illustrates how mobile technology can decisively narrow historic learning gaps. Therefore, SIGNova is more than a technological advance, it is a measurable pedagogical advance that exemplifies a sustained obligation to educational equity and inclusiveness across systemic practice.

Keywords: sign language learning, deaf-mute education, mobile learning application, inclusive education technology, special needs pedagogy

INTRODUCTION

The rapid evolution of mobile technology is reshaping educational landscapes, yet students with disabilities, particularly those who are both deaf and have limited oral proficiency, still face hurdles to accessing rich, high-quality learning opportunities (Cheung & Slavin, 2012). Although they navigate interactions using sign language, standard curricula dutifully translated to video formats neglect to embed interactivity, remain largely incidental within digital platforms, and often reproduce the constraints of classical lectures. Recent audits have identified the limited stock of learning resources in Malaysian sign language as particularly acute, the available materials lack interactivity, are siloed in repositories, and fail to leverage mobile reach (Nasaruddin et al., 2023). To bridge this void, the developers have unveiled SIGNova, an adaptive mobile learnware designed to scaffold sign language mastery through progressively personalized pathways. Early trials indicate promising uptake of inclusive behaviours, amplified independent inquiry, and enhanced sign fluency (Kale & Waghmare, 2021). Continuing evaluations quantify the app's educational returns and render a replicable playbook for an inclusive, technology-infused educational vision occurring within the Malaysian ecosystem and analogous educational landscapes.

METHODS

Building on a quantitative framework, this investigation collects numerical indicators to determine the deliberate impact of the SIGNova platform on students who are deaf or hard of hearing. An integrated approach, merging quasi-experimental and survey elements, supplies simultaneous, comprehensive evidence regarding how the app performs and how learners themselves evaluate the experience.

In order to quantify how SIGNova is expected to affect learning outcomes, the protocol adopts a quasi-experimental design that explicitly models causal relations (Smith & Doe, 2025). Such a design proves well adapted to educational settings in which random assignment of students raises both feasibility and ethical concerns. Consequently, the sample is partitioned into two delineated groups, labelled as the intervention and comparison sets. At the outset, a baseline test (O1) is provided to both sets, securing initial data on levels of mastery. After the baseline is recorded, the intervention group interacts with the SIGNova tool (X1), whereas the comparison group continues to follow established instructional routines (X2). Once the instructional phase concludes, a follow-up test (O2) is administered to both groups to measure any observed changes in academic performance, thereby isolating the influence linked to the differing instructional modalities.

Treatment group	R	O1	X1	O2
Control group	R	O2	X2	O2

Figure 1.: Experimental approach

Although total random assignment was not feasible, the quasi-experimental framework still permits stringent control of confounding variables (Smith & Doe, 2025). The evaluation of the SIGNova application centers on the differential change in mean scores between pre- and post-tests administered to the same cohort. By juxtaposing the treatment group, which utilizes the application, against a comparable control cohort, the design isolates the application’s effect on sign-language proficiency.

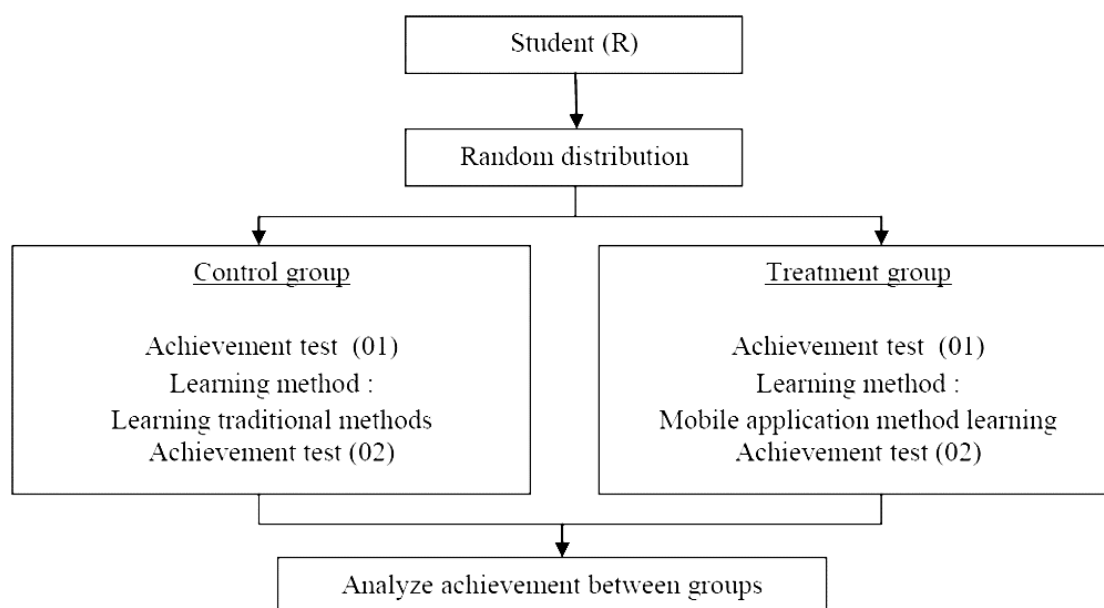


Figure 2.: Experimental design

Alongside the performance metrics based on logged activity, a cross-sectional survey investigated motivation and self-perceived communicative competence after using the SIGNova application. Incorporating this psychosocial lens is essential to understand the impact of digital pedagogies on learners with disabilities. Constructing the survey followed the procedure of (Samsudin et al., 2020), moving through stages of articulating the problem, reviewing the relevant literature, specifying the measured variables and hypotheses, defining the target population and selecting a probabilistic sample, building an instrument aligned with the research question, collecting the data, and finally performing inferential analysis.

The instrument focused on two domains such as engagement with digital content and the participants’ non-verbal communicative skills. Respondent selection was confined to a merged operational definition of distinct disabilities, ensuring relevance to the special educational context, after which growth in motivation and communicative proficiency was measured by comparing pre-test and post-test data.

The integration of an experimental group with survey administration enabled cross-validation of quantitative usage data and subjective self-reports, reinforcing the robustness of the evaluation results. Such a mixed-method approach is in keeping with contemporary special education scholarship, which advocates for accumulating both performance evidence and learner voice to guide the iterative design of instructional technologies.

FINDINGS

Analysis of Student Achievement

The findings contrast the classic teaching model with the inclusion of the SIGNova mobile app in special education settings. The data shows that standard instructional approaches yielded inconsistent shifts in student achievement. Gains from post-test to pre-test varied, landing anywhere from stagnation to a peak of 54.55%. Remarkably, one learner experienced a decline of -22.24%, underscoring the uneven impact. Overall, the group taught by traditional methods produced a summed performance gain of 359.82%.

Table 1. Pre-Test and Post-Test Results for Conventional and Mobile App Methods

Bil	Conventional			Mobile Apps		
	Pre Test	Post Test	% Increment	Pre Test	Post Test	% Increment
1	25	66.66	166.64	50	83.83	67.66
2	37.5	45.83	22.21	15	74	393.33
3	12.5	16.66	33.28	35.5	79.16	122.99
4	12.5	16.66	33.28	42.25	87.5	107.1
5	45.83	66.66	45.45	33.33	79.16	137.2
6	41.66	45.83	10.01	14.5	87.5	489.66
7	25	29.16	16.64	25	75	200
8	37.5	29.16	-22.24	30.2	75	148.34
9	45.83	70.83	54.55	35.5	75	111.27
10	33.33	33.33	0			
Total			359.82	Total		1777.55

The cohort using the SIGNova platform far surpassed expectations. Every participant advanced on the follow-up assessment, progression ranged from 67.66% to 489.66% and cumulatively produced a 1777.55% lift from initial scores. Such evidence emphatically demonstrates that SIGNova produces

anterior, efficient growth in sign language and interconnected subjects.

When SIGNova results match those from traditional settings, the platform's effect multiplies by five. Instruction supported by purpose-driven technology produces uniform growth and, in addition, presents tailored, multisensory exposure that effectively assists learners with distinctive needs. SIGNova customizes curricular input, minimizes hindrances, and creates a genuinely inclusive landscape. Together, these dimensions confirm the capacity of mobile applications to serve as powerful, evidence-backed allies within specialized instruction, effectively addressing long-embedded disparities in achievement.

Analysis of Student Motivation Level

Correlation analysis indicated that a modest 34.7% of variance in student motivation was explained by the combined influence of the five identified predictors such as communication method, pedagogical strategy, learning module, design, and mobile device. Although this R^2 was lower than that resulting from the prior communication analysis, pedagogical strategy and mobile device achieved significance at the .05 level. Intervariable correlations were predominantly weak, except for a moderate positive relationship between pedagogical strategy and mobile device, the remaining correlations were weak or slightly negative. Regression analysis confirmed the persistent influence of pedagogical strategy ($\beta = .284$, $p = .003$) and mobile device ($\beta = .218$, $p = .044$), both of which displayed moderate, statistically significant effects on motivation. The learning module, design, and communication method, however, yielded nonsignificant coefficients. Examination of variance inflation factors revealed no multicollinearity concerns among the predictors.

Analysis of Student Communication Level

The regression model explained 46.9 percent of the variance in student engagement with communication activities, corresponding to a moderate to substantial effect size (Pearson $R = .685$). Among the independent variables included, only pedagogic strategy attained statistical significance ($p < 0.05$), learning module, mobile device usage, instructional design, and pre-specified methods exhibited non-significant contributions. Multicollinearity diagnostics indicated satisfactory conditions, with variance inflation factors confined within thresholds of 0.8, although the model retained a moderate level of overall explanatory capacity. The pedagogic strategy manifested the dominant effect, substantiated by the largest standardized regression coefficient (Beta = .606, $p = .000$) and a moderate partial correlation coefficient of 0.553, these metrics converging across multiple re-estimations. Battery diagnostics further corroborated model robustness, confirming pedagogic strategy cast as the pre-eminent predictor of enhanced student engagement in communication tasks.

CONCLUSION

Empirical analyses validate that the SIGNova mobile platform statistically elevates academic outcomes, enhances motivational levels, and enriches interaction among students with special educational requirements. Within the parameters of the controlled trial, comparative stratum revealed that learners

exposed exclusively to SIGNova consistently outperformed the standard cohort across key academic indicators, thereby attesting to the application's established contribution to cementing subject-area mastery (Yu, 2022). Motivation analyses indicated that both focused instructional strategies and mobile interface functionalities serve as separate, affirmative facilitators, emphasizing that synchronized application of instructional theory and technology is essential for the maintenance of prolonged learner drive. When examining levels of peer and educator exchange, findings revealed that the explanatory force lay within the delivered instructional architecture, thereby substantiating the assertion that pedagogical adjustments aligned with learners' profiles are a necessary antecedent to efficacious communication (Navas-Bonilla et al., 2025; Samsudin et al., 2020). The cumulative dataset, therefore, permits the reasoned assertion that SIGNova constitutes a multifaceted pedagogical scaffold within the field of special education, concurrently advancing achievement, cultivating intrinsic motivation, and mediating interaction. The comprehensive experimental framework further categorizes the platform as a legitimate and equitable technological option within modern instructional architecture (Kotsi et al., 2025).

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SMART MICRO-CREDENTIALS IN HIGHER EDUCATION: ENHANCING STUDENT ENGAGEMENT IN PROBABILITY LEARNING

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ABSTRACT

In an era where digital learning continues to transform the educational landscape, micro-credentials have emerged as a viable alternative to traditional degree programs. This study investigates the effectiveness of micro-credentials in Probability education within the UiTM Learning Management System (LMS), particularly the Ufuture platform (<https://ufuture.uitm.edu.my/courses/overview/UMC379>). The research aims to evaluate student satisfaction, knowledge acquisition, and engagement in the micro-credential course Counting and Probability, offered at UiTM. By leveraging learning analytics, the study examines student interactions, assessment results, and engagement patterns to provide actionable insights into the efficacy of micro-credentials in statistical education.

Using a survey-based quantitative approach, data was gathered from 74 undergraduate students enrolled in the micro-credential course, assessing seven key dimensions: knowledge gain, content relevance, assessment effectiveness, confidence improvement, instructional delivery, instructor approachability, and overall enjoyment. Statistical techniques, including descriptive analysis and correlation analysis were applied to interpret student responses. The findings reveal a high level of satisfaction, with an average rating above 4.6 across all dimensions. The strongest correlation was identified between engaging instructional methods and overall enjoyment, underscoring the importance of interactive pedagogical strategies. Micro-credentials developed within Ufuture UiTM are structured to facilitate self-paced learning while maintaining rigorous academic standards. The Counting and Probability module covers fundamental probability concepts, including Set Theory, Probability Rules, and Bayes' Theorem, incorporating adaptive learning technologies, gamification, and interactive problem-solving exercises. Learning analytics data from Ufuture revealed that students engaging with interactive content demonstrated higher assessment scores and improved retention rates compared to those relying solely on textual materials. Furthermore, instructor

accessibility and assessment clarity emerged as critical factors influencing learner confidence and engagement. While the study confirms the effectiveness of micro-credentials in Probability education, minor disparities in satisfaction levels suggest potential areas for improvement. Specifically, personalized feedback mechanisms, real-world application scenarios, and adaptive learning pathways should be enhanced to address diverse learner needs. The integration of AI-driven learning recommendations and peer interaction forums is recommended to further elevate engagement and learning outcomes. This research contributes to the broader discourse on micro-credentials in higher education, offering empirical evidence on their impact in Probability education. Future initiatives should focus on optimizing content delivery through data-driven instructional design and expanding micro-credential offerings in other mathematical domains. By leveraging learning analytics, UiTM's Ufuture platform can continue to refine its digital learning ecosystem, ensuring a student-centric, data-informed approach to higher education.

Keywords: *Micro-Credentials; Learning Analytics, Probability Education, Digital Learning, Ufuture UiTM*

INTRODUCTION

The rapid expansion of digital education has led to the adoption of micro-credentials as a flexible and competency-based learning approach. Probability is a fundamental subject in many disciplines, and students often struggle with its abstract nature. The introduction of micro-credentials via UiTM's Ufuture platform aims to provide an accessible and interactive learning experience that enhances conceptual understanding. This study examines the effectiveness of micro-credentials in Probability education through learning analytics, measuring student engagement, assessment performance, and satisfaction levels (Chek et al., 2023; Krismanto & Tahmidaten, 2022; Lee et al., 2020; Shamir-Inbal & Blau, 2020; Wang & Xu, 2016; Yang et al., 2020).

METHODS

The rapid expansion of digital education has led to the adoption of micro-credentials as a flexible and competency-based learning approach. Probability is a fundamental subject in many disciplines, and students often struggle with its abstract nature. The introduction of micro-credentials via UiTM's Ufuture platform aims to provide an accessible and interactive learning experience that enhances conceptual understanding. This study examines the effectiveness of micro-credentials in Probability education through learning analytics, measuring student engagement, assessment performance, and satisfaction levels. The survey assessed seven key dimensions of student satisfaction: knowledge acquisition, content relevance, assessment effectiveness, confidence improvement, instructional delivery, instructor approachability, and overall enjoyment. Statistical analysis techniques, including descriptive statistics, and Pearson correlation analysis were utilized to interpret the findings (Abror, 2022; Cerón et al., 2021; Gandomkar et al., 2020; Jossberger et al., 2020; Yu et al., 2020).

RESULTS AND DISCUSSION

Table 1 presents the summary of learner satisfaction ratings across different dimensions. Basically, the high satisfaction across all categories, which category has a mean score above 4.6, indicating that students generally had a positive learning experience. The standard deviations ranged between 0.45 and 0.55, showing that most students had similar perceptions.

Table 1.: Learner Satisfaction Ratings

Category	Mean	Standard Deviation	Min	Max
Knowledge Acquisition	4.75	0.45	3	5
Content Relevance	4.70	0.48	3	5
Assessment Effectiveness	4.65	0.50	3	5
Confidence Improvement	4.60	0.55	3	5
Instructional Delivery	4.72	0.47	3	5
Instructor Approachability	4.68	0.49	3	5
Overall Enjoyment	4.73	0.46	3	5

A Pearson correlation analysis was conducted to examine relationships between different factors of learner satisfaction. The strongest correlation was observed between engaging instructional methods and overall enjoyment ($r = 0.90$), indicating that interactive learning significantly enhances student satisfaction. Additionally, students who reported high levels of knowledge acquisition also exhibited greater confidence ($r = 0.83$). The findings highlight the need for enhanced interactive elements, including AI driven recommendations, gamified learning techniques, and peer-based discussion forums to further improve engagement and learning retention (Chek et al., 2019; Ekrami et al., 2020; Ismail et al., 2023).

CONCLUSION

This study confirms the high effectiveness of micro-credentials in Probability education through learning analytics-based assessments. Key findings suggest that interactive instructional methods, instructor accessibility, and well-structured assessment frameworks significantly impact student satisfaction. Recommendations include implementing adaptive learning strategies, real-world application scenarios, and enhanced feedback mechanisms to further optimize UiTM's Ufuture micro-credential offerings (Ismail et al., 2019).

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STRATEGIC CURRICULUM REVIEW FRAMEWORK USING HOUSE OF QUALITY (HOQ)

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ABSTRACT

Curriculum review (CR) is a periodic process for an academic program. In higher education, the process is conducted once every 3-5 years for the purpose of continual improvement, addressing feedback from stakeholders and compliance with relevant standards and policies. House of Quality (HOQ) is a graphical presentation that integrates key information to support decision making and is widely used in the manufacturing industry. There is a need for a structured framework in addressing the CR process due to complexity and multitude of variables involved. This work proposes a framework to support the CR process utilizing the HOQ. The process began with the identification of a theme for the new CR. Then, potential courses were brainstormed and organized by using an affinity diagram which clustered the courses into (i) four main academic areas and (ii) the four academic years of the program. Each academic year was then assigned a theme to represent the level of the courses offered. A double relationship diagram was employed to determine (i) the interrelationship among the proposed courses and (ii) the alignment with sustainable criteria and the technical requirement. These elements were then incorporated into the HOQ. A matrix analysis together with correlation matrix were then calculated. A competitive evaluation and benchmark performance were conducted by comparing to one (1) local university and one (1) international university, respectively. Through this framework, the most influential variables in the CR process were identified and benchmarked, enabling comprehensive analysis of the strengths of the new curriculum relative to the selected institutions.

Keywords: Curriculum review (CR), House of Quality (HOQ), Framework

INTRODUCTION

Curriculum review (CR) is an essential and continuous process in higher education that ensures academic programs remain adaptable, progressive, and aligned with the evolving expectations of stakeholders and the demands of the job market. In the Malaysian context, universities are guided by

frameworks such as the Malaysia Education Blueprint 2015–2025, which mandates systematic curricular renewal every three to five years to maintain consistency with both national and global standards. An effective review process typically involves comprehensive needs analysis, stakeholder consultations, benchmarking against comparable programs, compliance with accreditation requirements and relevant policies, and the fulfillment of institutional expectations.

The utilization of HOQ in curriculum review is not new. Ayse Aytac and Veli Deniz, 2005 have employed the method in the Tyre Technology Department at the Kocaeli University Kosekoy Vocational School of Higher Education (KU-KVSHE), Turkey. In the study, questionnaires were distributed to stakeholders and the list of courses to be offered were the observed criteria. Akundi et al. (2022) focus on assessing the effectiveness of course structure and instructional implementation in the classroom while Satter et al. (2010) and Cropley (2020) emphasis on the program outcomes. Yet, benchmarking with other universities is essential in identifying the competitive advantage of the offered program. A very comprehensive approach was conducted by Gonzalez et al. (2011). Hundreds of questionnaires were distributed to stakeholders to formulate the sustainability criteria which in the end can offer several new courses. However, the work is overwhelming and time consuming.

This work presents the use of HOQ as a strategic and simplified CR framework. This framework can be used to highlight important issues in the program and analysis can be done from various perspectives simultaneously. The framework can be employed in any academic program in higher education. The example presented here pertains to the Bachelor in Mechanical Engineering with Honours at Faculty of Mechanical Engineering, Universiti Teknologi MARA.

METHODS

The process commenced with the identification of the main theme for the new CR. This is essential to ensure the content is streamlined with the theme. Subsequently, potential courses were brainstormed. Then, by using an affinity diagram, the courses were grouped according to (i) four main academic areas offered by the program, and (ii) the four academic years of the program. Each academic year was assigned with a specific theme to reflect the intended level of course complexity. The first relationship diagram was utilized to examine the interrelationships among the proposed courses. Following this, the draft of the courses consisting of the course outcomes, course content and the assessment were developed based on comments from the External Examiner (EE), Industrial Advisory Panel (IAP) and Round Table Discussion (RTD) with alumni and industry stakeholders, audit report and market survey. A second relationship diagram was then constructed to assess the alignment sustainability criteria and technical requirements selected. These components were subsequently integrated into the House of Quality (HOQ). Matrix and correlation analyses were then performed. Finally, a competitive evaluation and benchmarking exercise were conducted by comparing the proposed curriculum with those of one selected local and one international university. Figure 1 shows the flowchart for the framework.

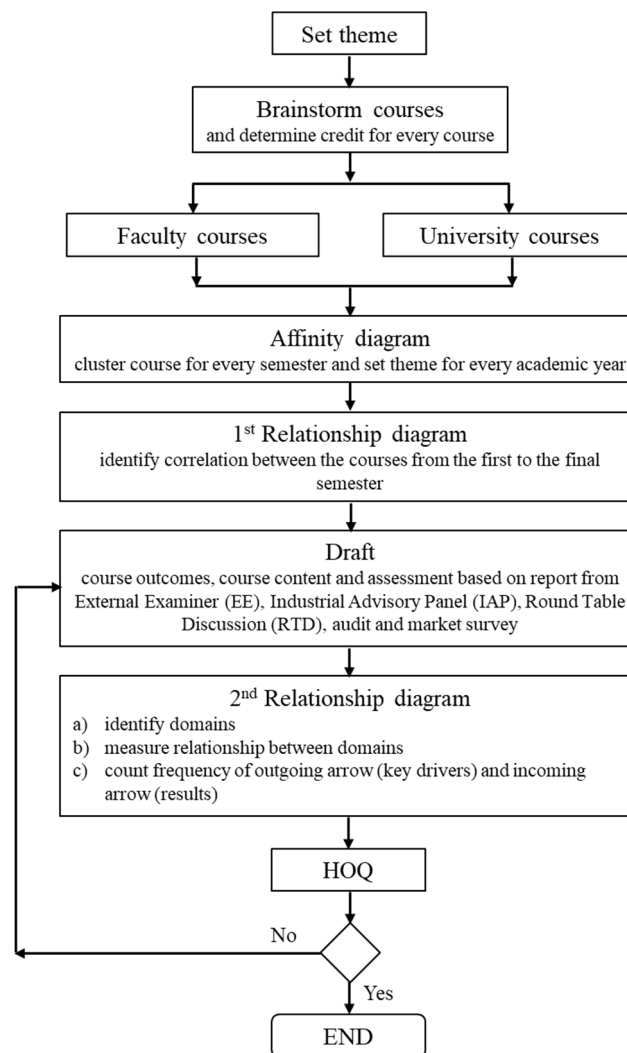


Figure 1.: Framework of Strategic Curriculum Review

RESULTS AND DISCUSSION

The Faculty of Mechanical Engineering, Universiti Teknologi MARA adopted “Driving Innovation for Industry Readiness” as the theme for the new curriculum review. Following a structured brainstorming session, a total of 54 course were to be completed for the program. Of these, 39 courses offered by the faculty were categorized under four academic areas. The 30 main compulsory courses were nine from Manufacturing and Industrial Engineering (MIE), six from Mechanics and Materials (M&M), seven from Thermofluids (TFS) and eight from Dynamics and Control Engineering (DCE). The remaining faculty courses included industrial training, two final-year projects, two electrical courses and three elective courses which can be selected from any of the four academic areas. In addition, 16 university-mandated courses were included in the program covering courses such as Islamic and civilization, co-curriculum, second and third language, mathematics and one cross faculty course. With the identified courses, the course credit hours were predetermined.

Then, another affinity diagram was made to cluster the courses into suitable semesters and years of studies regarding a given theme : Year 1 - Fundamental courses, Year 2 - Fundamental and Applied Courses, Year 3 - Applied & Experiential Learning and Year 4 - Research, Industry Immersion & Experiential Learning. The first relationship diagram was constructed to identify the correlation among the courses starting from the first to the final semester. The interdependencies among the courses can be visible including the pre-requisite and the co-requisite. This process is essential for ensuring the logic sequence and the development of course content across the program. Then, the course outcomes, course content and the assessment can be drafted.

The second relationship diagram was subsequently created to visualize the interconnections between the domains. The domains were identified based on critical elements for the curriculum review. The diagram facilitated the identification of key drivers and the resultant connections. In this context, the primary key drivers and domains were selected to represent sustainability requirements and technical requirements to be incorporated into the HOQ. The main identified domains were Content, Facilities, Recognition, Employability, Industry related, Collaboration and Cost. After constructing the diagram, the number of incoming and outgoing arrows for each primary domain were counted. Outgoing arrows represented the key driving factors, while incoming arrows indicated the resultant effects. The frequencies were then ranked as presented in Table 1. Based on these findings, the top three domains with the highest frequency of outgoing arrows were selected as criteria for sustainability requirements namely Content, Facilities and Collaboration. The five technical elements identified from the domains with the highest frequency of incoming arrows are Recognition, Employability, Collaboration, Cost and Facilities. A matrix analysis was performed on these selected domains before integrating into the HOQ.

Table 1.: Frequency of the key drivers and the results from the relationship diagram

No	Key drivers (Outgoing Arrow)	Frequency	Results (Incoming Arrow)	Frequency
1	Content	6	Recognition	5
2	Facilities	6	Employability	5
3	Collaboration	5	Collaboration	5
4	Recognition	4	Cost	5
5	Employability	4	Facilities	4
6	Industry related	3	Industry related	4
7	Cost	2	Content	3

To complete the HOQ as illustrated in Figure 2, a matrix analysis was conducted to examine the relationships between the identified sustainability and technical requirements. The technical requirements with the highest ratings were considered most critical to the success of the CR, with Employability receiving the highest score. This highlights the curriculum's strong emphasis on enhancing graduate marketability. Subsequently, a correlation matrix was computed in the triangular section at the top of the HOQ diagram to evaluate the interrelationships among the technical requirements. A competitive benchmarking exercise was also conducted by comparing the proposed curriculum with those of one local (University A) and one international (University B) institution. The

results indicated that both benchmarked universities demonstrated strong alignment with the identified sustainability requirements. Benchmark performance indicators were positioned at the bottom of the HOQ diagram, representing the target performance levels for each technical requirement. The comparative analysis revealed that the revised curriculum is on par with the benchmarked institutions, demonstrating its competitiveness and alignment with both national and international academic standards.

This example illustrates how the framework can be effectively utilized during the CR process. If the program is not satisfied with the results of the benchmarking performance, the draft course outcomes, course content, assessment methods, and relevant domains may be revisited and refined accordingly.

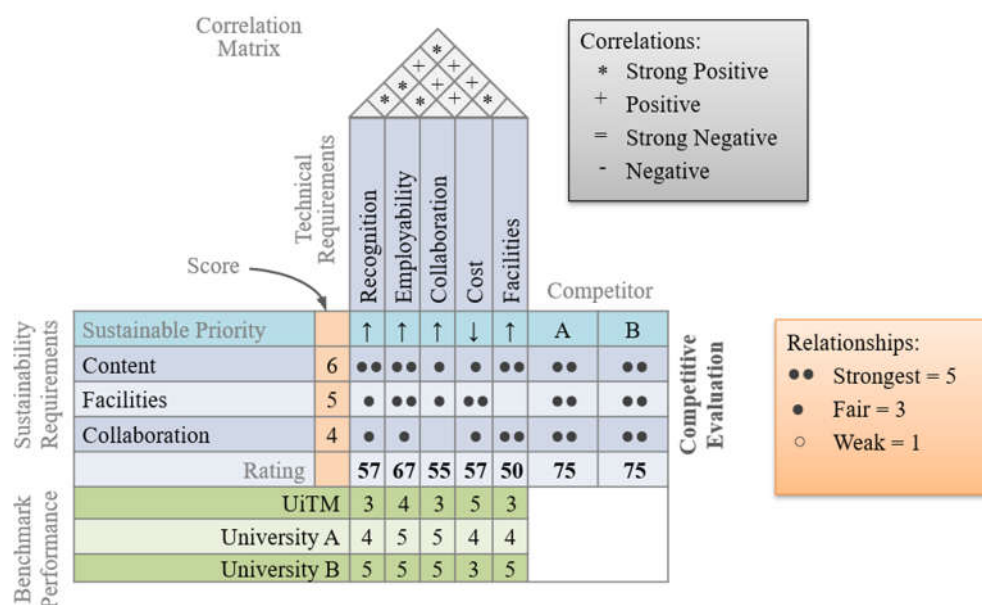


Figure 2.: House of Quality (HOQ) diagram

CONCLUSION

The CR process can often become overwhelming due to the multitude of activities and extensive information to be analyzed. The development of the framework adopted a structured and data-driven approach, incorporating thematic alignment, affinity and relationship diagrams, and the HOQ. Through systematic analysis, key sustainability and technical requirements were identified, with employability emerging as the most critical factor. Benchmarking against local and international institutions demonstrated that the revised curriculum is both competitive and aligned with global standards. Overall, the redesigned curriculum strengthens course coherence, industry relevance, and graduate marketability.

ACKNOWLEDGEMENT

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TECHNOLOGY AS SUICIDE RISK AND PROTECTIVE FACTORS: FROM COUNSELLING POINT OF VIEW

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ABSTRACT

Rising suicide rates, particularly among adolescents and marginalized groups, are causing increased interest in the development of innovative and inclusive mental health interventions. These interventions include integrating technological advances into mental health counselling. This paper focuses on one area of application for technology in counselling professional helping relationship. This research aimed at exploring association integrating technology in counsellors' professional practices in addressing suicide behaviours. This study utilized a qualitative case study methodology to structure this research. The data were collected using semi-structured individual interviews and selected documents. Eighteen participants involved this in research. Among those include ten professional counsellors, four individuals who experienced incomplete suicide attempts, and three caregivers, all were recruited through purposive sampling. Rigorousness of the data collected were sought. Thematic analysis was employed for data analysis to extract meaningful phrases, codes, patterns, categories and themes. Findings emerged from this research include technology to be identified as one of the interferences in service delivery and technology was indicated to be among the risk factors and protective factors for suicidal behaviours. The findings underscored the need to enhance counsellors' best practice in managing suicidal crisis issues that are critical case in Malaysia. Practical and policy recommendations related to this study are discussed.

Keywords: Suicide, Suicidal behavior, Counsellors, Counselling, Technology, Malaysia

INTRODUCTION

The World Health Organisation in 2018 reports that suicidal behaviours are the leading global cause of death among teenagers aged 15 to 29. In 2020, Malaysia recorded about 872 young people in Malaysia took their lives from January 2019 up to May 2021, as reported by the Royal Malaysia Police. UNICEF in 2021 has notified that Children between 15 and 18 years old made up 51 per cent of the total 1,708 suicide cases recorded in that time. The use of technology in modern life is inescapable as its application

extends beyond digital platforms and mediums, including social media. After all, the use of technology can be both beneficial and detrimental to humankind.

Suicidality refers to suicide-related behaviours and thoughts, including completing or attempting suicide, suicidal ideation, or communications. The model of suicide by O'Connor and Kirtley (2018) through the integrated motivational-volitional (IMV) model deliberated suicide into three phases: the premotivational, motivational and volitional phases. The individuals with suicidality undergo a phase of having events or episodes that could be triggering, then turn into ideation or intention towards suicide and later are followed by behavioural activation. Recently, gadgets were available to individuals of all ages, including youngsters. Suicide risk factors elevate the one's tendency towards suicidal behaviours. A risk factor is referred to as an aspect that pertains to an individual's perpetual thinking of suicide, while suicide warning signals indicate pressing conditions that take place in minutes or days, which can set off suicidal behaviours (Rudd, 2008). Technological usage related to suicide risks can be observed in various forms. In the absence of adequate supervision and screen time restrictions, youngsters playing with technology may expose themselves to cyberbullying (Dorol-Beuroy-Eustache & Mishara, 2021). Youngsters who excessively use digital gadgets for social media and web browsing negatively affect their psychological well-being (Chamarro et al., 2024). The relationship between technology use and suicide risk has been shown in records of online threats (Massing-Schaffer & Nesi, 2020), excessive gaming (Chamarro et al., 2024), trouble sleeping (Hamilton et al., 2023), and abrupt losses resulting in social relationships (Orline et al., 2020). These noticeable effects in teenagers who engage extensively in online platforms depicted negative consequences ranging from harassment and threats to feelings of hopelessness and helplessness. This may contribute to psychological dysregulation and disconnection from others and compromised wellbeing resulting in further diminished psychological functioning.

Technology offered not only negative implications but benefits too. The benefits are believed to alleviate the suicidal tendency and curb the issues from worsening, known as protective factors. A protective factor is referred as reduce the potential for a person's suicide or suicidal behaviour. Protective factors are referred to as individual dimensions or external conditions that help balance or reduce the risk that they are exposed to (Dias & Cadime, 2016). Protective aspects related to technology might encompass various elements. Technology as protection can be observed from the aspect of having support through online communities (Li et al., 2023) and intervention offerings from internet-based mediums (Erting et al., 2023). Technology hence provides room for us for intervention through digital intervention via accessible apps or programmes found on web pages or media outreach. This can also be enhanced through the availability of online support groups, which can help the affected individuals feel understood. Additionally, the existence of a supervisory system mitigated the risks for adolescents to use inappropriate apps.

While technology and digital platforms have expanded its usage across age and population, both suicide risk and protective factors showed inconsistent results from the context of mental health and counselling. As the interventions involving mobile and web apps showed a reduction in suicidal thoughts and improved psychological wellbeing, research highlighting participants lived experiences and insights on technology and suicidal behaviours and unique conditions was found to be limited. The use of an AI-driven detection system, including NLP models, depicted promising results in detecting

warning signs of suicide, but the best practices and conduct of mental health professional counsellors remained unstudied (Kee et al., 2024).

Yet, counsellors and the utilisation of technological devices require further study, as services in counselling are not only limited to intervention merely but include the administration of psychological tests, need analysis data gathering, record keeping and many others. This service process, though can be eased using technological advancement, yet thorough consideration should be emphasised (Anni, 2018). Additionally, counsellors' training in technological devices or applications limits the use of technology in delivering their services (Deslonde & Becerra, 2018). In the case of technology integration into counselling, ethical boundaries and counsellors' competencies in technological utilisation should be further explored and researched in the context of psychological cases, particularly when the strike of the Covid-19 pandemic at global level (Woo, Dondanville, Jang, Na, & Jang, 2020). These findings, shed light on the need for further exploration of how technological usage and suicidality are tailored to counselling professionalism in Malaysia. This research aimed to explore how technology is embedded in suicidal behaviours tendency from the lens of counselling practices.

METHODS

The use of a qualitative case study approach in this research helped to further explore the issue in counselling contextual events. Data collection was done using both available documents related to addressing suicide and interview sessions. For analysis, researchers read through the documents and transcription verbatim several times before beginning to identify keywords, codes, phrases and the thematising process. Purposive sampling and document gathering were utilised for data collection in this research, and they aimed to enhance the triangulation process. Validation of the data was done through the process of member check. Experts' validation for both interview protocols and emergent themes was conducted to gain further validation. Thematic analysis was employed to generate meaningful themes and subthemes. For ethical consideration, researchers as registered counsellors observed psychological risks displayed by participants and offered emotional support if there was any distress shown by participants.

RESULTS AND DISCUSSION

Three major themes were generated from this study in relation to technological utilisation and suicidal behaviours. Technology was identified as interfering with service delivery, determinant risk factors, and protective factors. The findings shed light on the significance of technology in counselling services provided by counsellors in addressing suicidal cases.

Figure 1 highlighted the themes for this finding by indicating the respective themes associated with it. Three main themes related to technology and suicidal behaviours highlighted three distinctive themes, namely service interferences, suicide factors and suicide protective factors, and the subthemes

additionally deliberate each theme according to its context. The first theme highlighted technology as interference in services, which refers to having inadequate continuous support in technological processes, culturally bound issues when technology is introduced in the counselling services and technologically based supports are newly introduced in the line services. These have been highlighted that technology has interfered with the traditional counselling practices. Secondly, the theme highlighted technology as part of risk factors for suicidal behaviour triggered from excess involvement in social media and involvement technological platforms. The involvement has been depicted as a risk for counselling clients inclined towards suicidal behaviours. Thirdly, technology, in contrast, is indicated to be part of protective factors for suicide behaviours, which the sources of crisis support delivery via online platforms. Technological usage can be perceived as platform of continuous support and its services rendered required strategies and skillsets from counsellors to increase in job competencies in delivering services.

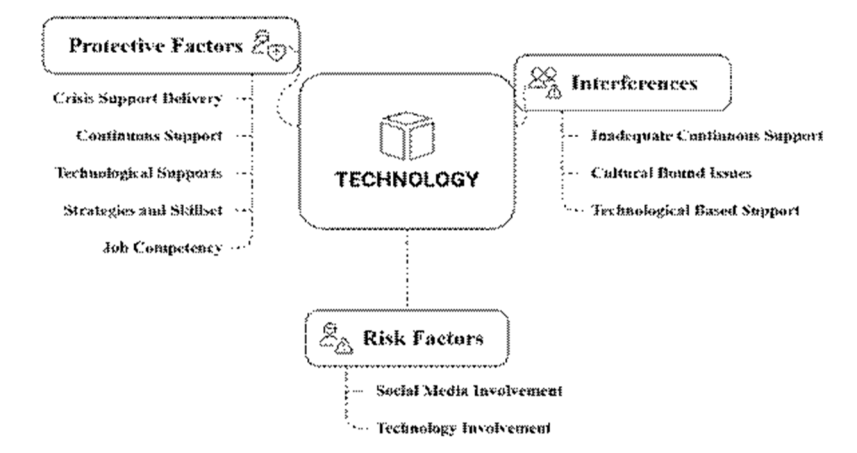


Figure 1.: Technology as suicide risk and protective factors

CONCLUSION

Interferences, suicide factors and suicide protective factors have shed light on the importance of having technology related to the competency of counsellors in addressing clients with suicidal behaviours. Thorough exploration of technology in the counselling field and the context of suicidal behaviours implies that counsellors are required to make themselves ready for the involvement of technology in psychological and mental health cases, irrespective of settings. The evolving of technology is essential to complement counselling supports. Keeping up with advanced interventions embedded with technology will be a challenge to counsellors to sustain the effectiveness of counselling intervention and clients' wellness. In conclusion, this qualitative research offered another insight into technology and counselling practices in addressing suicidal behaviour concerns. The findings are believed to inform counselling practitioners on the critical position of technology, and counselling intervention should be made available to address the issues. It also emphasised the necessity of establishing adaptive and

humanised policy standards, along with an enhanced delivery of holistic mental health services in Malaysia. For future research, findings suggested to explore on the effectiveness or relevancy of technology in suicide prevention and intervention; specified interventions with technology, and artificial intelligence usage are suggested to suit multicultural settings and available resources in Malaysia. It is to suit community-based interventions and update mental health policies enhancement and improvement.

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THE KHUTUB KHANAH

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ABSTRACT

The Khutub Khanah (TKK) is an innovative AI platform that is built to locate and centralize access to a selection of reliable AI websites that are suitable for educational purposes. In the current digital landscape, AI tools are being developed rapidly, and there are tons of AI websites that are growing in number and complexity. It is an advantage to use AI for learning purposes; it can create interactive learning and can be used as a guide for learning purposes. However, it can be overwhelming to identify an AI platform that is not effective and age-appropriate for learning, other as an ethical issue that needs to be considered while using AI. TKK addresses this gap by offering a curated hub that is safe and relevant for users with different learning levels. Recognizing the potential of AI in transforming education, TKK comes by using the technology to support an interactive learning experience and explore the ethical implications and responsibilities associated with the use of AI. TKK is created to support 3 categories of learners for their learning purposes. These 3 groups are researchers, school students, and young children. For researchers, it provides access to AI tools that support research activities. TKK offers school students to enhance their understanding of core subjects and guide them with their homework. For children, it will be a safe and fun AI-based education tool to promote early literacy. TKK makes AI tools more accessible, structured, and safe for smart education across all age groups.

Keywords: Artificial Intelligence (AI), AI Hub, Educational Platform, Smart Education

INTRODUCTION

Artificial intelligence is rapidly growing greatly in various industries, including education, and it has an impact on the current learning process. The integration of artificial intelligence has slowly altered from conventional teaching methods to personalized learning, which offers diverse educational requirements, especially for students with special needs. Artificial intelligence has reshaped learning paradigms and opened different possibilities for individualized and dynamically adaptive educational experiences (Walter, 2024). Artificial intelligence tools have offered personalized learning, other of which is an intelligent tutoring system that acts as a learning assistance.

Artificial intelligence tools have been approved as one of the latest methods for educational purposes because AI offers an unparalleled opportunity for education to adapt to current technological trends (Tafur & Molina, 2023). AI offers a variety of tools for different users, most tasks can be done using AI, and it is more flexible and time-consuming. However, the ethical considerations while using AI need to be concerned. Building ethical AI or getting AI to act ethically requires an understanding of AI ethics. What is ethically right and wrong is determined by ethical or moral beliefs and principles (Huang et al., 2023). It is important to use AI as a medium of education in the right way because technological revolutions contribute to preparing more educated and informed citizens, drive innovation, and support economic growth necessary for achieving a sustainable future (Strielkowski et al., 2023).

Despite this artificial intelligence growth, the number of artificial intelligence tools keeps rising, and the safety of the tools and ethical considerations on using the tools are still being questioned. The Khutub Khanah is designed in order to provide a safe place for personalized learning activities. The Khutub Khanah or TTK is an application that works as a platform for researchers, students, and young children to explore knowledge in a modest and interesting way with the help of artificial intelligence. TTK provides and gathers a few AI tools that are already available in one place. This application is suitable for different age ranges and education levels because it has divided the tools based on user education level. It also serves as a platform to expose the ethics of using AI.

Through this initiative, TTK aims to encourage educators, learners, and researchers to implement AI-based practices that are both effective and ethically responsible. The expected results include stronger digital literacy, equitable access to modern educational technologies, and the development of future-ready mindsets.

METHODOLOGY

The process of designing innovations requires a structured framework that is suitable for the outcome of the innovation. This innovation is designed using the ADDIE model, it is used in the development of the Khutub Khanah. The ADDIE model is widely used in educational and training programs to guide a systematic and well-structured creation of effective and learner-centered educational tools. The ADDIE model applies to meet different teaching requirements in all online educational environments (Spatioti et al. 2022). It consists of five phases: analysis, design,

development, implementation and evaluation.

Analysis

In the idea of creating TKK AI tools, the target user groups are identified in order to fulfil their learning needs. For this innovation, there are three types of users: researchers, school students and young children. It is important to divide them into their education level to understand the user limitations, such as device accessibility and age-appropriateness.

Design

The design of TKK is important to make it suitable for user preferences. The layout of the TKK platform is clarity, accessible and minimalist to make sure that users can easily understand the functions of these applications. The interface is different based on their categories and is user-friendly.

Development

After completing the design phase where the layout and interface were carefully designed based on user categories. The development phase of the TKK application focuses on building and assembling all the components from the design specification. This phase transforms the design ideas into real products. However, for TKK, the tools of AI still need to be selected carefully and cannot be inserted into the application yet because it is still in the idea and prototype stage.

Implementation

TKK is still in the prototype stage, so there is no implementation yet for this innovation. It is hoped that TKK will work as an AI education hub for researchers, school students, and young children, so they don't have to find AI tools on different websites, which takes a lot of time. They can only access one application to the other AI tools.

Evaluation

As mentioned, TKK is still in the prototype stage, so there is no evaluation that can be done for these innovations.

RESULTS AND DISCUSSIONS

The innovation of The Khutub Khanah (TKK) as an educational AI hub is hoped to have an impact on society, educational institutions, and the country. The prototype of TKK successfully achieved the intended goals of providing a safe place for an AI educational platform that highlighted the ethical use of AI, and it provided an AI learning hub for three different types of learners.

The impact of TKK on society is, it will provide an equitable access to AI-driven learning tools for different categories of learners, including underserved communities. Educational institutions will

also benefit from this innovation because it offers personalized AI tutoring and resources in Science, Technology, Engineering, and Math, improving student outcomes. This innovation also aligns with Malaysia’s digital education roadmap and the Ministry of Education’s push for hybrid and future-ready learning. TKG stands as a capable educational innovation that encourages sustainable learning through the integration of AI.

Table and Illustration

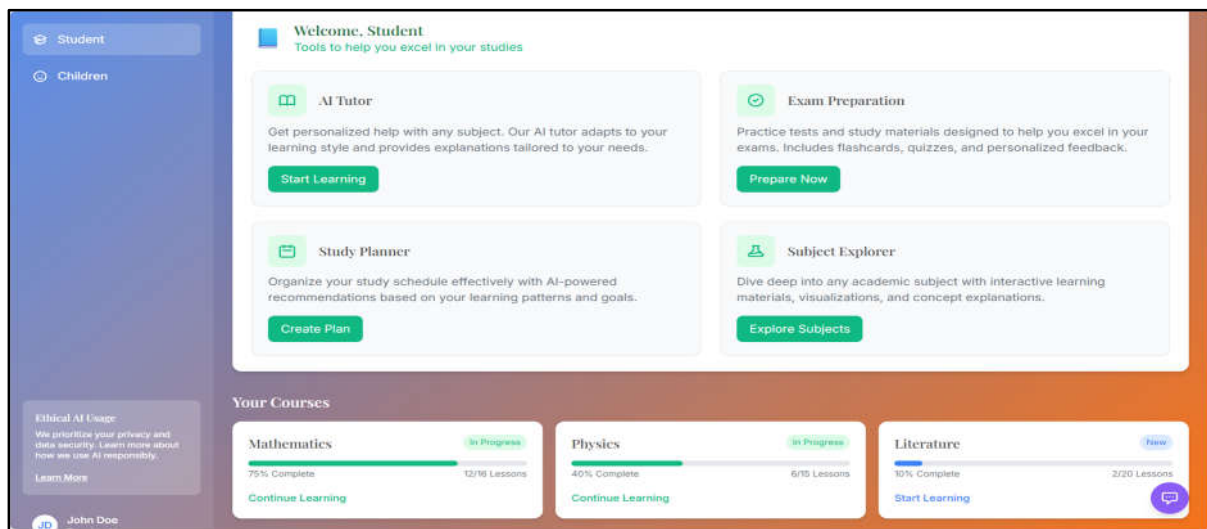


Figure 1.: Website interface

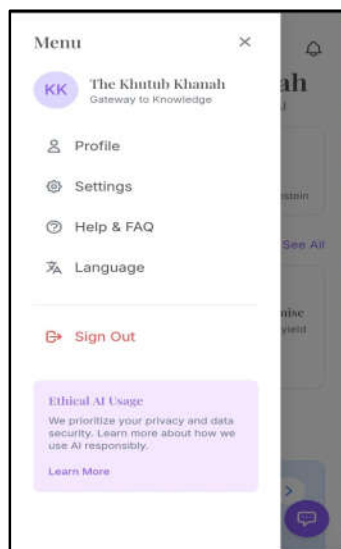


Figure 2.: Mobile menu bar

CONCLUSION

TKK not only enhances STEM education and research but also aligns with national priorities and global goals such as SDG 4: Quality Education. As Malaysia moves toward a future shaped by digital transformation, the Khutub Khanah stands as a beacon of innovation, empowering minds and uplifting communities preparing Malaysia's next generation for IR 4.0 and AI-integrated industries. TKK has the potential to revolutionize how students engage with digital resources. It empowers users to become more independent, informed, and innovative in their learning journey. In the future, it is hoped that TKK will be a useful instrument in the future of intelligent and sustainable education and remain responsive to evolving educational needs.

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THE MEDIA'S DOSE OF DUTY: GUIDELINES FOR ETHICAL REPORTING

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ABSTRACT

“The Media’s Dose of Duty: Guidelines for Ethical Vaccine Reporting” was developed with the aim to assist media practitioners in making proper choices in addressing vaccination issues with specific purposes. Using a grounded theory approach, the guideline was a result of interviews with health experts, media professionals, and government officials, analyses of content related to vaccination, and was later refined through a discussion with the media practitioners in Malaysia. This guideline is unique as it presents a contextual and evidence-based content that is relevant to the Malaysian context. In this guideline, there are four processes that should be undertaken by the media practitioners when handling vaccination reporting starting with consideration of general issues followed by strategies in reporting, verification, and affirmation. This four-step process is followed by the rule-of-four that encapsulates the dos and don’ts of vaccination reporting. Among the advantages of using this guideline are maintaining the media’s credibility because bad reporting undermines media status while reinforcing their credibility to the public. The guideline is hoped to combat vaccine misinformation while increasing vaccine literacy in the community.

Keywords: Ethical reporting, Misinformation, Media, Vaccine reporting

INTRODUCTION

The research innovation entitled the “Media's Dose of Duty: Guidelines for Ethical Vaccine Reporting” was developed to help media professionals make the right decisions while covering vaccination-related topics for certain objectives. The guideline consists of general considerations, exposure and portrayal strategies, verification, and affirmation. The process in the guideline is summarised in Figure 1 below:

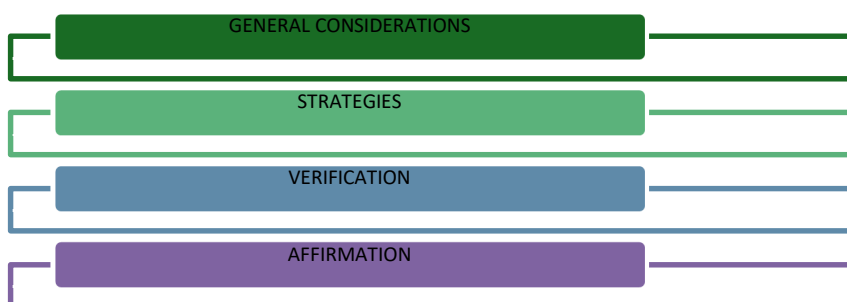


Figure 1.: The four-stage media reporting process on vaccination

In the general considerations, media practitioners are reminded to perceive their roles to assist individuals in making an informed decision on vaccine uptake. This includes report cautiously by maintaining accuracy over being the first to publish; avoid featuring comments that could reduce vaccine confidence; be proactive to current vaccine issues and reactive to their related concerns; use responsible and positive headlines; focus on issue-specific reporting; understand the details of information before reporting; consider appropriate photos and other supporting materials that will not create fear towards vaccination; and acquire expert views before publication.

The guideline proposes two strategies; exposure and portrayal. In the exposure strategy, story placement, frequency, and slot of publication as well as interactive format should be considered in vaccine reporting. While the portrayal strategy emphasises on deciding which facts or sides of an event or issue should be reported. Reporters should consider the use of religious views and persuasion techniques (Ghazali et al., 2025), such as storytelling format, and address specific readers and their concerns in their news reports.

In the third process, the media practitioners are advised to carry out self-verification and external confirmation by approaching the right expert. This entails checking the historical background, provenance, and authenticity of claimed information by sources.

The last process focuses on affirmation, in which news reports should try to provide statements at the end of the news reports to demystify misinformation and misconceptions, such as by publishing the misinformation and its sources, directing audiences to the right sources, and listing the verified platforms that audiences could refer to with regard to vaccination. In short, the guideline highlights the dos and don'ts as shown in Table 1 below:

Table 1.: The dos and don'ts in reporting vaccination stories

THE DO'S	THE DON'TS
Collaborate and verify	Feature anti-vaxxers on linear communication
Sensitive and responsible reporting	Unverified, one-sided sources
Proactive on continuous education	Clickbait, sensational reporting
Reactive on current debates	Conflicting viewpoints

METHOD

Based on in-depth interviews, a focus group discussion, a triangulation technique using respondents' confirmation of evidence, and content analyses of Malaysian vaccination reporting undertaken in this research, a context-specific guide entitled "Media's Dose of Duty: Guidelines for Ethical Vaccine Reporting" was developed. Consequently, the final stage of the development of the guideline involved seeking opinions from experts in health communication and vaccination.

RESULTS AND DISCUSSION

This guideline aims to help media institutions lead national efforts in raising awareness about vaccination. It mainly works to echo the effort of public health services in Malaysia. As the media is often used as an agent of social change and national development, they should as well respond to issues of public concern such as health. As the background, vaccines were introduced in Malaysia by the Health Ministry through the National Immunisation Programme in the 1950s with the aim of protecting all children regardless of race from diseases like hepatitis B, diphtheria, whooping cough, poliomyelitis, measles, the human papillomavirus, and a few others (Arumugum & Solhi, 2019). The immunisation programme has been improved from time to time to provide comprehensive coverage for children's health. Parents are given appointments with health clinics for scheduled check-ups for their child from birth. The immunisation activity is under the Family Health Development Division (BPKK), which is the heart of public health services. The health of infants and children is monitored and recorded at intervals to meet their health needs. However, despite the continuous care and supervision, recent data showed a declining rate in vaccine uptake among children, especially from the records of the immunisation schedule.

Therefore, the guideline was developed and proposed to be used to educate the current and future media practitioners. Notably, media guidelines are commonly used to guard the media practice on many

issues. The guideline is hoped to encourage responsible, specific, and sensitive reporting on vaccination among media practitioners. It is important to note that the guideline is not a form of censorship but a protocol to ensure important vaccination details are communicated accurately and clearly. Ultimately, the guideline will ensure that the public will receive accurate, verified, and truthful information related to vaccination that will influence their vaccine uptake decision. This will assist the government's aim to create a healthy society through the development of herd immunity that protects the whole community from vaccine-preventable diseases.

Another defining advantage of this guideline is it serves to maintain media credibility as a trusted information source because bad reporting undermines media status. Besides, the guide will help media institutions to perform self-regulation while giving ongoing vaccination awareness through reporting (Mohamed et al., 2022). Therefore, the works of media could be synergised to be in line with the public health services, government's aspirations, and self-regulatory bodies like Communication and Multimedia Content Forum (CMCF).

CONCLUSION

In conclusion, the "Media's Dose of Duty: Guidelines for Ethical Vaccine Reporting" is an important product entailing the *process* of responsible and sensitive vaccine reporting. The guideline is currently being reviewed by media practitioners to improve its content to ensure possible adoption among them. The guide will also be published under CMCF, an institution under Malaysian Communications and Multimedia Commission (MCMC), which is responsible for maintaining and promoting industry self-regulation as well as supervision of content dissemination and related issues enforced by MCMC.

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<https://doi.org/10.31436/imjm.v21i4>

TRANSFORMING PROGRAMMING EDUCATION THROUGH A QUIZ-BASED MOBILE APP: AN INNOVATION IN FORMATIVE LEARNING FOR C++

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ABSTRACT

This study investigates the impact of a quiz-based mobile application on student engagement and learning outcomes in an introductory C++ programming course. The app featured topic-specific multiple-choice quizzes with instant feedback, unlimited reattempts, and automatic scoring. It was deployed to 301 undergraduate students for voluntary self-practice before formal assessments. Engagement data showed that 63% of students attempted the quiz for Topic 1, and 39% for Topic 2. Many students reattempted the quizzes multiple times, highlighting the application's role as a self-paced formative learning tool. A comparative analysis between students who used the app ("Answered" group) and those who did not ("Did Not Answer" group) revealed significant performance improvements. For Topic 1, app users scored an average of 25.16 compared to 22.36 for non-users (+2.80); for Topic 2, users averaged 26.51 versus 22.64 (+3.87). Independent samples t-tests confirmed that these differences were highly significant ($p < 0.0001$), indicating a strong positive impact on learning outcomes. The app's effectiveness is attributed to several pedagogical factors: real-time feedback to correct misconceptions, repeated practice that reinforces learning, and a low-stakes environment that promotes exploration and learning from mistakes. This innovation reflects a transformative approach to programming education by integrating mobile technology to foster learner autonomy and lifelong learning habits. It also contributes to educational research by demonstrating how mobile formative assessment tools can drive innovation in student engagement and academic achievement. Future work will focus on expanding content and incorporating personalized feedback mechanisms.

Keywords: C++ Programming Education, Mobile Learning, Formative Assessment, Gamified Quizzes, Student Engagement

INTRODUCTION

Enhancing student engagement and improving learning outcomes are critical in transforming education, especially in foundational courses such as C++ programming (Hellin et al., 2023). C++ is often perceived as difficult due to its abstract syntax and problem-solving demands. Many students struggle to grasp core concepts like variables, data types, and control structures (Van Der Kooij et al., 2022; Yang et al., 2023; Cabo, 2023; Eckert, 2023). Traditional instruction, which primarily relies on lectures and static assignments, often lacks the interactivity and timely feedback required to sustain student interest and promote deep understanding.

To drive innovation in programming education, mobile learning provides an accessible and flexible alternative. Research shows that mobile applications offering instant feedback and opportunities for repeated, low-stakes practice can significantly improve comprehension (Halim et al., 2020; Sheng, 2025). Moreover, when gamified learning techniques are integrated into mobile platforms, they have been shown to motivate learners and support consistent engagement (Giannakas et al., 2019; Jaramillo-Mediavilla et al., 2024). These strategies represent a shift toward learner-centered and technology-enhanced environments that empower students to take control of their learning journey.

This study investigates the impact of a quiz-based mobile application on student engagement and learning outcomes in an introductory C++ course. The app, developed for Topics 1 and 2, includes interactive quizzes with immediate feedback, unlimited reattempts, and gamified progression. By supporting self-paced and reflective practice, this innovation aims to foster deeper understanding, encourage lifelong learning habits, and contribute to the global agenda of empowering learners through transformative digital education.

METHODS

This study employed a quasi-experimental design to evaluate the effectiveness of a quiz-based mobile application as a formative learning tool in an introductory C++ programming course. The methodology outlines the participants, intervention design, data collection procedures, and the statistical method used to assess learning outcomes.

Participants and Context

This study involved 301 second-semester Diploma in Civil and Mechanical Engineering students enrolled in CSC128, an introductory C++ programming course at Universiti Teknologi MARA, Pasir Gudang Campus. The course focuses on foundational programming concepts. To support early comprehension and preparation for the first formal assessment, a quiz-based mobile application was introduced voluntarily during the initial weeks of the semester.

Intervention Design

The intervention consisted of an interactive quiz application developed using iSpring QuizMaker, covering Topic 1 and Topic 2 of the course syllabus. These topics included variables, data types, arithmetic operators, assignment statements, and input/output statements, which are essential concepts that serve as prerequisites for more advanced topics such as control structures, functions, and arrays.

The quizzes included various graded question types, such as Multiple Choice, True/False, Sequence, Matching, and Drag and Drop. The app allowed unlimited reattempts, instant feedback, and automatic score tracking. Results, including student names, scores, and completion status, were automatically emailed to both the student and instructor, encouraging reflective, self-paced learning. The application was deployed online and made accessible to all students at <https://cppspark.itch.io/cppspark>, allowing access via mobile and desktop devices. The user interface of the deployed application is shown in Figure 1.

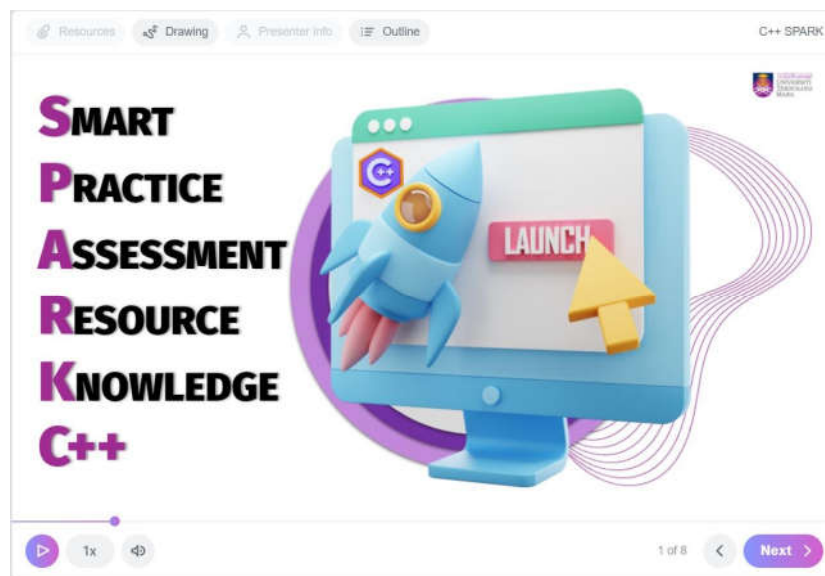


Figure 1: Home screen of the quiz-based mobile application used in the study.

Data Collection

Data on application usage was automatically recorded, including the frequency of reattempts, the total number of quiz attempts, and the number of unique student users. Among the 301 students enrolled, 190 (63%) attempted the Topic 1 quiz, while 116 (39%) attempted the Topic 2 quiz. A total of 302 attempts were logged for Topic 1 and 162 attempts for Topic 2, indicating that many students attempted the quizzes more than once. This usage pattern demonstrates active engagement with the application's formative features and highlights its role in supporting independent, self-paced revision.

Performance Measurement and Statistical Analysis

To assess the impact of the intervention, student scores from the first formal assessment (out of 30 marks) were analyzed. Students were categorized into two groups based on their use of the quiz application. The first group consisted of students who completed at least one quiz attempt prior to the assessment ("Answered" group), while the second group included those who did not engage with the quiz application ("Did Not Answer" group). Mean scores for each group were calculated for both topics. An independent samples t-test was conducted to determine whether the differences in performance between the two groups were statistically significant, with the significance level set at $p < 0.05$. The findings are presented in the Results and Discussion section.

RESULTS AND DISCUSSION

Student Engagement with the Application

Out of the 301 students enrolled in the course, 190 students (63%) engaged with the quiz for Topic 1, while 116 students (39%) engaged with the quiz for Topic 2. These students collectively made 302 quiz attempts for Topic 1 and 162 attempts for Topic 2, indicating that many students attempted the quizzes more than once. The availability of unlimited reattempts and instant feedback encouraged repeated usage, suggesting that the app functioned effectively as a self-paced learning and revision tool. The difference in participation rates between Topic 1 and Topic 2 may be attributed to variations in perceived difficulty, the timing within the semester, or an increase in academic workload. Nevertheless, the overall level of engagement validates the application's usefulness in promoting voluntary, formative learning.

Learning Outcomes

A comparison of student performance in formal assessments was conducted between students who used the quiz application ("Answered" group) and ("Did Not Answer" group). The average results are summarized in Table 1.

Table 1.: Average Assessment Scores

Group	Topic 1	Topic 2
Answered Group	25.16	26.51
Did Not Answer Group	22.36	22.64
Difference	+2.80	+3.87

Statistical analysis revealed that the differences in scores between the two groups were highly significant ($p < 0.0001$) for both topics, suggesting a strong positive impact of the quiz application on student learning outcomes.

Interpretation

The substantial improvement in the scores of students who used the quiz app indicates that the tool not only supported student engagement but also reinforced key programming concepts. Several pedagogical factors likely contributed to this effect: immediate feedback helped correct misconceptions in real time; repeated practice supported retention through retrieval-based learning; and the low-stakes environment encouraged exploration and learning from mistakes without fear of penalty.

These findings are consistent with educational research that emphasizes formative assessment and feedback as critical elements in effective learning, particularly in complex subjects such as programming.

The success of the quiz application also highlights the value of mobile learning tools that are accessible, flexible, and designed to promote learner autonomy. However, since participation in this study was voluntary, there is a possibility of self-selection bias. Students who chose to use the application may have been more motivated or proactive than those who did not.

CONCLUSION

This study demonstrates the effectiveness of a quiz-based mobile application in enhancing student engagement and improving learning outcomes in an introductory C++ programming course. Featuring formative, interactive quizzes with instant feedback and unlimited attempts, the application promoted repeated practice and supported self-directed learning. A significant proportion of students voluntarily engaged with the app, and those who did achieved statistically higher assessment scores compared to their peers who did not use the tool.

The findings highlight the potential of mobile learning technologies to complement traditional teaching methods, especially in concept-heavy subjects like programming. By fostering learner autonomy, encouraging reflective practice, and enabling accessible, feedback-driven learning, the innovation aligns with broader efforts to transform education and support lifelong learning. Future development of the app will include additional topic coverage and personalized learning analytics to further empower students and tailoring the experience to individual needs.

ACKNOWLEDGEMENTS

The authors would like to express their sincere appreciation to Universiti Teknologi MARA, Pasir Gudang Campus, for the institutional support provided throughout this study. Special thanks are also extended to the students who participated and lecturers of the Faculty of Computer and Mathematical Sciences for their collaboration and encouragement during the implementation of the quiz-based mobile application.

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TEKNIK “SIMBOL” SATU KAEDAH MENGUASAI TAJUK TEORI PENGELUARAN

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ABSTRAK

Kajian ini dijalankan bertujuan untuk mengatasi masalah yang dihadapi oleh murid Tingkatan 5 Wira berkaitan topik pengeluaran. Murid tingkatan 5 Wira merupakan murid kategori tahap penguasaan dan kemahiran sederhana. Semasa pengajaran dan pembelajaran (PdP) topik pengeluaran, pemerhatian menunjukkan murid kurang berminat, suka berbuat bising dan sentiasa mengantuk semasa PdP dijalankan. Selain itu, murid tingkatan 5 Wira kurang memahami elemen dalam tajuk teori pengeluaran adalah jumlah keluaran, keluaran purata dan keluaran marginal. Objektif pertama ialah meningkatkan keupayaan murid untuk menghafal formula jumlah keluaran, keluaran purata dan keluaran marginal. Objektif kedua ialah menghitung jumlah keluaran, keluaran purata dan keluaran sut. Objektif ketiga ialah menjelaskan hubung kait antara jumlah keluaran, dengan keluaran purata dan keluaran marginal. Seramai 18 murid tingkatan 5 Wira dan seorang guru terlibat dalam kajian ini. Tinjauan awal telah dilaksanakan melalui pemerhatian, soal selidik dan ujian pra. Ujian pra menunjukkan 18/18 murid mendapat gred G. Bagi keputusan ujian pra juga kurang memberangsangkan. Kajian ini telah diselesaikan dalam tempoh 10 minggu. Bagi hasil pemerhatian menunjukkan murid lebih seronok dan tidak mengantuk semasa PdP. Dapatan soal selidik menunjukkan seramai 18/18 murid lebih mengingati dan menghafal formula jumlah kos, kos purata. Hasil keputusan ujian pos menunjukkan sebanyak 4 (22.22%) orang pelajar mendapat keputusan yang cemerlang iaitu gred A, 7 (38.89%) murid mendapat gred B dan 7 (38.89%) murid mendapat gred C. Kesimpulannya, kajian tindakan ini memberi impak kepada guru-guru untuk menjalankan anjakan paradigma daripada pengajaran hanya berpusatkan kepada peperiksaan malah murid perlu meneroka ilmu dan meningkatkan kemahiran dalam mata pelajaran ekonomi. Teknik Simbol sangat signifikan dan telah berubah sikap murid lebih berminat mempelajari mata pelajaran ekonomi.

Kata kunci: Teknik Simbol TP, AP, MP

PENGENALAN

Pelajar kelas 5 Wira merupakan pelajar yang sederhana dan sebilangan pelajar adalah lemah. Selama 18 tahun iaitu bermula 2007 hingga 2025, saya telah mengajar mata pelajaran Ekonomi Asas dan Ekonomi bagi kedua-dua tingkatan iaitu tingkatan 4 dan tingkatan 5. Semasa saya menyemak buku latihan dan kertas peperiksaan, saya berasa kecewa dengan tahap penguasaan pelajar terhadap tajuk teori pengeluaran. Sebanyak 90% pelajar tidak dapat menjawab soalan daripada teori pengeluaran. Pelajar Cina dapat menjawab soalan pengiraan tetapi mereka gagal menghuraikan hubungan antara jumlah keluaran, keluaran purata dan keluaran sut. Di samping itu, pelajar Melayu dan pelajar India gagal menjawab kedua-dua bahagian iaitu pengiraan dan hubung kait. Rasanya, saya telah berusaha semampu yang boleh membuat modul topikal, ujian eco-hafal dan sebagainya. Apabila pelajar 5 Wira berada di tingkatan lima pada 3hb Mac 2025, saya telah memperkenalkan Teknik Simbol kepada pelajar tersebut. Oleh itu, saya bertekad untuk meningkatkan prestasi pelajar-pelajar tersebut kerana setiap perkara yang diinginkan pasti ada jalan yang membawa kita ke arah kejayaan. Dalam kajian ini, saya cuma menggunakan teori pengeluaran sahaja.

Isu Kajian

Saya telah menganalisis soalan-soalan tahun lepas Ekonom (SPM) dan mendapati bahawa item teori pengeluaran merupakan soalan popular bagi kertas 1 dan kertas 2, tetapi dalam tajuk kajian ini terdapat beberapa masalah berikut:

Antaranya, pelajar tidak dapat menghubungkan kait antara jumlah keluaran, keluaran purata dan keluaran sut. Masalah kedua pula, pelajar gagal membahagikan jadual mengikut urutan tetapi mereka bercampur adukkan susunan ayat semasa membuat hubung kait. Masalah ketiga, pelajar mengabaikan input berubah semasa membuat huraian. Masalah keempat pula, pelajar menghadapi masalah kekeliruan sama ada titik maksimum atau titik minimum.

Objektif Kajian

Selepas kajian ini selesai dijalankan, pelajar-pelajar diharapkan akan mencapai objektif berikut:

Objektif Am

Kajian ini bertujuan untuk meningkatkan kemahiran mengira dan menghubungkan kait jumlah keluaran, keluaran purata dan keluaran marginal dengan input berubah.

Objektif Khusus

1. Mengira jumlah keluaran, keluaran purata dan keluaran marginal.
2. Menghubung kait antara jumlah keluaran, keluaran purata dan keluaran marginal dengan input berubah.
3. Membantu pelajar mendapat keputusan yang cemerlang dalam peperiksaan SPM.

METODOLOGI KAJIAN

i) Sampel Kajian

Kajian ini melibatkan 18 orang pelajar daripada 35 orang pelajar. Tahap pencapaian murid ini adalah sederhana dan lemah.

Jadual 1.: Kumpulan Pelajar Mengikut Etnik Kaum

<u>Bangsa</u>	<u>Lelaki</u>	<u>Perempuan</u>
<u>Melayu</u>	6	8
Cina	-	-
India	2	2
<u>Jumlah</u>	8	10

Sumber: Data Entrolmen Tingkatan 5 Wira/2025

ii) Instrumen Kajian

Beberapa instrumen digunakan untuk mengkaji permasalahan tersebut. Instrumen-instrumen yang digunakan ialah:

- Pemerhatian
- Ujian Pra
- Ujian Pos

PELAKSANAAN DAN DAPATAN KAJIAN

Dalam pelaksanaan kajian, tinjauan masalah dibuat berdasarkan pemerhatian, ujian pra, dan ujian pos.

i) Tinjauan Masalah

- Pemerhatian

Saya telah memerhatikan tingkah laku murid semasa proses pengajaran dan pembelajaran (PdP) berlangsung sebelum kajian dijalankan. Sebelum kajian, murid kurang memberikan tindak balas kepada soalan yang diajukan oleh guru. Kebiasaannya murid perempuan yang lebih bersedia memberi

kerjasama dan menunjukkan kesungguhan serta minat sebaliknya murid lelaki kurang memberi tumpuan dan kurang mengambil bahagian dalam aktiviti PdP yang dijalankan.

b) Ujian Pra

Ujian Pra diberikan kepada kumpulan sasaran untuk mengesan sejauh mana kefahaman dan ingatan mereka terhadap teori pengeluaran. Selepas saya menanda dan menyemak jawapan pelajar, saya mendapati sebanyak jawapan pelajar salah. Kesalahan yang saya kenal pasti melalui jawapan pelajar ialah yang pertama tidak mengira jumlah keluaran, keluaran purata dan keluaran marginal dan tidak dapat menulis hubungan kait antara jumlah keluaran, keluaran purata dan keluaran marginal dengan input berubah. Oleh itu, saya telah memulakan satu teknik iaitu Teknik Simbol selepas waktu persekolahan iaitu pada pukul 1.05 petang hingga 2.00 petang kepada kumpulan sasaran. Selepas seminggu memperkenalkan teknik tersebut, saya telah memberi ujian pra kepada pelajar. Satu minggu selepas ujian pra, saya telah memberi ujian pos menggunakan set soalan yang sama dengan ujian pra.

c) Ujian Pos

Ujian pos diberikan kepada kumpulan sasaran untuk mendapatkan maklum balas pelajar.

Analisis Tinjauan Masalah

Berdasarkan pemerhatian selepas kajian dijalankan terhadap kumpulan sasaran didapati:

Pelajar lebih berkeyakinan untuk menjawab soalan yang diajukan oleh guru secara lisan. Mereka menjawab dengan suara yang lantang. Murid lebih suka menerangkan hubungan kait antara jumlah keluaran, keluaran purata dan keluaran sut secara individu serta dalam kumpulan masing-masing dan menukar jawapan antara satu sama lain dengan kumpulan lain.

i) Aktiviti Pemerhatian 1

Semasa waktu ekonomi, saya mengambil 15 minit untuk melaksanakan Teknik Simbol dalam PdP.

ii) Aktiviti Pemerhatian 2

Selepas waktu persekolahan kumpulan sasaran balik semula kelas untuk mendedahkan Teknik Simbol dengan menggunakan aplikasi canva. Pada masa itu, guru menerangkan satu per satu tentang hubungan kait jumlah keluaran, keluaran purata dan keluaran marginal serta menunjukkan jalan kira untuk menghitung jumlah keluaran, keluaran purata dan keluaran marginal dengan menggunakan Teknik Simbol. Pada masa yang sama pelajar mencatatkan nota dan selepas 10 minit guru mengedarkan soalan-soalan tahun lepas kepada kumpulan sasaran.

iii) Analisis Ujian Pra Dan Ujian Pos

Jadual 2, menunjukkan perbandingan pencapaian murid dalam ujian pra dan ujian pos.

Jadual 2.: Pencapaian Murid Dalam Ujian Pra dan Ujian Pos Mengikut Gred

Jadual 2: Pencapaian Murid Dalam Ujian Pra dan Ujian Pos Mengikut Gred

<u>Gred</u>	<u>Skala Markah</u>	<u>Ujian Pra (Bil Pelajar)</u>	<u>Peratus (%)</u>	<u>Ujian Pos (Bil Pelajar)</u>	<u>Peratus (%)</u>
A	80-100	0	0	10	55.56
B	60-79	0	0	6	33.33
C	50-69	3	16.67	2	11.11
D	40-49	4	22.22	0	0
E	0-39	11	61.11	0	0
Jumlah		18	100 %	18	100%

Sumber: Ujian Pra dan Ujian Pos Tingkatan 5 Wira/2025

Berdasarkan jadual 2, bilangan pelajar yang mendapat gred A dalam ujian pos lebih ramai daripada ujian pra manakala pelajar yang mendapat gred B juga lebih baik daripada ujian pra iaitu sebanyak 6 pelajar. Ujian Pos seramai 11.11% pelajar mendapat gred C manakala ujian pra sebanyak 16.67 peratus. Kesimpulannya, hasil kajian mendapati bahawa pencapaian murid ujian pos lebih memberangsangkan daripada ujian pra.

REFLEKSI DAN KESIMPULAN

Melalui kajian tindakan ini, saya telah memperoleh pengalaman yang amat bermanfaat dari segi meningkatkan tahap profesionalisme saya sebagai seorang guru dan penyelidikan. Sebagai seorang penyelidik pula, saya telah mempelajari cara untuk mengenal pasti masalah pengiraan yang dihadapi oleh murid-murid melalui penggunaan ujian pra. Dengan ini saya dapat merancang satu tindakan yang menjurus kepada peningkatan penguasaan murid-murid terhadap sesuatu kemahiran dalam mata pelajaran ekonomi.

Saya sebagai guru mata pelajaran ekonomi, berasa bersyukur kerana melalui kajian tindakan ini, Teknik Simbol dapat membantu murid-murid menguasai kemahiran menulis dalam tajuk sumber ekonomi. Kajian ini memberi peluang kepada saya memajukan kecekapan saya. Ia selaras dengan Visi dan Misi Kementerian Pendidikan Malaysia iaitu Pendidikan berkualiti, insan terdidik negara sejahtera dan anak baik lagi cerdik (ABC) serta selaras dengan Pendidikan digital negara.

Cadangan Kajian

- Tajuk ini boleh disarankan kepada pelajar tingkatan enam sama ada tingkatan enam rendah.
- Teknik Simbol boleh digunakan mata pelajaran geografi bagi PMR, SPM dan STPM iaitu bab cuaca dan iklim.

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TRANSFORMING ODL PRACTICES: AN ASSESSMENT TOOL FOR CONTINUANCE INTENTION IN HIGHER EDUCATION

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ABSTRACT

This study developed and validated a questionnaire to assess accounting lecturers' continuance intention to use Open and Distance Learning (ODL) for teaching. Addressing the need to understand factors influencing this intention, especially following increased adoption during the COVID-19 pandemic, the tool integrates the Expectation-Confirmation Model (ECM), Technology Acceptance Model (TAM), and Self-Determination Theory (SDT). The questionnaire comprises five sections covering demographics, perceived usefulness, technostress, confirmation and satisfaction, and continuance intention. Of the 50 items included, 44 underwent content validation by six experts using the Content Validity Index (CVI). Results demonstrated strong individual and overall validity, confirming the questionnaire's effectiveness in capturing key factors influencing accounting lecturers' continuance intention to use ODL. This instrument provides reliable insights into enablers and barriers affecting online teaching continuance. It supports educational transformation by fostering innovation and guiding inclusive policies that promote lifelong learning. The questionnaire serves as a valuable resource for institutions seeking to enhance online teaching quality and sustain ODL practices in higher education.

Keywords: *Open and distance learning, Continuance intention, Content validity index*

INTRODUCTION

Open and Distance Learning (ODL) has become increasingly significant in higher education and is expected to remain relevant, particularly in discipline-specific areas such as accounting (Sarea et al., 2021). Although the concept is not new (Yazid & Malik, 2022), it gained renewed importance during the COVID-19 pandemic, which prompted a rapid shift to ODL across Malaysian universities. This shift has since been reinforced by national initiatives and growing demand for more flexible and accessible education options (Shahbodin et al., 2024). Since the adoption of the Sustainable Development Goals (SDGs), ODL has become essential for improving accessibility, scalability, and adaptability in education, and plays a key role in achieving SDG 4's goal of inclusive and equitable

quality education for all (Saikia et al., 2024). As many lecturers began using ODL in response to the pandemic, there is a growing need to investigate the factors that influence their intention to continue adopting this mode of instruction (Talib et al., 2024). Accounting lecturers are increasingly expected to teach online due to its flexibility (Bastos et al., 2021), with online instruction anticipated to become a standard requirement for accounting faculty in the near future (Niemoitko & Tolan, 2020). Given this shift, Farsawang and Songkram (2022) highlighted the need for further research to identify factors that drive educators to continue using ODL, especially in practice-oriented disciplines such as accounting. The long-term success of online learning depends not only on its initial adoption but also on the continuance intention of educators and learners (Tania et al., 2022). In response, this innovation presents a validated assessment tool to evaluate accounting lecturers' continuance intention to use ODL, supporting sustainable and inclusive teaching in higher education.

METHODS

A questionnaire was used as the assessment tool, which is a commonly applied method in studies on technology continuance intention (Roca & Gagné, 2008). The questionnaire was developed based on the study's theoretical framework to examine the factors influencing accounting faculty members' continuance intention to use ODL. A similar integration of TAM, SDT, and ECM has been employed by Chibisa and Mutambara (2022) to examine the factors influencing continuous use of technology. It consisted of five sections, labelled Section A through Section E. Section A gathered demographic information; Section B measured perceived usefulness; Section C focused on aspects of technostress; Section D assessed confirmation and satisfaction; and Section E measured continuance intention. A total of 50 items were included in the questionnaire, all presented in English. Of these, 44 items measuring the main constructs were subjected to content validation. The instrument was created using Google Forms and distributed via email to a targeted group of respondents. To ensure content validity, the Content Validity Index (CVI) was employed to evaluate the appropriateness of each item in relation to its intended construct. According to Lynn (1986), a panel of three to ten experts is considered sufficient for content validation. In this study, six experts, including academic professionals, were involved in the review process. The CVI includes two components: the item-level CVI (i-CVI), which assesses the validity of individual items, and the scale-level CVI (s-CVI), which measures the content validity of the entire scale.

RESULTS AND DISCUSSION

The experts were provided with an overview of the study and instructions for completing the CVI rating. Using a four-point rating scale adapted from Davis (1992), the experts rated each item's relevance as: 1 = Not Relevant, 2 = Somewhat Relevant, 3 = Quite Relevant, and 4 = Highly Relevant. After collecting these ratings, the i-CVI and s-CVI were calculated. The i-CVI was determined by dividing the number of experts who rated an item as 3 or 4 by the total number of experts. The items demonstrated good individual content validity, with i-CVI values ranging from 0.80 to 1.00. Additionally, each construct showed excellent overall content validity, with s-CVI values between 0.90 and 1.00. The CVI results are summarized in Table 1. Overall, the questionnaire demonstrated strong content validity,

indicating that the items and constructs are well-suited to measure the factors influencing accounting faculty members' continuance intention to use ODL. This validated tool helps measure lecturers' intention to continue using ODL and supports improving online education by providing reliable data. It identifies the key factors that enable or hinder lecturers from continuing online teaching. The tool also helps universities plan better for ODL by guiding the development of inclusive policies that encourage lifelong learning.

Table 1. Content Validity Index (CVI) Results

Constructs	Number of Items	i-CVI	s-CVI
Perceived Usefulness	5	1.00	1.00
Technostress	26	0.80 - 1.00	0.90 - 1.00
Confirmation	4	1.00	1.00
Satisfaction	4	1.00	1.00
Continuance Intention	5	0.80 - 1.00	0.90 - 1.00
Overall Scale	44	0.80 - 1.00	0.95

CONCLUSION

This study developed and validated a questionnaire as an innovative assessment tool that provides reliable insights into the factors influencing accounting lecturers' continuance intention to use ODL. By supporting educational transformation and fostering innovation in online teaching, the tool promotes inclusive policies that advance lifelong learning and enables institutions to support educators in creating a more accessible and sustainable ODL environment.

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USING GEMINI AI TO IMPROVE MATRICULATION STUDENTS' WRITING PERFORMANCE

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ABSTRACT

This study explores the use and impact of using Gemini AI as a supporting tool to enhance the writing performance among matriculation students. The study utilized qualitative methods to assess the impact of the use of Gemini AI on students' argumentative essays and to investigate their interest towards the use of Gemini AI in writing. Interviews and writing samples were collected from six matriculation students identified as having low writing proficiency. Over a period of eight weeks, students were engaged with a structured writing lesson using Gemini AI as a supporting tool. Collected documents included essays, presentation sheets, and survey responses via Google Forms. Students' writing responses were then examined thoroughly. The research was carried out through the following developmental steps: (1) students wrote a pre-test essay (Test A); (2) in groups of six, they produced an argumentative paragraph using Gemini AI, followed by peer proofreading; (3) they then wrote a full five-paragraph essay using Gemini AI; and (4) finally, they completed an individual post-test essay (Test B) without using Gemini AI. The findings revealed that students showed great improvements in their argumentative essays after following an eight-week intervention involving structured writing lessons with Gemini AI. The tool was proven to influence the writing performance of matriculation students with low writing proficiency positively. Additionally, students expressed interest and positive perceptions towards using the AI tool for writing tasks.

Keywords: Writing, Writing performance, Gemini AI

INTRODUCTION

Writing skills is the ability to communicate ideas effectively in written form. It is an important component taught in the Matriculation English Language Studies and Malaysian University English Test (MUET) as it helps the students in Negeri Sembilan Matriculation College (KMNS) to express and communicate their thoughts in different types of writing. Thus, this research investigates the use and impact of Gemini AI as a learning tool in the digital learning platform (DELIMa) to assist students to write good essays. This is parallel to the advancement of technology of digital platforms (DELIMa) which was introduced by the Ministry of Education (MOE) to allow matriculation lecturers and students to experience a new digital learning approach in Malaysian education. Therefore, it is easy for the

matriculation lecturers and students to access the impact of Gemini AI in teaching writing in a digital and virtual classroom (Jen & Salam, 2025).

This action research paper aimed at enhancing students' writing performance using Gemini AI in writing classes and providing support for a limited time to help students learn and get better at what they do. In this research, Gemini AI serves as a temporary support for students as active learners who construct their own knowledge (McLeod, 2024) and the researchers are able to observe the learning process and the skill improvements. During the process, scaffolding activity is done by providing a thesis statement, sentence starters and paragraph frames to guide students' thinking and structure their responses (Khalifa & Albadawy, 2024) using Gemini AI to support the learning process. Therefore, the overall results show a significant increase in students' writing performance.

Matriculation students struggle with essay writing due to weak content development, poor grammar skills, limited vocabulary, and difficulty organizing ideas. These issues challenge the assumptions about their writing readiness and vocabulary growth, showing that without targeted support, many fail to meet academic standards (Limone, 1978).

This action research was carried out by two English lecturers with complementary expertise: Mdm. Efa, who has nine years of experience teaching the Malaysian University English Test (MUET) and specializes in English Language Assessment and academic writing, and Mdm. Revathy, who recently transitioned from teaching Upper Secondary to the SES Matriculation Programme, bringing fresh insights into the challenges students face as they enter matriculation. Their combined perspectives shaped the focus of the study on Mdm. Efa's accounting class (A3P5), where students often struggle to generate ideas, develop content, and write effective paragraphs. The study explores whether Gemini AI can serve as a practical tool to help these students expand their vocabulary, build topic-related knowledge, and produce better-structured essays.

The researchers applied Bruner's Scaffolding Theory (as cited in McLeod, 2024) to design materials that support students in crafting topic sentences, providing relevant examples, and applying correct grammar—key components of MUET writing. This support is gradually reduced as students gain confidence and competence. With their combined experience and strong foundation in writing instruction, Mdm. Efa and Mdm. Revathy offers guidance through feedback and classroom interaction, aligning with Vygotsky's scaffolding approach (Wheeler, 2025).

The objectives of this action research are to:

1. assess the impact of the use of Gemini AI on students' argumentative essays.
2. investigate students' interest towards the use of Gemini AI in writing classes.

METHODOLOGY

Participants

This action research focused on a group of six students from the accounting class (A3P5) at Kolej Matrikulasi Negeri Sembilan (KMNS), enrolled in the 2024/2025 academic session. The group comprised five female students and one male student, all enrolled in the compulsory English subject for both semesters (July 2024–May 2025). These students were specifically selected due to their consistent struggle with paragraph development, often producing only a single sentence per paragraph during essay writing exercises.

Research Design

Figure 1 shows the **qualitative action research model** employed in this study, guided by the **Kemmis and McTaggart Model (1988)**, as cited in Burns (2010). The model includes a continuous and reflective four-phase cycle: **planning, acting, observing, and reflecting**. This approach allowed for ongoing improvements in instructional strategies and provided opportunities to assess student progress throughout each intervention cycle.

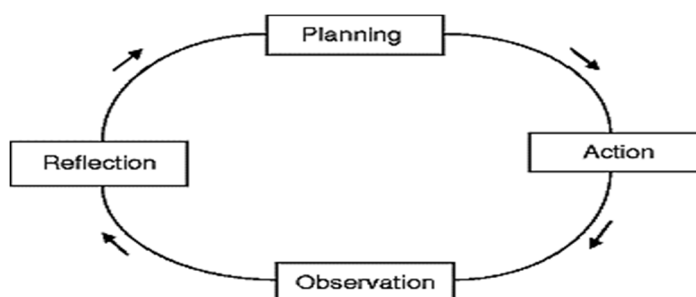


Figure 1.: Action Research Model by Kemmis and McTaggart

Research Setting and Role of Researchers

The research was conducted in a real classroom setting at KMNS. The primary researcher, Mdm. Efa acted as both the instructor and the facilitator of the interventions, while Mdm. Revathy served as a co-observer. Observations were carried out during lessons to monitor student responses and engagement throughout both group and individual writing tasks.

Intervention Overview

The intervention, titled ‘**Let’s Write Using Gemini AI**’, was conducted in two cycles:

- **Cycle 1 (Group-Based Intervention):** Students worked collaboratively to construct content paragraphs using **Gemini AI**. The focus was on understanding paragraph components: topic sentence, supporting details, examples, and concluding sentence. The AI tool was used for idea generation, grammar checking, vocabulary improvement, and sentence restructuring.

- **Cycle 2 (Individual-Based Intervention):** Students independently wrote full essays using the same MUET-format question from Cycle 1. Gemini AI was used as a supporting tool during this process. Later, a **final test (Test B)** was administered under exam conditions without the use of Gemini AI to evaluate students' independent writing abilities.

Data Collection and Instruments

Table 1 presents the data collection process and instruments, which included essays, mahjong paper presentations, and survey responses via Google Forms as outlined below:

Table 1.: Data Collection Process and Instruments

No	Process	Instrument
1	Diagnostic Test (Test A)	Argumentative essay: ' <i>Modern society has taken freedom for granted. Discuss.</i> '
2	Cycle 1 (Group Work)	Paragraph writing using Gemini AI, followed by a proofreading activity presented on mahjong paper.
3	Cycle 2 (Individual Work)	Full essay writing using Gemini AI.
4	Test B (Final Test)	Individual essay without Gemini AI (same topic from Cycle 1 & 2).
5	Students' Perception on Gemini AI	Google Form survey on students' interest and experience using Gemini AI.

RESULTS AND DISCUSSIONS

Students' Writing Performance

Each student's writing performance is measured in this study by looking at the differences between Test A and Test B. The argumentative essays in Test A and Test B were marked using the MUET marking guidelines rubric for preparing students for MUET based on two important criteria, task fulfilment and language. Both have a total score of 60 marks. Each student's writing performance is also compared to find out how much students have gained or improved by using the descriptive statistics as seen in Table 2 below.

Table 2.: Student's Writing Performance: Results of Test A and Test B

Sample	Test A	Test B	Difference
1	15	30	15
2	12	24	12
3	13	22	11
4	14	24	10
5	15	26	11
6	11	26	14

The final stage of the process in this study was to reflect and evaluate, which was to assess the impact of the use of Gemini AI on students' argumentative essays. Table 2 indicates improvements in students' writing performance as the marks' difference increased from 10 to 15 marks. Sample 1 shows the highest difference of 15 marks. Whereas, sample 4 showed the lowest difference of 11 marks. The results indicate writing performance among students. Therefore, this achievement aligns with Jee and Aziz (2021) who claim that good grades demonstrate learners are able to grasp the question or statements offered in the evaluation. As a result, the increased writing performance showed that using Gemini AI has a positive impact on students' essays.

The second research objective is to investigate students' interest towards the use of Gemini AI in writing classes. Students had expressed their opinions and thoughts by responding to one survey question via a simple Google Form. Students' responses were recorded as shown in table 3 below.

Table 3.: Students' Personal Responses on the Use of Gemini AI in Writing Classes

Sample	Student's Personal Response
1	Gemini AI can help me elaborate more about ideas in essays.
2	Gemini AI could help me become a better writer by correcting my grammar, giving me new ideas, and helping me make my writing clearer and easier to understand.
3	I think all matriculation students should use Gemini AI to ace an essay.
4	By giving me great ideas to write essays.
5	Generates outline of writing.
6	Gemini AI helps me think about the ideas of my point, help with my vocabulary and expand more on my ideas.

The data obtained from table 2 revealed 100% of the students improved tremendously in their writing performance showing Gemini AI is useful for students in writing argumentative essays. At the end of the study, students were able to write longer essays confidently without referring to Gemini AI. Students were able to expand and develop contents by giving appropriate topic sentences, elaboration, examples and a short conclusion. Basically, the outcome of this study shows that teaching writing using Gemini AI has helped students in developing ideas in a more organized and coherent way. Students also gained more confidence in their writing skills as they got to come across new knowledge and vocabulary.

On the other hand, this study also investigated students' interest towards the use of Gemini AI in writing classes. Table 3 shows that 100% of the students expressed positive responses towards using Gemini AI in the writing classroom. They provided the benefits of Gemini AI in writing essays such as generating and outlining ideas and points, helping to expand ideas and gaining appropriate vocabulary. One student agreed that Gemini AI could help him become a better writer by correcting his grammar, giving him new ideas, and helping him produce clearer and more comprehensible writing. Additionally, one of the students suggested all matriculation students should use Gemini AI to ace an essay.

However, there are two problems encountered while conducting this study. First is to deal with time limitations before study week. Due to time constraints, there are not many activities that could be done to enhance students' writing performance. So, it is recommended that more time should be given so that students could try writing different sets of questions using Gemini AI. The second problem is that Gemini AI is available only on teachers' digital platform (DELIMa) and not on students' accounts. As a result, students had to log in using their personal Google accounts, which in some cases required payment to access Gemini AI.

CONCLUSION

In conclusion, this action research was aimed to improve teaching strategy so that teachers are able to help students to write better essays and score higher marks in their writing component paper. It is hoped that this would eventually result in a better performance in MUET which would enable students to obtain a higher MUET band.

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VIRTUAL ESCAPES: EXPLORING THE EFFECTS OF NATURE-BASED VR ENVIRONMENTS DURING ACADEMIC BREAKS

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ABSTRACT

Mental health issues among students attending lectures pose a significant concern, potentially negatively impacting their academic performance and overall well-being. Recent years have seen an increasing interest in the potential advantages of immersive nature experiences for psychological well-being, particularly among students in educational environments. However, there is a limitation of research examining the effect of the natural environment on students during their class breaks. Therefore, the objective of this study is to evaluate the restorative effect of natural environments video on students during their class break. This study employs a questionnaire survey to assess the restorative outcome scale and involves 140 students from the public universities in Malaysia. The video intervention was tested using a nature environment setting. Data were analysed using descriptive statistics, focusing on the mean. The results showed that students reported a relatively high level of restoration. These findings suggest that natural environment video can be beneficial in addressing mental health challenges during class breaks.

Keywords: *Mental health restoration, restorative effect, nature environment video, student*

INTRODUCTION

Mental health problems among students during lecture classes are a significant concern, as they can adversely impact academic performance and overall well-being. Several factors contribute to these issues, including academic stress, the nature of classroom interactions, and the coping strategies employed by students.

Academic stress is a major contributor to mental health challenges among students. Research indicates that the pressures associated with academic performance can lead to heightened levels of anxiety and stress. For instance, Dahdal (2023) highlights that pre-exam anxiety is a common issue, disrupting students' focus during lectures and ultimately affecting their academic outcomes. Similarly, Hasanah et al. (2023) discuss how the demands of coursework can overwhelm students, leading to mental health deterioration if not managed effectively. This academic pressure is often compounded by the expectations placed on students to perform well, which can create a cycle of stress and anxiety that is difficult to break (Putra, 2023).

The interaction between students and educators during lectures plays a crucial role in shaping students' mental health. Raji et al. (2022) highlight the importance of educators being aware of mental health issues among students, as their ability to recognise and address these problems can significantly shape students' classroom experiences. Conversely, a lack of mental health literacy among educators may result in negative attitudes toward students facing mental health difficulties, further aggravating their distress (Raji et al., 2022). On the other hand, students can build resilience in a supportive classroom environment where educators are trained to recognise and address mental health issues, thereby enhancing students' ability to cope with academic pressures (Kamarunzaman et al., 2020). Addressing these issues requires a multifaceted approach that includes enhancing mental health literacy among educators, fostering supportive classroom environments, and promoting effective coping strategies among students.

Natural environment videos may specifically serve for promoting positive emotional states, which are directly correlated with mental well-being. For example, viewing nature videos has been linked to promoting relaxation and reducing stress levels, therefore mitigating symptoms of depression and anxiety (Hoffmann et al., 2019). These videos have the power to arouse emotions of calm and optimism, strengthening resistance to stress. These responses are consistent with Fredrickson's Broaden-and-Build Theory, which proposes that positive emotions induce expansive thinking and behavior, thereby enhancing psychological resilience (Lu et al., 2024).

This innovative approach highlights that nature video has potential as a tool for mental health intervention, replicating the therapeutic effects of nature in a controlled and accessible manner. However, there is a dearth of research examining the effect of natural environment video on students during their class breaks. Consequently, the objective of this study is to evaluate the restorative effect of natural environment video on students during their class breaks. By prioritizing mental health in educational settings, institutions can help mitigate the negative impacts of mental health issues on students' academic performance and overall well-being.

METHODS

To evaluate the restorative effects of natural environment video during class breaks among students, a quantitative survey was conducted using an online questionnaire. The study took place from March to November 2024 at a public university in Malaysia. The questionnaire has four sections. However, the results of this study focused on the restorative outcome from the natural environment video after class break. The restorative outcomes scale used in this research was developed by Korpela et al. (2008)

The self-reported survey began with a briefing on the purpose of the study. Students then attended a 40-minute lecture, followed by a 10-minute natural environment video accompanied by healing music. The natural environment video, sourced from the Free HD Videos - No Copyright channel on YouTube, featured scenes such as snowy landscapes, waterfalls, flowing rivers, blue skies, blue water, flowers, clouds, mountainous landscapes, beaches, beach waves, river landscapes, sunsets, sunrises, animals, open lawns/fields, moving cloud, flying birds. After viewing the video, students completed a questionnaire to assess the restorative outcomes of the natural environment video experience during their class break. They expressed their preferences on a seven-point Likert scale ranging from 1 = Not at all to 7 = Completely. On average, students took approximately 5 to 10 minutes to complete the questionnaire.

In this study, the Statistical Package for the Social Sciences (SPSS) version 23 was used to conduct descriptive analyses of the data. Specifically, the mean scores of the restorative outcomes, measured after students' exposure to the natural environment video during their class break, were calculated. Descriptive statistics were employed to summarise the data and provide insights into the overall restorative effects reported by the students. The analysis focused on determining the average level of restoration experienced by students, based on their responses to the Likert scale in the questionnaire.

RESULTS AND DISCUSSION

In total, there were 140 students who had answered the questionnaire. The mean analysis in Figure 1 indicates that most students reported experiencing restoration after watching the natural environment video during the class break. This suggests that natural environment video experiences have the potential to enhance subjective vitality, reduce stress, and promote positive emotional states.

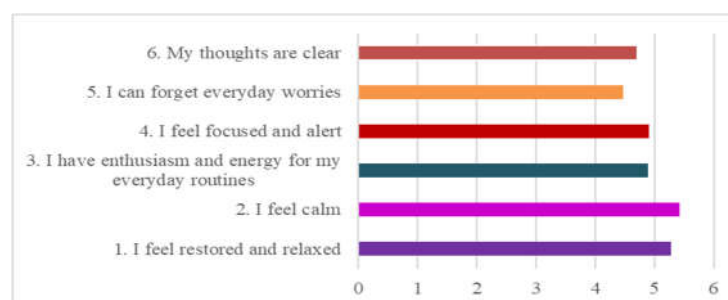


Figure 1.: Natural environment video effect after class break

Based on the results presented in Figure 1, the highest mean scores were recorded for "I feel restored and relaxed" (1) and "I feel calm" (2), with scores close to 5. This demonstrates that the natural environment video experience significantly contributed to students' relaxation and emotional calmness, suggesting that nature environments can effectively promote relaxation and reduce stress during academic breaks. These findings are consistent with previous research indicating that exposure to nature, whether real or virtual, has a positive effect on emotional well-being, particularly in reducing stress (Li et al., 2021).

Moderate mean scores were observed for "I have enthusiasm and energy for my everyday routines" (3) and "I feel focused and alert" (4). While these scores were still positive, they indicated a more modest effect on students' energy and alertness, suggesting that the natural environment experience had a less substantial impact on enhancing cognitive vitality in comparison to its effects on emotional restoration. This result aligns with studies that suggest nature-based interventions, including virtual nature, may have a stronger impact on emotional restoration than cognitive functions like focus or alertness (Franco, Shanahan & Fuller, 2017).

The lowest mean scores were recorded for "I can forget everyday worries" (5) and "My thoughts are clear" (6), highlighting that while the natural environment video provided restorative benefits, it had a lesser impact on alleviating daily worries and enhancing cognitive clarity. This suggests that while the experience effectively reduced emotional stress, it may not have fully addressed mental clutter or cognitive stressors. These results are in line with previous studies that found that while virtual nature environments can foster emotional relaxation, their effects on cognitive functions such as mental clarity or worry reduction may be less pronounced (Owens, 2023).

In conclusion, the natural environment video was particularly effective in promoting emotional restoration, specifically in terms of relaxation and calmness. However, further research is necessary to explore its impact on cognitive factors such as focus, mental clarity, and the reduction of daily worries. Given these promising results, natural environment video experiences should be considered as part of mental health interventions for students, especially in the context of academic settings, where stress management is crucial for maintaining well-being.

CONCLUSION

In conclusion, this study evaluates the restorative effect of natural environment video during the class break among students. The empirical findings of this study suggest that natural environment video experiences, particularly during academic breaks, can effectively contribute to relaxation and emotional restoration among students. Also, natural environment video bridges the gap between technology and mental health by providing students with a portable and effective means to access restorative environments during class breaks. Given the potential benefits, incorporating natural environment video as part of mental health interventions may be an effective strategy for enhancing well-being, especially in environments where access to real-world natural spaces is restricted. Furthermore, natural environment video breaks can improve cognitive functioning, enhancing attention, problem-solving

abilities, and creativity, all of which are vital for academic success. Further research is needed to compare different natural environment video immersion levels to determine optimal experiences for maximum restorative benefits and to explore nature video interventions across diverse educational settings and various student populations, the broader applications of nature video in mental health interventions and its impact on cognitive and emotional factors beyond relaxation and stress reduction.

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