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HARMONY IN PROGRESS:

INTEGRATING SCIENCE, TECHNOLOGY, AND SOCIAL INNOVATION FOR SUSTAINABLE DEVELOPMENT GOALS

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HARMONY IN PROGRESS: INTEGRATING SCIENCE, TECHNOLOGY, AND SOCIAL INNOVATION FOR SUSTAINABLE DEVELOPMENT GOALS

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PREFACE

We are delighted to present the Negeri Sembilan International Exposition (NSIEx) & Research Symposium 2025 e-book, themed “Harmony in Progress: Integrating Science, Technology, and Social Innovation for Sustainable Development Goals”. This edition marks another significant milestone for researchers, inventors, and innovators who have devoted their time and creativity to transforming ideas into impactful products, before showcasing them at the NSIEx & Research Symposium 2025. We strongly believe that NSIEx & Research Symposium 2025 has once again fulfilled its role as a vibrant platform to spotlight outstanding innovations, inventions, and design concepts across science, technology, and the social sciences. More than just a competition, the exposition nurtures a culture of research and innovation, inspiring participation among young learners as well as established professionals. To celebrate and acknowledge the contributions of these researchers, this book brings together their work after a careful review and selection process by the editors.

We are truly inspired by the diversity and creativity of the ideas presented, and we hope that this spirit of innovation continues to flourish, driving sustainable progress in the years ahead.

Editors

TABLE OF CONTENTS

PAGE

PREFACE iv

THEME 1 PRESERVERANCE IN SOCIETY
YOUNG INNOVATORS (SOCIAL SCIENCE)

YSS001 - MODEL KONSEPTUAL KOMPETENSI PENGETUA TERHADAP PELAKSANAAN PENDIDIKAN STEM 1
Sariati Talib, Bity Salwana Alias, dan Mohd Effendi @ Ewan Mohd Matore*

YSS002 - T&L- PBL FRAMEWORK WITH THE CARTOON CONCEPT 5
Nur Izzati Mohd Shafri, Mohd Nazir Md Zabit, NurulAsyikin Hassan, Tirzah Zubeidah Zachariah, Eian Amsyar Mohd Nazir, dan Nurul Fadzleen Shadzween Mohd Rosli*

YSS003 - NOAH AND THE MAGIC KUIHS 8
*Tengku Adeline Maryam Tengku Ahmad Zariman, Mohammad Rafael Idris Junaidi, Muhammad Nufail Syahmi Fahmy, Ainul Sufiah Abd Raof, Sharifah Shasha Shahabudin Syed Mohamad Yohan, and Muhamad Hanapi Khamis**

YSS004 - YUSUF'S CAMERA ADVENTURE 11
*Alif Danish Ahza Ahmad Azahari, Marissa Arshiya Noor Arman Putra, Nik Nur Damia Batrisyia Nik Mohd Hasmizie, Nur Balqis Sofea Mohd Khairul Nizan, Yuairin Natasya Yudanyl Aify, and Muhamad Hanapi Khamis**

YSS005 - AN ASSESSMENT TOOL FOR MEASURING FACULTY CONTINUANCE INTENTION TO USE OPEN AND DISTANCE LEARNING (ODL) 14
Shafinaz Lyana Abu Talib, and Rusliza Yahaya*

YSS006 - ZEROBU: ZERO READY TO FIGHT AGAINST BULLYING 18
Syam Syam Sanjaya, Doni Firmansyah, Kamila Mecca Dewi, Vira Septiani, Shalu Tannya Yanwar, and Selly Feranie*

YSS007 - INNOVATIVE ONLINE SURVEY : ASSESSMENT OF ODL'S IMPACT ON GRADUATE SKILLS AND CAREER OUTCOMES 22
Fatin Adilah Razali, and Noor Lela Ahmad*

YSS008 - PORTABLE SMART SINK 26
*Ahmad Shahmi Abu Zahir, Julia Johari, Nur Ainaa Binti Azrul, Nur Hawa Hana Humaira Mohd Shukry, Nursyuhada Mohd Zamzuri, and Zaidatulhusna Mohd Isnani**

YSS009 - GreenMOORA: A WEB-BASED PYTHON TOOL FOR BIG DATA MCDM IN SUSTAINABILITY AND INNOVATION IMPACT 29
*Muhammad Nur Azhari Johari, Puteri Afiqah Yusri, Nur Humaira Najihah Mohd Hamidi, Wan Syaidatul Izzati Wan Abdul Rahman, and Zahari Md Rodzi**

YSS010 - UNLOCKING KNOWLEDGE: A TRANSFORMATIVE FRAMEWORK FOR BOOSTING OPEN DATA ADOPTION IN MALAYSIAN ACADEMIA 32
Yusra Madihah Shamsudin[1], and Wahidah Mohd Zain[2]*

YSS011 - SENSIBUDDY : SENSORY TOY FOR SPECIAL NEEDS CHILDREN 37
*Muhammad Faezul Ikhwan Ahmad Zahudi, Muhamad Alif Firdaus Mohd Sahrulnizam, Afrina Shamri, Nur Aisyah Antasya Rosni, Nur Haziqah Hanis Norkamal, Siti Luthfiah Mohd Nizer, and Aslizah Mohd Aris**

THEME 2 ADVANCING SOCIETY WITH TECHNOLOGY
YOUNG INNOVATORS (SCIENCE AND TECHNOLOGY)

YST001 - ADVANCED NON-PLANAR ARCHITECTURE: NANOPOROUS ALUMINA (NPA) MILLIRODS 41
*Nurul Hanis Nabilah Ahmad Faizal, Abdul Hadi Mahmud, Mawar Hasyikin Abu Seman, Abdul Mutalib Md Jani, and Kim-Fatt Low**

YST002 - CHITOTHYM PULP SHIELD: PROTECT, HEAL, REGENERATE 45
Nurul Izzani Zulkifle[1], Afzan Adilah Ayoub[2], Siti Aisyah Roslan[2], and Amalina Amir[3]*

YST003 - OXYPULSE ALERT SYSTEM 49
Ng Kai Sheng, Ng Rui En, and Nurul Haida Abu Bakar*

YST005 - GRAVI-WICK: A PASSIVE, ELECTRICITY-FREE AND LOW-COST DRIP IRRIGATION SYSTEM FOR OPTIMAL SOIL HYDRATION 53
Haikal Zulfa Alfarizi Hamzah, Radin Alyandru Keufkahfi, Debbyrizma Scevia Hardiyanti, Refy Hidayanti, Revalina Euniqe, and Selly Feranie*

YST006 - ORANGE PEEL CEREAL BARS 57
*Nik Nurnasuha Nik Mohd Kadri[1], and Nurain Aziman[2]**

YST007 - AUTOMATED NURSE SCHEDULING BY USING 0-1 INTEGER LINEAR PROGRAMMING 60
*Noor 'Ain Mohd Asri, Siti Nur Izzah Mohd Azimin, and Abdullah Yahya**

YST008 - FROM PEEL TO PROTECTION: ECO-FRIENDLY INSECT REPELLENT FROM POMELO 64
Muhammad Nazarudin Afiq Mohd Nizam, Nurazira Mohd Nor, and Boon Yih Tien[*]

YST009 - INTEGRATING IMAGE ENHANCEMENT WITH YOLO FOR IMPROVED LOW-LIGHT FACE DETECTION 68
Farah Safiyyah Md Zahidan[1], and Farizuwana Akma Zulkifle[2]*

YST010 - MICROBIAL POTENTIAL OF BEE HONEY IN YOGURT PROCESSING 72
*Nurul Aein Mohd Noor[1], Siti Sarah Shahimi[2], and Safiyyah Shahimi[1]**

YST011 - IMPACT OF SOURDOUGH FERMENTATION AND BAKING TEMPERATURE ON CALCIUM-FORTIFIED SOURDOUGH BREAD 75
*Hana Maisarah Mohd Hambal, Nur Aisyah Ismail, and Safiyyah Shahimi**

YST012 - PENGGUNAAN SISA BUANGAN KACA SEBAGAI BAHAN TAMBAH AGREGAT HALUS DI DALAM KONKRIT 78
Dhiraj A/L V.Krishnan, Muhammad Ilman Hakim Mustaza, Muhammad Aznor Atiyah Azman, Nur Aliah Nadirah Abd Rasid, Nur Alysa Husna Mohd Firdaous, dan Sitil Balqis Abdul Kadir*

YST013 - OSSS CONNECT: OUTING SMART SCHOOL SYSTEM USING JAKOB NIELSEN'S PRINCIPLES 83
Siti Aishah Mohd Rahim[1], Rashidah Mokhtar[2], and Nur Huda Jaafar[2]*

YST014 - POTENTIAL OF BORNEO INDIGENOUS SEED (*KOP* NUT) AS A NEW SOURCE OF FOOD PRODUCT 87
Shahrina Shah Jahan, and Rafidah Husen*

YST015 - HARVESTPRO: INTELLIGENT PRODUCE MANAGEMENT SYSTEM 91
Ummi Umairah Ramli[1], Rashidah Mokhtar[2], and Nooradilla Abu Hasan[3]*

YST016 - AIR-DRIVEN CONVEYOR SYSTEM FOR FRICTIONLESS MATERIAL MOVEMENT 95
Keshwar Sharma[1], Nursyahirah Adnan[*], Nur Syazana Rashidi, and Nasif Mohd Idris

YST017 - NOTENEST: ALL YOUR NOTES IN ONE PLACE 99
*Julia Binti Johari, Mohd Badrul Amin Bin Abdul Ghani, Muhammad Alif Bin Anas, Nursyuhada Binti Mohd Zamzuri, Wan Batrisyia Adriana Binti Mohamad Faraok, and Haslinda Binti Noradzan**

YST018 - ALLERGIFY: MOBILE APPLICATION FOR REAL-TIME ALLERGEN DETECTION IN PACKAGED FOODS 102
*Nurul Umairah Mohd Badli, Zarith Sofea Mohd Jufri, and Norlina Mohd Sabri**

YST019 - LEARNTORECYCLE: HOUSEHOLD WASTE DETECTION AND RECYCLER FINDER MOBILE APPLICATION 106
*Aleeya Ahmad Mahmud, and Norlina Mohd Sabri**

YST020 - DESIGN & USER EXPERIENCE ASSESSMENT OF A MOBILE APPLICATION PROTOTYPE FOR DOCUMENTATION OF MEDICATION RELATED PROBLEMS AMONG UNDERGRADUATE PHARMACY STUDENTS (DREAMS-STUDY) 110
*Nur Aiza Azhuri[1], Muhamad Fareed Mohamad Saroni[2], and Norkasihan Ibrahim[1]**

YST021 - BOOK BUDDY 114
*Nur Sakinah Baharuddin, Amanda Balkish Alri Mohammad Haelmi Alri, Nur Izzah Nazurah Rosdi, Nurul Atiqah Khairul Anuar, and Sri Yusmawati Mohd Yunus**

YST022 - FUNDMYSTUDY: SCHOLARSHIP FINDER 118
*Elis Eliza Rosli, Nur Alisa Azlan, Nurlisa Adilah Shamsudin, Syahmina Humaira Hizir, and Wan Aryati Wan Ghani**

YST023 - FIT FIGHT MUSCLE CARD EDITION 121
Nurul Ardini Ahmad Sallehein , Muhammad Adam Khairul Anwar, Sharina Salmi Azmi, Nurul Syafawani Halim, and Siti Aida Lamat*

YST024 - ECOTOPSIS: A BIG DATA APPROACH FOR SUSTAINABLE EVALUATION AND RANKING 124
*Muhammad Harris Farhan Hussein, Fiqhley Ilmey A'mal Fadhaililamal, Nursyahirah Syafiqah Arzanee, Muhammad Mukhlis Kamarul Zaman, and Zahari Md Rodzi**

YST025 - INNOVATIVE LOCATION-ROUTING OPTIMIZATION USING K-MEAN CLUSTERING ALGORITHM AND MTZ-TSP MODEL 128
*Nisya Syafinas Bahanuddin, Nur Arwina Ashyiqa Yusof, Nur Dalila Mohd Khalil, and Zati Aqmar Zaharudin**

YST026 - DEVELOPMENT OF THERMAL INSULATING MATERIALS FROM CORN HUSK FIBRES 132
*Saidatul Filzah Saifuddin, Norasyika Hasmadi, Nurul Khadeja Ruslan, Nur Haifa Najwa Mohamad Razif, and Atiyyah Musa**

YST027 - SO-LEANYUM: FUNCTIONAL SAUCE FROM TERUNG ASAM (SOLANUM LASIOCARPUM DUNAL) WITH ENHANCED ANTIOXIDANT PROPERTIES AND ANTI-OBESITY POTENTIAL 135
Muhammad Naufal Qaweim Rushdy[1], Aniza Saini[1], Muhammad Daniel Eazzat Mohd Rosdan[1], Mohammad Amil Zulhilmi Benjamin[1], Hasdian Mudin[1], and Mohd Azrie Awang[1,2]*

YST028 - PIPERPURE: HERBAL ANTIMICROBIAL MOUTHWASH POWERED BY *PIPER BETLE* L. 139
*Dhia Ali Fudail Che Rosli, Wan Ahmad Irfan Hakimi Wan Abd Malik, and Mazlin Mohideen**

YST029 - PYRRO-3: IN SILICO STUDY OF A MULTI-TARGET INHIBITOR **142**
*Nur Aisyah Humaira' Mahadi, Amalia Sofia Sulaiman, Maisara Hakima Roslim, and Nor Habibah Mohd Rosli**

YST030 - OPTIMIZING SCHOOL EXAMINATION TIMETABLES WITH INTEGER LINEAR PROGRAMMING **145**
*Noor Shafiqka Mohd Yazid, Wan Nur Alya Sofea Wan Mohd Sukri, and Nurul Liyana Abdul Aziz**

YST031 - BLOOMYBURST **150**
*Hamizah Hanani Abd Rasidi[1] ,Muhammad Sharizal Zalmy Mohd Safeie[1] , Muhammad Rafiqi Jamian[1], Nur Aini Syahirah Anuar[1], Eddie Tan Ti Tjih[1,2], and Siti Azima Abdul Muttalib[1,2]**

YST032 - DEVELOPMENT OF AN AGROROVER FOR SMART AGRICULTURAL AUTOMATION TO ENHANCE PRODUCTIVITY USING WIRELESS COMMUNICATION **153**
Muhammad Ikmal Yazid, Nathan Randall Anak James Bae'e, and Najmiah Radiah Mohamad*

YST033 - ORANGE PEELS AND BASIL LEAVES HERBAL TEA **157**
Nur Ayuni Nabila Jemaron[1] , Muhamad Hazim Luqman Mohd Haidar[1], and Nurain Aziman[2]*

YST034 - DAILEETOX (POMEGRANATE BOTANICAL DRINK) **161**
Marina Zulkifli, Nur Aisyah Rozaiman, Najwa binti Mohamad Daud, Nur Adlyn Najiha Norhadi, Nur Alisa Zahidi, Nurul Wafa Azzahra Ruzhalman, and Siti Asyura Aina Saiful Azhar*

YST035 - TWO-STEP ANODIZATION APPROACH FOR FABRICATING NANOPOROUS ALUMINA ON ALUMINUM HOLLOW TUBES **165**
Mawar Hasyikin Abu Seman[1], Nurul Hanis Nabilah Ahmad Faizal[1], Low Kim-Fatt[1,2], and Abdul Mutalib Md Jani[1,2,3,]*

THEME 3 COMMUNITY AND CULTURAL SUPPORT
PROFESSIONAL (SOCIAL SCIENCE)

PSS001 - S-ILTIZAM: ISLAMIC MICRO SAVING AND LEARNING TOOL FOR UNIVERSITY STUDENTS **169**
Nor Razuana Amram[1], Muhammad Asyraaf Hashim[1], Mohd Faizal Jamaludin[2], and Nuur Atikah Ghazali[3]*

PSS002 - FSPPP EXAM KIT 2.0: DEVELOPMENT OF A MOBILE/WEB-BASED EXAM INFORMATION SYSTEM **173**
Noorie Haryaniee Moulton, Nor Ezrine Yussoff, Nasyrah Ahmad, Nurul Haiza Ibrahim, Maria Abdul Manap, and Nur Afiq Ikhwan Zainor*

PSS003 - i-INTEGRATED AUDIT MANAGEMENT SYSTEM **178**
Rashidah Mohd Said, Mohamadnor Basri Shafe, Wan Zaliha Wan Othman, Elango Periasamy, Rashida Awang, Hamidah Mat, and Rokiah Mohd Nazir*

PSS004 - GAME-INTEGRATED COMMUNICATIVE FRAMEWORK: TRANSFORMING ESL SPEAKING THROUGH MAINSTREAM DIGITAL GAMING **181**
Stefanie Natasha Rich Joseph[1], Cindy Robert[1], Shirley Clare Jeri[1], Tracy Adeline Ajol[1], and Shirley Sinatra Gran[2]*

PSS005 - GLOBAL VOICES: AI PERSONA LAB (CONSUMER PERSONA CHATBOT) 185
Galvin Kuan Sian Lee

PSS006 - VISUALIZING CONTRADICTIONS: AN INTERACTIVE COMIC FOR LEARNING PHYSICAL CONTRADICTION 188
Aina' Madihah Binti Zulkifli, Jing Rui Tang, and Wan Nurlisa Wan Ahmad*

PSS007 - i-FIQH EASY 191
Wan Nor Aisyah Wan Yussof [1], Nursafra Mohd Zhaffar[1], Siti Nur Husna Abdul Rahman[1], Suhaila Sharil[1], Najihah Abd Razak[1], Nur Fadhiela Mohd Khairul Nizam[1], dan Siti Nadiah Babge[2]*

PSS008 - DARI PENTAS KE PODCAST: THEATRE THAT ECHOES 195
Dzeelfa Zainal Abidin[1], Siti Nur Dina Haji Mohd Ali[1], Anis Shahira Bazlan[1] Muhaimyn Ahmed Suhaimi[2], Muhammad Iqmal Hakimi Erwan Erizull[2], and Noor Shafiqa Abdullah[2]*

THEME 4 RESILIENCE IN SCIENTIFIC PURSUE
PROFESSIONAL (SCIENCE AND TECHNOLOGY)

PST001 - GAMMAGLOW DUCK: READY-TO-COOK SMOKED DUCK MEAT PRESERVED VIA GAMMA TECHNOLOGY 199
Mohamad Shahrimi Hashim[1,3], Salma Mohamad Yusop[1], Irman Abdul Rahman[2], and Mohamad Saiful Nizam Jahaluddin[4]*

PST002 - THE FIREFIGHTER ROBOT WITH CAMERA-BASED DETECTION AND GPS NAVIGATION 202
Logesvaran Wasu1, Nadiah Kamaruzaman[1], Suhassni Ganeson[1], Zaris Izzati Mohd Yassin[1], Murni Syafiqah Balqis Mohd Sukor[2], and Ku Siti Syahidah Ku Mohd Noh[3]*

PST003 - XactMath: AN INNOVATIVE TEACHING TOOL TO SUPPORT FORMULA AND TOPIC SELECTION IN BUSINESS MATHEMATICS 206
Nurul Aityqah Yaacob[1], Zuraida Jaafar[1], Nur Ida Aniza Rusli[1], Siti Noor Dina Ahmad[1], Mardiana Ahmad[2], and Nadiah Mohamed[1]*

PST004 - MAMMOAI: AUTOMATED MAMMOGRAPHIC BREAST CANCER CLASSIFIER POWERED BY AUTOML 210
Faikah binti Awang@ Ismail[1,2], Muhammad Khalis bin Abdul Karim[2], Mohd Mustafa bin Awang Kechik[2], Izdihar binti Kamal, Siti Izzatul Akma Zaidon[3], and Katham Abdulwahid Noor[4]*

PST005 - EMPOWERING SUSTAINABLE INFRASTRUCTURE WITH SCDesignPro: AN INNOVATIVE EVALUATION OF STONE COLUMN PERFORMANCE 214
Juliana Idrus[1], Ng Kok Shien[1], and Chew Yee Ming[2]*

PST006 - Z-FERT: NATURAL FERTILITY FOR BETTER PLANT GROWTH 218
Nurul Hazieqa Rosli[1], Lili Syahani Rusli[2,3], Nor'Aishah Abu Shah[1,3], Sarah Shazwani Zakaria[1,3], Nur Azimah Osman[1,3], Nadia Aqilla Shamsusah[1,3], Syazuani Mohd Shariff[1,3], and Nur Hasyimah Ramli[1,3]*

PST007 - *LUBRIGREEN*: ECO-FRIENDLY BIOLUBRICANT BASE STOCK FROM SOYBEAN OIL 222
Nurazira Mohd Nor[1,2], Asiah Abdullah[1,2], Muhammad Muizzuddin Khairuddin[1], Muhammad Aiman Ahmad Salleh[1], and Nurul Athirah Abdul Karim[1]*

PST008 - MORILIEF: SUGAR-FREE *MORINGA OLEIFERA* HERBAL LOZENGES FOR NATURAL THROAT CARE 225
Nozlena Abdul Samad, Melissa Kilus, Rolla Al Shalabi, and Ghazal Abdullahi Olawale*

PST009 - ECOFUSION: SUSTAINABLE COMPOSITES FROM RECYCLED PLASTICS AND WATER HYACINTH FIBRES 228
Siti Nor Din, Atia Batrisyia Abdul Raof, Amiera Hazleen Sofea Che Karola, Muhammad Faris Shamshul Kamal, and Faiezah Hashim*

PST010 - KIK SmartJury: AN AUTOMATED REAL-TIME SCORING SYSTEM FOR KIK CONVENTION JUDGING 231
Tuan Norhafizah Tuan Zakaria[1], Nasrul Hazim Mohamad[2], and Nur Nadia Dzulkifli[3]*

PST011 - ALGALEAN MEAT (LOW-FAT MEAT ANALOGUE WITH BORNEO SEA GRAPES) 235
Wolyna Pindi[1], Low Bei Xuan[2], Nurul Shaeera Sulaiman[2], Patricia Matanjun[1], Sylvester Mantihal[1], Norliza Julmohammad[2], and Mohamad Norisham Mohamad Rosdi[2]*

PST012 - A PRACTICAL EXCEL SOLUTION FOR MULTI-CRITERIA ANALYSIS USING THE ENTROPY-ARAS APPROACH 239
Nor Faradilah Mahad, Nur Anisha Roslan, Ahmad Fakhri Ismail, and Mohamad Hajim Aqil Mohamad Nazri*

PST013 - A USER-FRIENDLY EXCEL TEMPLATE FOR MULTI-CRITERIA DECISION MAKING (MCDM) PROBLEMS USING THE ENTROPY-COPRAS METHOD 243
Nor Faradilah Mahad, Mohamad Hajim Aqil Mohamad Nazri, Nur Anisha Roslan, and Ahmad Fakhri Ismail*

PST014 - A FRAMEWORK OF NATIONAL MONITORING AND REPORTING SYSTEM TO PREVENT UNAUTHORIZED RON95 PURCHASES 247
Noreha Mohamed Yusof, Noorezatty Mohd Yusop, Norani Amit, Nor Faradilah Mahad, Nur Hidayah Mohd Razali, and Noor Aisyah Idris*

PST015 - CHOCOSHIELD: PROBIOTIC CHOCOLATE FROM LOCAL LACTIC ACID BACTERIA AGAINST MULTIDRUG-RESISTANT FOODBORNE PATHOGENS 251
Siti Nur Hazwani Oslan[1], Nurhazwani Sa'aid[2], Joo Shun Tan[2], Hizriana Nuril Fitri Herryady[1], Norazlina Mohammad Ridhwan[1], and Norliza Julmohammad[1]*

PST016 - FAST, GREEN & CLEAN: 5-MINUTE DYE REMOVAL USING CHICKEN FEATHER ACTIVATED CARBON 254
Rozidaini Mohd Ghazi[1], Muhammad Akashah Sehat[1], Jessie Chai Xin Ying[1], Nur Annisa Binti Mohd Nazri[1], Nik Raihan Nik Yusoff[1], Asanah Radhi[2], Ikarastika Rahayu Abdul Wahab[3], and Musfiroh Jani[1]*

PST017 - MEDIRANK: A LIGHTWEIGHT, WEB-BASED PRE-SCREENING TOOL USING EUCLIDEAN DISTANCE SIMILARITY 258
Zahari Md Rodzi[1], Wan Normila Mohamad[2], Jamilah Mohd Mahyideen[2], Nurul Kamalia Yusuf[3], Sharfizie Mohd Sharip[4], Ida Muryany Md Yasin[5], and Ahmad Zaki Abd Razak[6]

PST018 - ELECTRO LAND: REDOX REACTIONS LEARNING DIGITAL ESCAPE GAME 262
Wan Elina Faradilla Wan Khalid[1], Nor Akmalazura Jani[1] , and Siti Zaharah Mohd Ruslan[2]*

PST019 - SERENITYSENIOR:AN ELDERLY CENTERED DIGITAL MENTAL HEALTH PLATFORM 266
Nahreen Zannat

PST021 - COCO-FIT: FUNCTIONAL FAT FROM BAMBANGAN KERNET FAT STEARIN AS COCOA BUTTER IMPROVER FOR TROPICAL APPLICATIONS 270
Norazlina Mohammad Ridhwan[1], Nurul Azzaimah Fitri Khairil Anuar[1], Hasmadi Mamat[1], Siti Nur Hazwani Oslan[1], Dynatalie Delicious[2], and Norliza Julmohammad[1]*

PST022 - RINDCHI : A ZERO-WASTE, FERMENTED DELICACY FROM WATERMELON RIND 274
Sarini Ahmad Wakid[1], Zuraida Jaafar[2], Ilyanie Hj Yaacob[1], Ida Muryany Md Yasin[1] , and Nur Intan Hasbullah[1]*

PST023 - AI-POWERED MOBILE APPLICATION PROTOTYPE FOR *SURAH AL-MULK* MEMORISATION 277
Norsyaiful Bin Zakaria[1], Intan Syaherra Ramli [2], Muhammad Hafiz Saleh[3], and Anitawati Mohd Lokman[1]*

PST024 - ULTRASONIC POWERFLOW: A CAVITATION-DRIVEN FLOW SYSTEM FOR CELL DISRUPTION 281
Noraini Mat Budari[1], Ku Halim Ku Hamid[2], Siti Aisyah Ghazali[3], Siti Safirah Rashid[1], Nazhirah Muhammad Nasri[4], and Mohammad Hafizudden Mohd Zaki[4]*

THEME 5 *RESEARCH SYMPOSIUM (SOCIAL SCIENCE)*

RSSS001 - THE EFFECTIVENESS OF HAND FOLD PACK IN PACKAGING DESIGN 285
Zulhelmi Ahmad[*], and Muhammad Nasuha Yusop

RSSS002 - ENHANCING CROSS-CULTURAL LEADERSHIP COMPETENCIES THROUGH EXPERIENTIAL LEARNING: A STUDY OF INDERALOKA INTERNATIONAL FESTIVAL 290
*Nurshalihah Diyanah Ajah Maidien, Nur Maizatul Hafyfa Ahmad Tajudin, Sabri Mohamad Sharif, and Khairul Nizam Suhaimin**

RSSS003 – STUDENT AND SUBJECT TEACHER ATTITUDE FACTORS CONTRIBUTING TO TRUANCY AMONG STUDENTS: A CASE STUDY 296
Muruga Krishnan[1,] Rani Ramanad[2], and Halijah binti Shaari[3]*

RSSS004 - FUNCsiFlex: AN INNOVATIVE DIGITAL FRAMEWORK FOR ENHANCING FUNCTIONAL WORKFLOW EFFICIENCY IN HIGHER EDUCATION 301
Jeniwaty Mohd Jody, Hazariah Yais Razali, Siti Melinda Haris, Nurliyana Mohd Shazali, Farah Adilla Ab. Rahman, Noorie Haryanie Moulton, Nor Zakiahanim Zakaria, Mohd Nor Rahim, Mohd Hairuz Razali, and Mohd Rushdan Yaacob*

RSSS005 - THE INFLUENCE OF SOCIAL MEDIA ON BUILDING BRAND EQUITY AMONG SME IN MALAYSIA 306
*Intan Hazlna Ayob, Norhalida Abd Rahim, Rosnaimah Mohamed Yunos, and Mohamad Dis Abdul Rahman**

RSSS006 - WISE MENTOR OF HISTORY 311
Nor Abizan Md Zain

THEME 6 *RESEARCH SYMPOSIUM (SCIENCE AND TECHNOLOGY)*

RSST001 - FACTORS AFFECTING RUBBER PRICES IN MALAYSIA 315
Nur Adibah Adzmi[1], Noor 'Adilah Ibrahim[2], Neelabja Chatterjee[3]*

RSST002 - FORECASTING DAILY LRT AMPANG LINE RIDERSHIP USING SARIMA MODEL 319
Suhaila Bahrom[1], and Eszleen Sies[2]*

RSST003 - UNVEILING ANTIOXIDANT PROPERTIES OF *RHODOMYRTUS TOMENTOSA* (KEMUNTING): A COMPARISON BETWEEN ITS LEAF AND FRUIT 324
*Nur Najaa Nazihah Roslie, and Nur Aisyah Ismail**

RSST004 - DEVELOPMENT OF A MULTILINGUAL WEB-BASED EDUCATIONAL APPLICATION TO PROMOTE CULTURAL LITERACY THROUGH NASI DAGANG 327
Wan Muhammad Haziq Darwisy Wan Remle[1],Khairul Nizam Suhaimin[1], and Siti Syazwani Azmi[2]*

RSST005 - SUSTAINABLE TREATMENT OF AGRICULTURAL EFFLUENT USING SUGARCANE BAGASSE AND ALUMINIUM SULFATE 331
*Nurin Syahirah Ya'akub[1], Muhammad Khairudin Khalil[2], Ng Jing Lin[1], and Azinoor Azida Abu Bakar[1]**

RSST006 - FUNCTIONAL GROUP ANALYSIS AND ADSORPTION EFFICIENCY OF UNTREATED AND TREATED SPENT COFFEE GROUNDS IN CRYSTAL VIOLET REMOVAL 335
Rabuyah Ni[1], Firus Musfirah Poli, and Siti Kartina Abdul Karim*

RSST007 - DEVELOPMENT OF MUSHROOM PROTEIN HYDROLYSATE AS FLAVOUR ENHANCER: ITS PHYSICOCHEMICAL PROPERTIES AND SENSORY ACCEPTABILITY 340
*Nur Afiqah Jahaya[1], and Hisham Mohd Nooh[2,3]**

RSST008 - A REVIEW OF INNOVATIONS IN MOBILE AND REMOTE INSPECTION TECHNOLOGIES FOR THE CONSTRUCTION INDUSTRY (2020 TO 2025) 344
Mohd Dhiya Hafreez Kamil[1,2], Mohd Najib Abd Rashid[3], and Mohamed Rizal Mohamed[4]*

RSST010 - COMPARATIVE ANALYSIS OF KETO BREAD FORMULATIONS: SENSORY, SHELF-LIFE, AND QUALITY ATTRIBUTES 348
Nur Aifa Safeeya Mohd Sadli[1], and Hisham Mohd Nooh[1,2]*

RSST011 - ANALYSIS OF VEGETATIVE COMMUNITY STRUCTURE AND DIVERSITY OF UiTM KUALA PILAH FOREST 355
*Iman Nabila Mohazam Shah, and Syazuani Mohd Shariff**

RSST012 - COPROLOGICAL AND MOLECULAR INVESTIGATION OF ANIMAL PARASITE IN COW STOOL IN KUALA PILAH, NEGERI SEMBILAN 360
*Farah Athilah Zainal Abidin, and Nurhamimah Zainal Abidin**

RSST013 - ADVANCING AI-READY TEACHER EDUCATION: INTEGRATION OF GENERATIVE AI 365
Anusuya Kaliappan, Shanty Sai'en, and Asmah Bohari*

NSIEX +RS 2025
NEGERI SEMBILAN INTERNATIONAL EXPOSITION

THEME 1

YOUNG INNOVATORS (SOCIAL SCIENCE) PRESERVERANCE IN SOCIETY

YSS001 - MODEL KONSEPTUAL KOMPETENSI PENGETUA TERHADAP PELAKSANAAN PENDIDIKAN STEM

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ABSTRAK

Inovasi ini membangunkan satu model konseptual kompetensi pengetua berasaskan Teori Kompetensi Boyatzis (1982) dan Model Kompetensi Bongkah Ais (1993) bagi menyokong pelaksanaan pendidikan STEM di sekolah. Model ini menggariskan tiga domain utama kompetensi pengetua iaitu pengetahuan, kemahiran dan atribut yang saling melengkapi dalam memastikan keberkesanan kepimpinan pendidikan. Pembinaan model ini adalah sebagai respon terhadap dapatan Laporan Indeks STEM Murid (ISM) 2022 yang menunjukkan tahap pelaksanaan pendidikan STEM masih rendah, khususnya di negeri Melaka, akibat kelemahan dalam aspek kepimpinan dan komitmen guru.Model ini bertindak sebagai alat penilaian kendiri dan rujukan diagnostik yang boleh digunakan oleh pengetua, pegawai pendidikan dan pembuat dasar dalam menilai kesiapsiagaan dan keupayaan kepimpinan mereka. Ia juga berpotensi menyumbang kepada reka bentuk intervensi latihan profesional yang lebih bersasar dan berimpak tinggi. Secara teoritis, inovasi ini memperkayakan literatur pendidikan dengan menyediakan satu kerangka kompetensi berasaskan teori yang kukuh. Dari aspek praktikal, ia memberi panduan strategik kepada pemimpin sekolah dalam menambah baik kompetensi individu berdasarkan keperluan pelaksanaan STEM. Sumbangan kepada dasar pula merangkumi sokongan kepada Pelan Pembangunan Pendidikan Malaysia (PPPM 2013–2025), khususnya Anjakan 5 berkaitan kepimpinan berprestasi tinggi.Akhir sekali, inovasi ini turut menyumbang kepada persekitaran sekolah yang lebih kondusif untuk pembelajaran STEM, melalui peningkatan kesediaan dan komitmen guru, yang seterusnya akan memberi impak positif terhadap budaya STEM dalam kalangan murid. Model ini diyakini mampu menjadi asas kepada pembangunan kepimpinan pendidikan yang lebih efektif dan relevan pada masa hadapan.

Kata kunci – Kompetensi Pengetua, Pendidikan STEM, Model Konseptual, Kepimpinan Pendidikan, Intervensi Profesional

PENGENALAN

Produk inovasi ini merupakan satu model konseptual yang dibangunkan berasaskan Teori Kompetensi Boyatzis (1982) dan Model Kompetensi Bongkah Ais (1993), yang menggariskan tiga domain utama iaitu pengetahuan, kemahiran dan atribut yang diperlukan oleh pengetua dalam melaksanakan pendidikan STEM secara berkesan. Model ini bertujuan untuk menjadi panduan penilaian kendiri dan rujukan profesional kepada pemimpin sekolah dalam memperkukuh kompetensi kepimpinan mereka.

Penghasilan produk ini berpunca daripada dapatan Laporan Indeks STEM Murid (ISM) 2022 yang menunjukkan pelaksanaan pendidikan STEM di sekolah, khususnya di negeri Melaka, berada pada tahap rendah. Antara faktor utama yang dikenal pasti ialah komitmen guru yang lemah dan kepimpinan sekolah yang kurang berkesan. Tambahan pula, ketiadaan model tempatan yang menyeluruh dan berasaskan teori untuk menilai peranan serta kompetensi pengetua dalam konteks pelaksanaan pendidikan STEM menjadikan pembangunan produk ini amat penting dan relevan.

OBJEKTIF

Objektif utama penghasilan produk ini adalah untuk membangunkan satu model konseptual yang dapat menilai dan memperkukuh kompetensi pengetua dalam konteks pelaksanaan pendidikan STEM. Model ini bertujuan menjelaskan secara menyeluruh tiga domain utama kompetensi iaitu pengetahuan, kemahiran dan atribut yang diperlukan oleh pengetua. Selain itu, model ini dihasilkan sebagai asas kepada pembangunan intervensi kepimpinan pendidikan yang lebih fokus, sistematik dan berimpak tinggi bagi menyokong kejayaan pelaksanaan dasar pendidikan STEM di sekolah.

PENERANGAN TENTANG PROJEK

Nama Produk:

Model Konseptual Kompetensi Pengetua dalam Pelaksanaan Pendidikan STEM

Butiran Produk:

Produk ini ialah sebuah model konseptual yang direka berasaskan dua teori kukuh iaitu Teori Kompetensi Boyatzis (1982) dan Model Kompetensi Bongkah Ais (1993). Model ini menggabungkan **tiga domain utama** kompetensi pengetua yang diperlukan untuk memimpin pelaksanaan pendidikan STEM secara berkesan:

1. **Pengetahuan** – merujuk kepada keupayaan dalam berfikir secara strategik untuk menentukan hala tuju sekolah, merancang dan membuat keputusan ke arah perubahan PdP kepada PdP berasaskan STEM, memimpin perubahan melalui penyelidikan dan pembangunan profesional, serta menyelesaikan masalah bagi meningkatkan keberkesanan pelaksanaan pendidikan STEM dan minat murid terhadapnya.
2. **Kemahiran** – termasuk kemahiran membuat keputusan, menyelesaikan masalah, pengurusan sumber,menyediakan keperluan, sumber, pengurusan sumber, memberi dorongan, menyediakan pembangunan kapasiti staf dan membina jaringan dan jalinan berkaitan pendidikan STEM.
3. **Atribut** – melibatkan ciri-ciri kepimpinan seperti komunikasi berkesan, berperibadian dan membina jaringan kolaborasi untuk perubahan pendidikan.

Fungsi dan Kegunaan Produk:

Jadual 1: Menunjukkan aspek dan perincian fungsi

Aspek	Perincian
Fungsi Penilaian	Sebagai alat penilaian kendiri atau instrumen diagnostik bagi menilai tahap kompetensi pengetua.
Fungsi Latihan	Menjadi asas bagi merancang latihan profesional berfokus kepada keperluan sebenar pelaksanaan STEM.
Fungsi Polisi	Membantu pihak pembuat dasar merangka intervensi kepimpinan berasaskan data dan keperluan semasa.
Fungsi Akademik	Memberi panduan kepada penyelidik dalam memahami dan mengembangkan kajian tentang kepimpinan pendidikan.

Kepraktisan Produk:

- Boleh digunakan oleh pengetua sebagai alat refleksi kendiri untuk memperkukuh kompetensi masing-masing.
- Digunakan oleh pegawai pendidikan daerah/negeri untuk menyaring keperluan latihan dan penempatan pengetua.
- Sesuai diaplikasikan dalam latihan NPQEL, bengkel kepimpinan dan modul pembangunan profesional berterusan.

PEMBAHARUAN

Model Konseptual Kompetensi Pengetua dalam Pelaksanaan Pendidikan STEM ini merupakan satu pembaharuan yang bersifat asli, berasaskan teori, dan kontekstual, dengan keunikan tersendiri dalam pendekatan dan aplikasinya. Antara pembaharuan utama yang diketengahkan ialah:

Pendekatan Berasaskan Teori Kukuh:
Model ini menggabungkan dua teori penting iaitu Teori Kompetensi Boyatzis (1982) dan Model Kompetensi Bongkah Ais (1993), yang belum pernah disesuaikan secara spesifik dalam konteks pelaksanaan pendidikan STEM pada peringkat sekolah di Malaysia. Penggabungan ini memberikan dimensi holistik terhadap pembangunan kepimpinan pendidikan.

Kerangka Kompetensi Berstruktur & Menyeluruh:
Model ini memperincikan tiga domain utama kompetensi pengetua iaitu pengetahuan, kemahiran dan atribut yang dirangka secara sistematik untuk memenuhi keperluan sebenar pendidikan STEM masa kini. Ini membezakan model ini daripada pendekatan umum yang lebih bersifat deskriptif atau berskala kecil.

Pemerhatian Baharu terhadap Pelaksanaan STEM:
Produk ini muncul hasil daripada analisis mendalam terhadap dapatan Laporan ISM 2022, yang mengenal pasti pengurusan dan kepimpinan sekolah sebagai antara punca utama kelemahan pelaksanaan STEM. Model ini memberikan justifikasi akademik dan praktikal bahawa pengukuhan kompetensi pengetua mampu meningkatkan komitmen dan kesediaan guru.

Aplikasi Sebagai Instrumen Penilaian dan Latihan Profesional:
Model ini bukan sahaja bersifat teoritis, malah dirangka supaya boleh diaplikasikan terus sebagai alat diagnostik dan refleksi kendiri, serta sebagai asas dalam membina modul latihan yang bersasar untuk pengetua, pegawai pendidikan dan pembuat dasar.

Pembangunan Khusus untuk Konteks Malaysia:
Tidak seperti model luar negara yang kurang sesuai dengan konteks pendidikan Malaysia, model ini dibangunkan berdasarkan data dan isu tempatan, menjadikannya lebih relevan untuk digunakan oleh KPM, IPG, dan pihak sekolah.

KESIMPULAN

Secara keseluruhannya, projek inovasi ini berjaya membangunkan satu model konseptual kompetensi pengetua yang berasaskan teori kukuh dan sesuai diaplikasikan dalam konteks pendidikan Malaysia. Model ini bukan sahaja memperincikan aspek pengetahuan, kemahiran dan atribut pengetua, malah turut menyokong pelaksanaan pendidikan STEM melalui pengukuhan kepimpinan sekolah.Keaslian model ini terletak pada pendekatan teoritis yang sistematik, aplikasinya dalam penilaian kendiri dan latihan profesional, serta keupayaannya menyumbang kepada dasar dan amalan pendidikan. Produk ini juga memberikan sumbangan penting dalam menangani isu kelemahan pelaksanaan STEM yang dikenal pasti dalam Laporan ISM 2022, dengan menawarkan penyelesaian yang berfokus kepada pembangunan kompetensi pengetua. Dengan adanya model ini, pihak sekolah, pegawai pendidikan, penyelidik dan pembuat dasar mempunyai satu alat yang praktikal dan relevan untuk memperkukuh kepimpinan pendidikan serta menyokong komitmen dan kesediaan guru dalam membudayakan pendidikan STEM. Maka, inovasi ini diyakini mampu memberi impak jangka panjang terhadap pembangunan pendidikan negara, khususnya dalam menghasilkan kepimpinan sekolah yang berwibawa dan responsif terhadap cabaran masa depan.

YSS002 - T&L- PBL FRAMEWORK WITH THE CARTOON CONCEPT

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ABSTRAK

Produk inovasi ini bermula penghasilannya apabila ianya melibatkan kajian yang telah dijalankan oleh pengkaji bertajuk Kerangka PdPc-PBL Berkonsepkan Kartun Mata Pelajaran Sejarah Pelajar Tingkatan Empat di Sekolah Menengah Kebangsaan (SMK) di seluruh Malaysia. Kerangka ini dibentuk menggunakan pendekatan kajian reka bentuk dan pembangunan atau *Design and Development Research* (DDR) bagi menghasilkan produk inovasi yang melibatkan tiga fasa utama iaitu analisis keperluan, reka bentuk dan pembangunan serta penilaian kebolehgunaan kerangka. Kajian ini akan membangunkan sebuah kerangka dengan pengintegrasian pendekatan *Problem-Based Learning* (PBL) berdasarkan Model McMaster University dengan Konsep Kartun dalam mata pelajaran Sejarah sekolah menengah. Pendekatan ini adalah sesuai dalam konteks kajian ini, yang akan menumpukan kepada penghasilan kerangka berteraskan PBL. Hasil kajian ini juga menunjukkan bahawa Kerangka PdPc-PBL Berkonsep Kartun Mata Pelajaran Sejarah boleh dijadikan panduan dalam menyediakan sebuah kerangka baharu dan komprehensif kepada PdPc Sejarah untuk meningkatkan penguasaan, kefahaman dan kebolehan pelajar. Makanya, ia dapat dilihat sebagai satu inisiatif yang baik apabila sebuah kajian membawa kepada penghasilan sesuatu produk yang baharu.

Kata kunci – Problem Based Learning, Berkonsepkan Kartun, Mata Pelajaran Sejarah, Design and Development Research, Model McMaster University

PENGENALAN

Produk inovasi ini bermula penghasilannya apabila ianya melibatkan kajian yang telah dijalankan oleh pengkaji bertajuk Kerangka PdPc-PBL Berkonsepkan Kartun Mata Pelajaran Sejarah Pelajar Tingkatan Empat di Sekolah Menengah Kebangsaan (SMK) di seluruh Malaysia. Kerangka ini dibentuk menggunakan pendekatan kajian reka bentuk dan pembangunan atau *Design and Development Research* (DDR) bagi menghasilkan produk inovasi yang melibatkan tiga fasa utama iaitu analisis keperluan, reka bentuk dan pembangunan serta penilaian kebolehgunaan kerangka.

Selepas merdeka, Pengajaran dan Pemudahcaraan (PdPc) Sejarah masih streotaip dengan hafalan kronologi naratif dan kebergantungan kepada buku teks. Masalah ini berterusan sedangkan hasrat dan matlamat Dokumen Standard Kurikulum Pendidikan (DSKP) Sejarah, Kurikulum Standard Sekolah Menengah (KSSM) adalah untuk melahirkan pelajar yang mampu mengenal diri dan negara. PdPc guru yang tidak menarik, pasif dan membosankan menyebabkan kemerosotan tumpuan, minat dan pencapaian pelajar dalam Sejarah. Sehingga kini, belum terdapat kajian penghasilan kerangka yang

mengintegrasikan *Problem Based Learning* (PBL) dan konsep kartun dalam mata pelajaran Sejarah. Maka, tercetusnya idea pengkaji di sini bagi membangunkan produk bertajuk T&L-PBL Framework With The Cartoon Concept.

OBJEKTIF

Kerangka PdPc-PBL Berkonsep Kartun ini berpotensi untuk meningkatkan kreativiti dan inovasi serta minat pelajar untuk memahami konsep. la dianggap sebagai kaedah yang mendorong pelajar untuk terus meneroka isu yang dibangkitkan, mencari jalan penyelesaian dan menjadi proses PdPc lebih bermakna. Kerangka PdPc-PBL Berkonsepkan Kartun ini sangat sesuai untuk diterapkan dalam bidang Sains Sosial termasuk Sejarah yang sering dianggap sebagai bidang yang memerlukan hafalan kronologi secara naratif dan sukar bagi sesetengah pelajar. Oleh itu, menjadi keperluan untuk pembinaan Kerangka PdPc-PBL Berkonsepkan Kartun boleh dijayakan dan seterusnya digunakan di sekolah. Kajian yang dicadangkan ini akan menjadi kajian pertama di Malaysia yang memberi tumpuan kepada pengintegrasian antara kaedah PBL dan konsep kartun yang dipelopori oleh Keogh dan Naylor (1999) dalam pembangunan dan pengesahan Kerangka PdPc-PBL Berkonsepkan Kartun Mata Pelajaran Sejarah di Sekolah Menengah.

PENERANGAN TENTANG PROJEK

Produk kerangka ini boleh merangsang Kemahiran dan Pengetahuan Pelajar Abad ke-21 iaitu kognitif, interpersonal, intrapersonal (berdasarkan model Pellegrino dan Hilton) serta melahirkan modal insan dalam pelbagai bidang yang berfikir pada aras tertinggi. Kerangka ini juga berhasrat membangunkan dan menyuburkan intelektual serta Kemahiran Berfikir Aras Tinggi (KBAT) dalam kalangan pelajar-pelajar sekolah di Malaysia. Kerangka ini boleh dijadikan panduan dan diaplikasikan oleh pelbagai institusi pendidikan dan latihan, individu atau agensi atau mereka yang berminat dengan bidang Sejarah, boleh dijadikan asas panduan kepada bidang-bidang lain. Kerangka ini juga bermanfaat kepada Kementerian Pendidikan Malaysia khususnya Bahagian Pembangunan Kurikulum, guru serta pakar Sejarah, para pelajar, individu-individu dan organisasi yang berminat dalam memperkasakan PdPc inovatif dalam menghadapi era pendigitalan terutamanya Artificial Intelligence (AI) ini.

PEMBAHARUAN

Kajian ini akan membangunkan sebuah kerangka dengan pengintegrasian pendekatan *Problem-Based Learning* (PBL) berdasarkan Model McMaster University dengan Konsep Kartun dalam mata pelajaran Sejarah sekolah menengah. Pendekatan ini adalah sesuai dalam konteks kajian ini, yang akan menumpukan kepada penghasilan kerangka berteraskan PBL. Hasil kajian ini menunjukkan bahawa Kerangka PdPc-PBL Berkonsep Kartun Mata Pelajaran Sejarah boleh dijadikan panduan dalam menyediakan sebuah kerangka baharu dan komprehensif kepada PdPc Sejarah untuk meningkatkan penguasaan, kefahaman dan kebolehan pelajar. Makanya, ia dapat dilihat sebagai satu inisiatif yang baik apabila sebuah kajian membawa kepada penghasilan sesuatu produk yang Baharu dalam dunia pendidikan.

KESIMPULAN

Secara umumnya, produk ini mempunyai beberapa kepentingan yang dapat dijadikan sebagai panduan kepada pihak berkepentingan dalam meningkatkan pencapaian dan kemahiran abad ke-21 iaitu membangunkan kerangka baharu sebagai suatu langkah ke arah pemangkinan pendidikan terkini di negara kita. Oleh yang demikian, hasil produk ini diharapkan dapat menjadikan persekitaran yang aktif dan menyeronokkan dalam kalangan pelajar yang menggabungkan pelbagai pendekatan pembelajaran masa kini yang selari dengan pendidikan abad ke 21. Ia juga sebagai salah satu strategi pembelajaran aktif dan berpusatkan pelajar serta menerapkan Kemahiran Berfikir Aras Tinggi (KBAT) di samping menekankan kefahaman konsep kartun.

YSS003 - NOAH AND THE MAGIC KUIHS

Tengku Adeline Maryam Tengku Ahmad Zariman, Mohammad Rafael Idris Junaidi, Muhammad Nufail Syahmi Fahmy, Ainul Sufiah Abd Raof, Sharifah Shasha Shahabudin Syed Mohamad Yohan, and Muhamad Hanapi Khamis*

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ABSTRACT

Noah and the Magic Kuih is a new way to preserve culture by using an interactive children's storybook to bring Malaysian food history to life. The story is about a young boy named Noah who finds a magical world where humanlike versions of traditional kuih live. Each one represents a different region's identity. Noah learns to like these cultural foods that he didn't like before by helping characters like Perak's Kuih Pelita and Terengganu's Kuih Seri Muka to overcome hard times. This eBook throws the important problem of cultural lack among youngsters by turning traditional desserts into fun story elements that teach heritage values through fun. The eBook utilises illustrations and interactive games, like puzzles and problem-solving tasks, to reinforce the stories about kuih. The unique method it uses is to give kuih humanlike traits while keeping real ties to their cultural and geographical roots. In the end, Noah willingly tries the kuih he once turned down, showing how effective experimental learning can be at changing a kid's mind. It uses play-based learning approaches that have been shown to help kids remember things about cultures. The eBook innovation goes beyond traditional storytelling by making a basis that could be used for other endangered cultural essentials. This opens the possibility of using multilingual versions. This work is a good example of how to protect intangible heritage while also teaching kids about cultures. It is especially useful for projects that focus on cultural sustainability and new ways of teaching.

Keywords – cultural, preserve, kuih, technology

INTRODUCTION

As the world is more connected, kids may be less concerned about old traditions and more interested in new goods. Noah and the Magic Kuih resolves this matter by utilising tales to bring back interest in Malaysian culture. The eBook portrays kids who can engage in cultural values better when they are actively involved in the learning process. This eBook contains an interactive and graphically rich style. The concept preserves these traditions alive by making kuih the major subject of the tale. It also makes them more interesting to individuals who grew up with digital technology.

OBJECTIVE

The objectives of the project are:

i. To maintain and promote Malaysian kuih as cultural symbols.

ii. To transform kids' perception about traditional dishes.
iii. To establish a new format that blends narrative with interactive learning.

DESCRIPTION OF THE PROJECT

This eBook contain 20 pages and the illustrations are bright and exciting. Many kuih characters are designed to illustrate where they came from, which helps people learn about diverse cultures. People may engage with the tale by solving puzzles and mazes. The graphics and text work together to create an experience that is both enjoyable and informative.

Figure 1: Book Cover

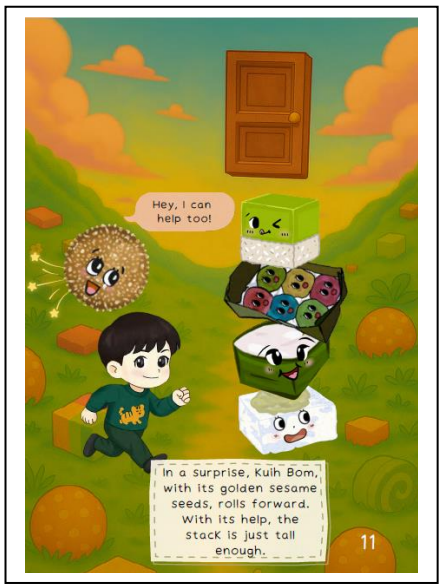

Figure 2: Content Page

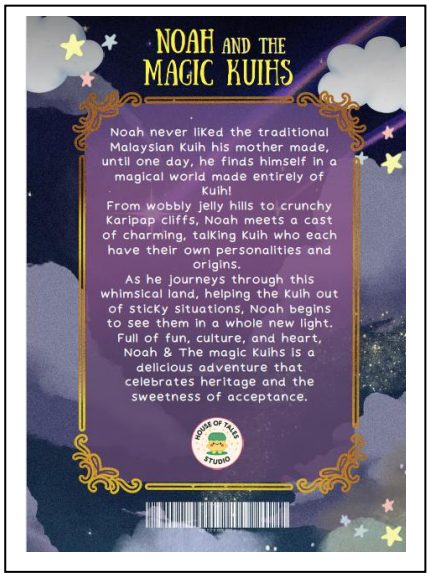

Figure 3: Back Page

NOVELTY

This project is unique because it is the children's book to turn Malaysian kuih into characters and include regional tradition and interactive gameplay. Its mix of attractive narrative and digital-friendly activities meets the needs of modern learners. The story uses Noah's character arc to show how exposure and understanding can change someone's mind about something they don't want to do.

CONCLUSION

Noah and the Magician Kuih's is an excellent example of how to tell custom story in new ways that would attract kids today. The eBook keeps tradition alive by presenting it in a fun and exciting context that kids can connect to. The fact that it worked suggests that such initiatives might help preserve intangible cultural assets all across the Malaysia states and serve as a model for future educational and storytelling innovations that can be employed on a bigger scale.

YSS004 - YUSUF'S CAMERA ADVENTURE

Alif Danish Ahza Ahmad Azahari, Marissa Arshiya Noor Arman Putra, Nik Nur Damia Batrisyia Nik Mohd Hasmizie, Nur Balqis Sofea Mohd Khairul Nizan, Yuairin Natasya Yudanyl Aify, and Muhamad Hanapi Khamis*

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ABSTRACT

Yusuf's Camera Adventure is an illustrated ebook for kids that combines digital photography to inspire creativity, discovery, and self-expression. This story is about a boy known as Yusuf who bumps into his father's locked telephone and accidentally discovers the camera function. He starts to photograph everything in his surroundings, including his cat, flowers, and the neighbor chicken. The end of his adventure is a self-expression activity where he transforms his photographs into hand-drawn sketches. This project shows how effectively traditional art skills and digital knowledge can work together. The book is for kids and includes a strong message about being aware, imaginative, and making stories. This project expands what picture books can achieve by merging narrative, technology, and art into a kind of experience learning. The innovation refers to its integration of digital into analog storytelling, putting the narrative as both relatable and forward-thinking. This project contributes to the genre of children's literature by promoting together media exposure, self-initiative, and positive family interaction.

Keywords – creativity, self-expression, storytelling, technology

INTRODUCTION

Children are being exposed to smart devices like tablets and smartphones at a very young age in this digital age. Although this spotlight presents chances for early digital learning, it also causes concerns about screen time, limit physical activity, and results in lacking creative expression. Instead of using technology as a tool for inspiration and active learning, many kids today use media content. As a result of this change, the gap between significant cognitive development and technological familiarity is widening.

An ebook innovation called "Yusuf's Camera Adventure" addresses this issue by incorporating digital interaction into an imaginative set. The book provides a balanced approach to digital engagement by narrating the story of an inquisitive child who uses a phone camera to record and then sketch his surroundings. It functions as a teaching tool that encourages creativity, digital savvy, observation, enabling kids to use technology in healthy and meaningful ways in their natural learning activities.

OBJECTIVE

The objectives of the project are:

i. To boost children's self-expression, creativity, and experimental skills.

ii. To incorporate digital components into conventional story construction.
iii. To inspire appropriate screen time through purposeful application.

DESCRIPTION OF THE PROJECT

This project is an illustrated children's ebook that tells the story of Yusuf, who records his surroundings with the camera on his father phone. By fusing the creativity of sketches with digital interface, he turns those images into vibrant drawings. The book inspires experimental learning and parental involvement while introducing children to the idea of recording and appreciating their atmosphere. In addition, the ebook motivates primary kids education to initiate attractive story. It is expected to be read for kids aged 5-7 and can be utilised as educational and recreational purposes.

Figure 1: Book Cover

Figure 2: Content Page

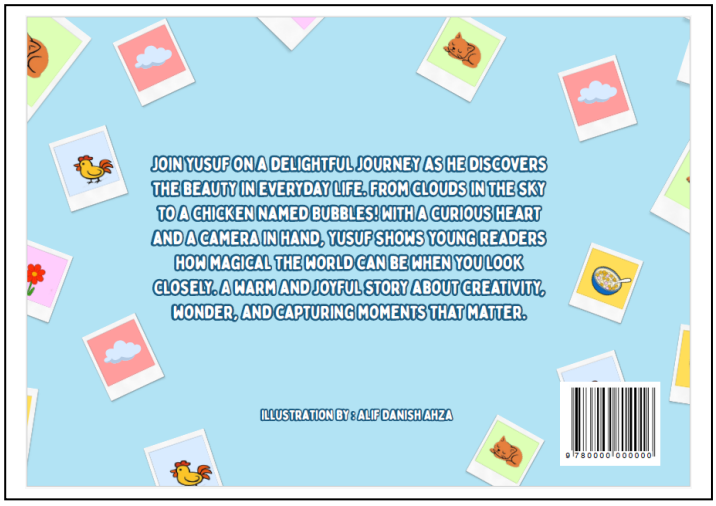

Figure 3: Back Page

NOVELTY

The ebook uniqueness belong in its thematic combination, which combines conventional teaching approaches with digital interest. In contrast to other children's books that either emphasise goodness or fiction, this one normalises digital tools as means for creativity rather than as disturbances. The book is exclusively innovative in parenting and educational frameworks because it is align with current trends in kids development.

CONCLUSION

Yusuf's Camera Adventure promotes thoughtful digital interaction and imaginative exploration. It is a useful and relevant educational tool that inspires kids to be creative, expressive, and mindful of their surroundings. The project makes a significant contribution to early childhood innovation in both the literary and educational domains with its dual highlighting on technology and creativity.

YSS005 - AN ASSESSMENT TOOL FOR MEASURING FACULTY CONTINUANCE INTENTION TO USE OPEN AND DISTANCE LEARNING (ODL)

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ABSTRACT

This paper presents a validated online assessment tool developed to measure the continuance intention of accounting faculty members to use Open and Distance Learning (ODL). Open and Distance Learning (ODL). Developed using Google Forms, the tool is grounded in an integrated framework that combines the Expectation-Confirmation Model (ECM), the Technology Acceptance Model (TAM), and Self-Determination Theory (SDT). It incorporates key constructs such as confirmation, perceived usefulness, satisfaction, and technostress creators. Its novelty lies in combining post-adoption beliefs and technostress creators to provide clearer insights into the evaluative perceptions and stress-related experiences that influence the continuance intention to use ODL. This tool promotes sustainable progress in education by combining ODL and social innovation to foster faculty continuance intention. It helps institutions collect actionable data, address lecturers' needs, and implement strategies that support the ongoing use of ODL. Its simple design and broad applicability contribute to Sustainable Development Goal 4 (SDG 4): Quality Education, which promotes equitable access, inclusive practices, and lifelong learning through effective online teaching.

Keywords – Continuance Intention, Accounting Faculty Members, Online Assessment Tool, Open and Distance Learning, Sustainable Innovation

INTRODUCTION

Although Open and Distance Learning (ODL) is not a new concept (Yazid & Malik, 2022), it has significantly evolved over time due to advancements in technology, teaching methods, and institutional practices (Pundir & Goyal, 2025). More recently, it gained prominence during the COVID-19 pandemic and continues to play an important role in education (Hashim et al., 2023; Shishi et al., 2023). As a result, lecturers had to quickly adopt online teaching technologies and adapt their teaching for virtual delivery (Agustina, 2025). In particular, the benefits of ODL are especially valuable in accounting education, where it helps simplify complex topics and accommodate different learning styles through tools like videos and interactive platforms. Furthermore, national policies and the demand for accessible education options have reinforced the relevance of ODL (Shahbodin et al., 2024). ODL is now widely used by accounting lecturers and is likely to become a standard practice in the near future (Bastos et al., 2021; Niemotko & Tolan, 2020). Its growing use

in higher education, including in accounting, positions ODL as a powerful tool for achieving SDG 4 (Quality Education) by promoting inclusive, equitable, and quality education for all (Saikia et al., 2024; Sarea et al., 2021; Shava et al., 2021). Moreover, it contributes to sustainability by reducing reliance on physical infrastructure and travel, thereby supporting SDG 13 (Climate Action) (Wiguna et al., 2025). Given this context, understanding the factors that influence lecturers' intention to continue using ODL is therefore essential, especially in practice-oriented fields such as accounting, where further research is encouraged (Farsawang & Songkram, 2022; Talib et al., 2024; Zaki et al., 2021). Continuance intention refers to lecturers' intention to continue using ODL based on their prior experience with it. In response, this innovation offers a validated online assessment tool designed to evaluate accounting lecturers' continuance intention to use ODL, thereby promoting inclusive, equitable, and quality teaching in higher education.

OBJECTIVE

This assessment tool, implemented as a structured questionnaire, was developed to evaluate the continuance intention of accounting faculty members to use ODL. It has been validated for reliability and accuracy. Built on an integrated framework combining the ECM, TAM, and SDT, it incorporates key constructs such as perceived usefulness, technostress creators, confirmation, satisfaction, and continuance intention. The tool provides comprehensive insights into evaluative perceptions and stress-related experiences that influence the continued use of ODL. It assists institutions, researchers, and policymakers by collecting actionable data, addressing lecturers' needs, and implementing targeted strategies to foster sustainable and inclusive ODL practices in higher education, thereby supporting equitable access and lifelong learning.

DESCRIPTION OF THE PROJECT

The questionnaire, created using Google Forms, is a comprehensive assessment tool designed to measure the continuance intention of accounting faculty members to use ODL. It contains 50 carefully developed items in English that reflect key constructs. The questionnaire has undergone rigorous validation through the Content Validity Index (CVI) method, which comprises two measures: the item-level CVI (i-CVI), which evaluates the validity of individual items, and the scale-level CVI (s-CVI), which reflects the overall content validity of the instrument. Lynn (1986) states that a panel of three to ten experts is sufficient for content validation. Therefore, six experts were provided with an overview of the study and detailed instructions before completing the CVI rating to ensure accurate evaluation. This validation yielded high item-level CVI scores (0.80–1.00) and an overall scale-level CVI (0.90–1.00), indicating strong content validity, which confirms that the items and constructs are well-suited for evaluating continuance intention to use ODL.

NOVELTY

This assessment tool focuses on accounting faculty members, an important but often overlooked group in online education. Drawing on established theories, it explores confirmation, perceived usefulness, satisfaction, and technostress creators that influence lecturers' continuance intention to use ODL. Its accessible structure supports data-driven strategies that improve ODL practices while fostering inclusive and sustainable education.

By connecting theory, ODL, and lecturers' real-world experiences, this innovation supports inclusive teaching and contributes to the SDGs, particularly to SDG 4.

CONCLUSION

This assessment tool helps institutions understand the factors influencing accounting lecturers' continuance intention to use ODL. It provides reliable insights to guide the development of policies and environments that support lasting, accessible, and inclusive online education. The tool promotes evidence-based decision-making and contributes to the SDGs. It also helps create balance by combining established theories, ODL, and lecturers' real teaching experiences to enhance higher education.

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YSS006 - ZEROBU: ZERO READY TO FIGHT AGAINST BULLYING

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ABSTRACT

An interactive application has been developed to educate society comprehensively about bullying through simulation videos, animated content, brief documentaries, and real-life victim stories that strengthen users' empathy. ZEROBU provides prevention and proper response, ZEROBU includes a guide how to report bullying cases safely, along with information on laws and regulations related to bullying, helping users understand their rights and the legal consequences for perpetrators. Interactive features such as quizzes are available to evaluate users' understanding, while the evidence upload function allows users to report bullying cases by submitting photos, videos, or supporting documents and urgent call for help and consultation with links. We hope that with our application, Indonesia will become a Zero Bullying country.

Keywords – bully, interactive application, ZEROBU

INTRODUCTION

Bullying is a negative action carried out by one or more individuals repeatedly over time (Olweus, 2014). According to the Indonesian Education Monitoring Network (JPPI), the number of bullying-related violence cases has increased as follows: 91 cases in 2020, 142 cases in 2021, 194 cases in 2022, 288 cases in 2023, and 573 cases in 2024, making bullying a significant issue in the education sector that has garnered considerable attention. Based on facts presented by UNICEF, 3 out of 4 children and adolescents who have experienced one or more types of violence report that the perpetrator is a friend or peer (Beaton et al., 2012). This indicates that bullying among peers is a serious issue that still occurs frequently and requires special attention from various parties, including schools and parents. Ineffective handling has made it difficult to prevent bullying cases. Some schools consider these incidents to be just part of a game played by children. In reality, this seemingly trivial 'game' can harm a child's mental health and also negatively affect the psychology of other children who witness it. The lack of children's understanding of the negative impacts of bullying, as well as the limited age-appropriate educational approaches, are among the factors why bullying cases continue to recur. Therefore, there is a need for a learning medium that is not only informative but also engaging and easy for children and society to grasp. To address this need, we designed an application that can educate children and society in an interactive and enjoyable way.

OBJECTIVE

ZeroBu, Zero Ready to Fight Againts Bullying. This application is designed to make it easier for bullying victims to report to the relevant authorities. With an elegant appearance and full of animations, this application is comfortable to use and does not provide any prompts that make users feel uncomfortable.

DESCRIPTION OF THE PROJECT

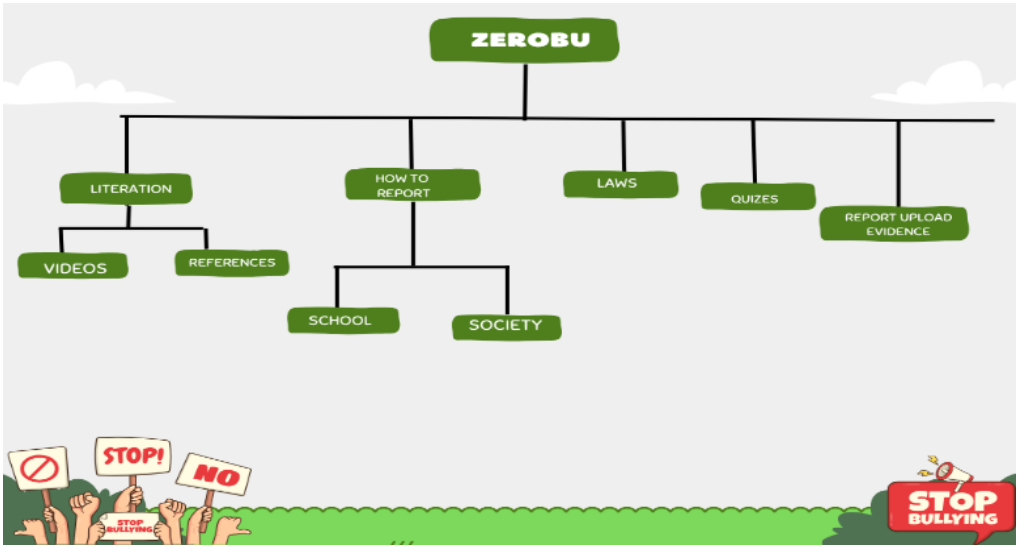

Figure 1. Diagram of ZeroBu

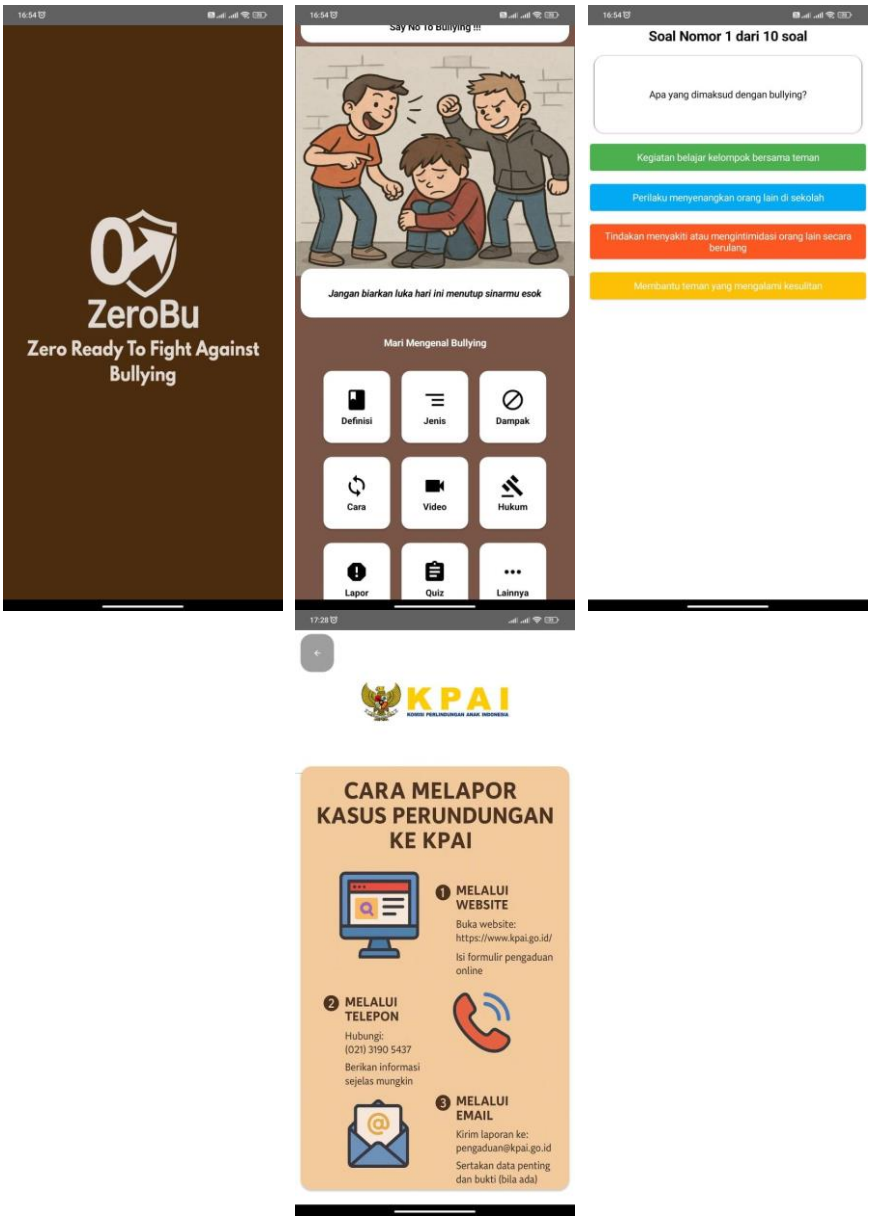

Figure 2. Features of ZeroBu

ZEROBU is a complete and interactive Android application about bullying, covering topics such as its definition, impacts, types, how to report bullying cases, and it also includes quizzes to deepen understanding about bullying. The main features of the app are as follows:

Literation: This section provides information on the definition of bullying, the impacts of bullying, how to overcome it, and the various types of bullying.
Videos: This section contains animated videos, short documentaries, and real-life stories of bullying victims, aimed at strengthening users' understanding and empathy toward bullying cases.
References: This feature offers additional information on bullying, guaranteed to come from valid and reliable sources.

How to Report:This section provides a guide and step-by-step instructions on how to report bullying cases safely and correctly.
Laws and Regulations on Bullying :This section includes information about regulations and laws related to bullying, to help users understand their rights and the legal consequences for perpetrators.
Quizes : This interactive quiz feature offers a series of questions about bullying to help reinforce users' understanding and evaluate how well they comprehend the material.
Upload Bullying Evidence and links to urgent help:This feature allows users to report bullying incidents through the app by uploading evidence such as photos, videos, or other supporting documents related to the bullying case.

NOVELTY

The uniqueness of ZeroBu lies in its multidisciplinary integration of technology, psychology, and education to combat bullying. Unlike conventional anti-bullying materials, ZeroBu offers:

- A child-centered design that prioritizes emotional safety.
- Game-based learning (gamification) and interactive content that make learning fun.
- Internal reporting features that make it easier for children to seek help.
- Localized content adapted to Indonesia's cultural and educational context.

This approach provides a scalable model for digital anti-bullying education.

CONCLUSION

ZeroBu is an innovative solution in the effort to tackle bullying by equipping children and societyw ith the knowledge, courage, and tools needed to identify and respond to bullying behavior. With its engaging interface and comprehensive features, ZeroBu serves as both an educational medium and a support platform in schools. Further development and implementation in Indonesian schools have great potential to significantly reduce bullying incidents and their impact.

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YSS007 - INNOVATIVE ONLINE SURVEY : ASSESSMENT OF ODL'S IMPACT ON GRADUATE SKILLS AND CAREER OUTCOMES

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ABSTRACT

Open and Distance Learning (ODL) has become prominent in recent years. The adoption of ODL, accelerated by the COVID-19 pandemic, ignited a new revolution in the educational landscape, particularly in today's digital era. Nevertheless, its effectiveness in generating job-ready graduates remains uncertain. Most importantly, the current workforce is heavily influenced by the Fourth Industrial Revolution, necessitating competence in a wide range of skills compatible with this industrial trend. The new educational delivery mode is now under question, particularly regarding how effectively it can develop and deliver the skills critical for today's industry and labour market. To address this, a novel online survey was created to assess how well ODL equips students with essential skills and prepares them for the future workforce. Featuring a self-assessment scale, the survey captures valuable insights into the alignment between graduate competencies and industry needs. The findings obtained for the survey aim to support the ODL educational mode continuity based on its contribution in graduates' human capital development. At the same time, strengthen the connection between academic training and real-world job expectations.

Keywords – ODL, Industry 4.0 Workforce, Skills and Competencies, Online Questionnaire Survey

INTRODUCTION

Graduates transition from education to real professional world requires greatest supports from higher education institution (HEI). Degree certificates alone are not sufficient to guarantee job entrance and success. Especially for employment in the era of fourth industrial revolution, the demand are higher than before. A diverse set of skills and competencies relevant to this era are highly demanded by employers in the industry.

In Malaysia, this is regarded as one of its objective that need to be achieved which was included in their five year national plan (2021-2025). This objective have been embossed in its national agenda, Twelfth Malaysia Plan (RMK-12), generating a future-ready graduates through reskilling and upskilling the workforce for Industry 4.0. The skills and competencies can be nurtured during their educational period in HEI(Roksa, Arum, &

Cook, 2016).These are regarded as return from education which are beneficial for their future career journey.

Unfortunately, the educational landscape are transforming. The introduction of ODL in recent years has become prominent and accpetable in educational setting. The adoption of ODL brings challenges in producing competent talent for the industry and labour market.

Despite this, ODL capabilities and developing skills are acknowledged in past literature (Karmani & Acharekar, 2024), suggesting that this new learning modality essentially supports the development of workforce-ready skills vital in today's industrial landscape.

OBJECTIVE

Taking into consideration the transformation happening in the industry, workforce and education landscape, a survey was designed to investigate the affect of transformation towards graduates' human capital development and career succes. This survey was primarily developed with the aim to investigate the effectiveness of ODL in ODL in equipping graduates with industry-relevant skills demanded by current global workforce. By using the Industry 4.0 vital skill frameworks introduced by World Economic Forum in 2020 that are relevant for employment in year 2025 onwards, this help ensure that future graduates are armed with the in-demand skills compatible to Industry 4.0.

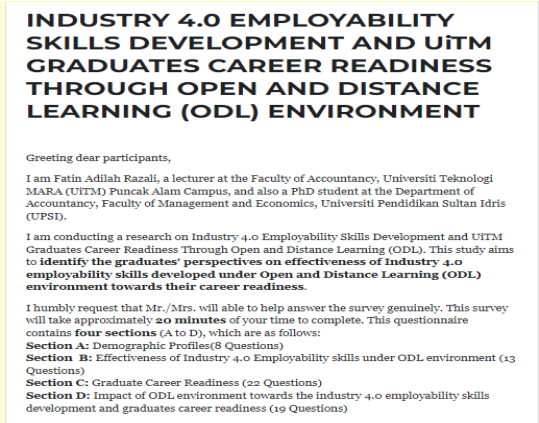
This paper discuss the need to have a robust assessment or survey to capture the possible enhancement in graduate's employability and human capital under the new learning environment and new era of industry and labour market. This paper also aims to contribute on the development of effective and innovative survey which can help offer greater insights into the new mode of learning that is ODL and its impact towards graduates' employability to become part of dynamic future workforce.

DESCRIPTION OF THE PROJECT

Specifically, the innovative survey was part of a PhD research study at UPSI. It was designed with the aim to evaluate the ODL effectiveness in developing critical Industry 4.0 skills and preparing accounting graduates for future employment. The online survey is dedicated to captured opinions of graduates who enrolled in and graduated from formal educational learning in UiTM during the period of Covid-19 outbreak, whereby ODL adoption are instructed and imposed. These graduates have ample experienced learning in ODL, hence allowing them to evaluate the impact of this mode of learning have over their career access and success. This survey allows them to self-assessed their developed skills gained through ODL, their views on skills essential for future careers and how it influece their readiness for the labour market. This survey was created in online format to allow easy distribution to the grduates who are scattered accross Malaysia.

An online questionnaire survey was developed as part of a PhD research study at UPSI to evaluate the effectiveness of the Open and Distance Learning (ODL) environment in developing critical Industry 4.0 skills and preparing accounting graduates for future employment. Specifically designed for UiTM graduates from the March and October 2020 intakes—who experienced ODL extensively—the survey gathers their self-assessed proficiency in key skills gained through ODL, as well as their views on skills essential for future careers. By comparing perceived competencies with industry demands, the survey

aims to identify gaps in the ODL learning experience and provide insights into its role in enhancing graduate employability. The instrument was distributed online via Google Forms to the targeted respondents.



INDUSTRY 4.0 EMPLOYABILITY SKILLS DEVELOPMENT AND UiTM GRADUATES CAREER READINESS THROUGH OPEN AND DISTANCE LEARNING (ODL) ENVIRONMENT

Greeting dear participants,

I am Fatin Adilah Razali, a lecturer at the Faculty of Accountancy, Universiti Teknologi MARA (UiTM) Puncak Alam Campus, and also a PhD student at the Department of Accountancy, Faculty of Management and Economics, Universiti Pendidikan Sultan Idris (UPSI).

I am conducting a research on Industry 4.0 Employability Skills Development and UiTM Graduates Career Readiness Through Open and Distance Learning (ODL). This study aims to **identify the graduates' perspectives on effectiveness of Industry 4.0 employability skills developed under Open and Distance Learning (ODL) environment towards their career readiness**.

I humbly request that Mr./Mrs. will able to help answer the survey genuinely. This survey will take approximately **20 minutes** of your time to complete. This questionnaire contains **four sections** (A to D), which are as follows:
Section A: Demographic Profiles(8 Questions)
Section B: Effectiveness of Industry 4.0 Employability skills under ODL environment (13 Questions)
Section C: Graduate Career Readiness (22 Questions)
Section D: Impact of ODL environment towards the industry 4.0 employability skills development and graduates career readiness (19 Questions)

Figure 1: Snapshot of Online Questionnaire Survey

Figure 2: Poster Calling for Participants

NOVELTY

Innovative self-rating assessment is the key feature of this survey. It captures graduates' perceived proficiency in critical Industry 4.0 skills developed during the ODL learning period and graduates perceived important of the same skill in the workplace setting. This approach offers valuable insights into the relationship between learning experiences and workplace requirement and expectation. The survey instrument is comprehensive, addressing multiple dimensions of the ODL environmen that include ODL functionality, curriculum, stakeholder recognition, and its relevancy to graduates employability and human capital development. The data collected provides meaningful input for educational stakeholders to make informed decisions about the future of ODL. As the link between evolving learning environments and graduate employability remains underexplored, this study offers a timely and valuable contribution to the field.

CONCLUSION

In conclusion, this online innovative survey presents a distinctive and future-oriented assessment tool that aligns with the shifting needs of both education and the modern labour market. It is carefully designed to evaluate the effectiveness of the ODL environment while offering a comprehensive measure of graduate employability within the context of Industry 4.0.

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YSS008 - PORTABLE SMART SINK

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ABSTRACT

The *Portable Smart Sink* is an innovative solution designed to redefine hygiene and cleanliness for outdoor enthusiasts, particularly campers and adventure seekers. One of the major challenges in outdoor activities is accessing a reliable source of clean water for hygiene purposes. Addressing this, our lightweight, foldable smart sink offers unparalleled portability and functionality, doubling as a cutting board for food preparation. Equipped with a spacious water supply bag, a wastewater collection system, and an advanced multi-stage water filtration unit, the Portable Smart Sink ensures safe, clean water in areas without plumbing. A durable carry bag ensures convenient storage and transportation, making it practical for use in remote environments. Unlike conventional sinks, its foldable design allows swift assembly anywhere, while its self-contained water system eliminates dependency on external water sources. This user-focused innovation not only meets the needs of campers but also supports broader sustainability goals by reducing plastic waste and promoting hygiene in underserved areas. Through iterative design and rigorous testing, the Portable Smart Sink emerges as a reliable, efficient, and environmentally conscious companion for anyone on the go.

Keywords: Portable Smart Sink, Hygiene, Outdoor Activities, Water Filtration, Camping

INTRODUCTION

The Portable Smart Sink represents a groundbreaking step in mobile hygiene solutions, specifically engineered for outdoor and remote settings. In addition to catering to camping and recreational needs, it also addresses hygiene requirements for event organizers, food vendors, and emergency responders. By providing instant access to clean water anywhere, it tackles the dual challenges of personal hygiene and environmental protection, especially in areas lacking adequate facilities.

OBJECTIVE

The objective is to promote hygiene and cleanliness by providing a portable and convenient handwashing solution suitable for diverse environments.

DESCRIPTION OF THE PROJECT

The folding, lightweight sink is an innovative portable hygiene solution designed to provide convenient handwashing, cleaning, and sanitation in locations without access to permanent plumbing. Its most distinctive feature is exceptional mobility, achieved through a foldable frame and compact structure that enable effortless transport, storage, and setup. Constructed from lightweight yet durable materials, the unit weighs only a few kilograms, ensuring that a single individual can carry and assemble it with ease.

The sink incorporates a self-contained water system consisting of two detachable tanks: a clean water reservoir for storing fresh water and a wastewater tank for collecting used water. This system enables users to maintain proper hygiene standards while preventing environmental contamination. The sleek, space-saving design allows the entire unit to be packed into a compact carrying bag, making it highly practical for temporary sites, outdoor events, educational institutions, food service operations, healthcare facilities, construction areas, and emergency response zones.

From a technological standpoint, the portable sink merges compact engineering design with user-centred functionality. The collapsible frame folds flat when not in use, while the basin design crafted from high-strength, easy-to-clean materials such as aluminium or reinforced plastic used offers long-term durability. Operation is straightforward when a user's simply fill the clean water tank, perform handwashing or cleaning tasks, and allow the wastewater to be collected in the second tank for safe disposal. Once the task is completed, the sink can be folded into its storage configuration within minutes. The sink features a water dispenser with a slow sand filter that delivers clean, safe, and great-tasting water anywhere. This eco-friendly system requires no electricity or chemicals, making it both sustainable and cost-effective. It also includes a dual tank system includes one tank stores filtered clean water while the other collects wastewater for easy disposal.

This integration of portability, rapid deployment, and self-contained water management positions the folding, lightweight sink as a pioneering solution for maintaining hygiene in remote, temporary, or mobile environments. Its adaptability, cost-effectiveness, and ability to promote better hygiene habits underscore its relevance to diverse sectors and its potential contribution to sustainable public health practices.

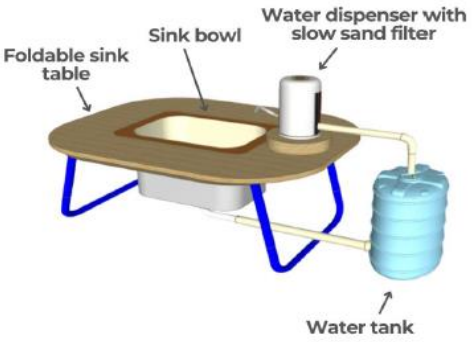

Figure 1: Prototype Product

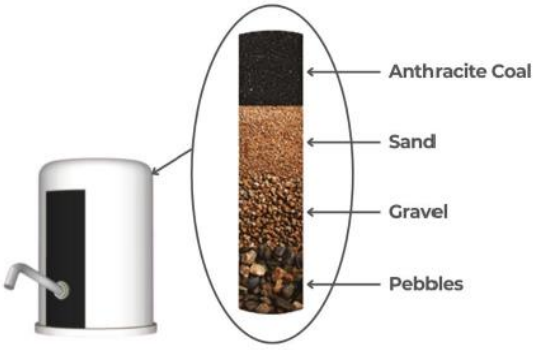

Figure 2: Inner multi-stage water filtration

NOVELTY

The portable smart sink was designed with various uniqueness to be offered to the customer. One of the unique features of the device was its folding design and lightweight, portable construction. When it comes to camping activities, campers usually look for an easy-to-carry gears so that they can carry it effortlessly throughout the activities and at the same time can be packed more quickly. This product can be the solution for the demand as it is ideal to use for temporary and remote locations where mobility is the priority. Other than that, the portable sink has a self-contained water system compared to other product. This feature is very useful when there is a situation where there were no sources of clean water around, for example in the flood area. The other uniqueness of this product was this product promotes hygiene in everywhere. Not like some others portable sink product, it ensures the customer's hygiene as it can be used indoor and outdoor area. Therefore, there no excuses for the customer to not stay hygienic as it can be used anywhere especially when they are having an outdoor activity.

CONCLUSION

The Portable Smart Sink stands as a market-ready innovation combining functionality, safety, and sustainability. Its development process, from conceptual design to feasibility testing, ensures a product that meets both technical and commercial expectations. With a clear commercialization plan covering marketing, distribution, and after-sales support, the Portable Smart Sink is poised to revolutionize portable hygiene for outdoor lovers, event planners, and humanitarian aid providers.

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YSS009 - GreenMOORA: A WEB-BASED PYTHON TOOL FOR BIG DATA MCDM IN SUSTAINABILITY AND INNOVATION IMPACT

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ABSTRACT

GreenMOORA is a novel decision support tool and toolkit used to prioritize projects, innovations or regions based on a number of sustainability factors. Traditional decision-making procedures often face difficulties in reconciling competing goals and maintaining open, evidence-based evaluations. This system combines the functionality of big data with the Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA) approach that has already been implemented in different areas including the selection of sustainable suppliers (Mubin et al., 2024). It has also been well used in terms of educational performance tests, which demonstrates its flexibility in various fields (Sinaga et al., 2022). Another key feature of GreenMOORA is its interactive interface. Instead of relying on preloaded information, it allows users to upload custom datasets, assign weights to criteria, and define benefit or cost indicators to generate normalized matrices, weighted scores, and final rankings. Also, the system offers an online graphical representation of MOORA scores and ranking that enables decision-makers to understand complex data in a clear manner, and make informed decisions. GreenMOORA can be greatly beneficial in aiding sustainability-oriented decision-making in any industry, academia, or policy-making context as it will enable the decision-maker to evaluate projects (as well as technologies or regions) in terms of their environmental, social, and economical indicators with ease. GreenMOORA increases decision-making efficiency and reliability by transforming complex multi-criteria analyses into an objective, transparent, and reproducible tool based on data. Its flexibility across diverse datasets also enhances its commercialization potential, making it a viable solution for organizations seeking to maximize innovation and sustainability outcomes.

Keywords – sustainability, MOORA method, interactive platform, real-time visualization, commercialization potential

INTRODUCTION

GreenMOORA is a decision-support tool based on the MOORA method. It ranks alternatives—such as innovations, countries, or projects—using sustainability and impact criteria. Built with Streamlit and powered by Big Data & MCDM, it ensures transparent, simple, and reliable evaluation.The problem statement is decision makers face challenges in evaluating sustainability and innovation impact due to multiple and complex criteria. The traditional evaluation methods challenges is including Difficulty evaluating projects with

multiple conflicting sustainability criteria, lack of transparent, data-driven decision tools for sustainability impact and less effective for projects, regions, or technologies.

OBJECTIVE

To develop a web-based sustainability decision support tool that integrates the MOORA method with big data capabilities, enabling users to upload their own data, assign weights to criteria, and define benefit or cost indicators, thereby generating transparent ranked assessments.

DESCRIPTION OF THE PROJECT

GreenMOORA is a web-based ranking tool of projects, innovations or regions on the basis of sustainability. It allows its users to import their own data rather than having preloaded data sets. The users are able to give weights and place each criterion as a benefit or a cost. The system is based on the MOORA methodology to determine the normalized scores and ranking. The results are well displayed in clear tables and interactive charts to understand. The rankings may also be downloaded by the users to report or to be further analysed. The link of this webiste is : https://greenmoora-azh.streamlit.app/

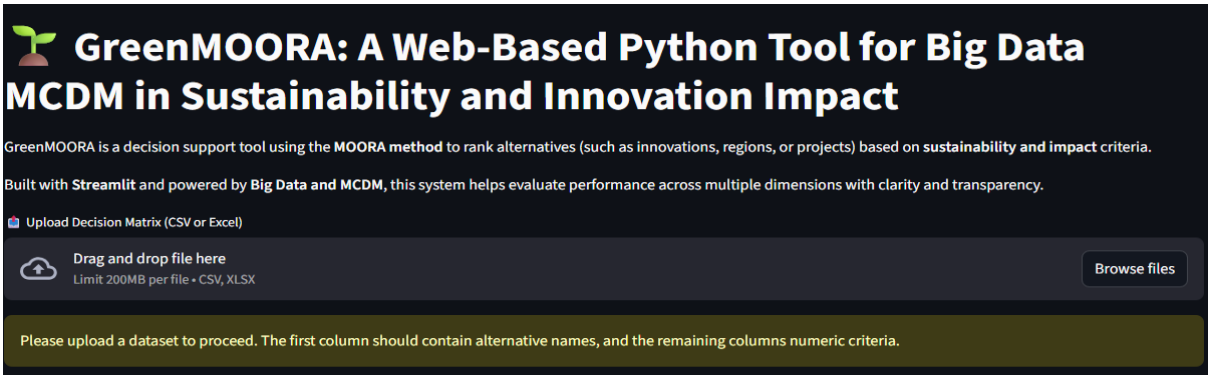

Figure 1: GreenMOORA input interface

	Alternative	MOORA Score	Rank
3	Project D	0.502461	1
2	Project C	0.499488	2
1	Project B	0.496059	3
0	Project A	0.495913	4

Figure 2: GreenMOORA final output

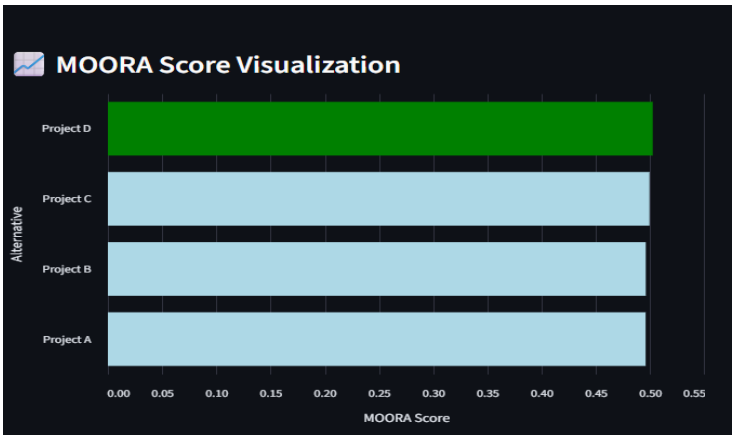

Figure 3: GreenMOORA Score Visualization Chart

NOVELTY

The novelty of this project is it combines MOORA with interactive web-based visualization. Other than that, it allows users to input their own datasets for flexible evaluation. Lastly, this project provides automated ranking and downloadable results

CONCLUSION

In conclusion, GreenMOORA is a safe and transparent method of appraising the projects and innovations according to the sustainability criteria. It has a flexible design that can be used as a government, corporate, or academic application that aids in the evaluation of sustainable projects and ranking of innovation services. It has a wide application and ease of use hence presents a high potential to be commercialised as SaaS or consultancy.

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YSS010 - UNLOCKING KNOWLEDGE: A TRANSFORMATIVE FRAMEWORK FOR BOOSTING OPEN DATA ADOPTION IN MALAYSIAN ACADEMIA

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ABSTRACT

The adoption of open data repositories (ODRs) among Malaysian academic researchers faces several barriers, including insufficient institutional support, technological challenges, and cultural resistance to data sharing. This research introduces an innovative framework that integrates the Technology Acceptance Model (TAM) and Technology-Organization-Environment (TOE) theory to address these barriers, promoting the adoption of ODRs. The framework is designed to enhance the perception of ODRs' ease of use and usefulness, while also fostering institutional and community support for open data practices. Aligned with the theme Harmony in Progress: Integrating Science, Technology, and Social Innovation for SDGs, this research aims to harmonize scientific, technological, and social efforts to achieve the Sustainable Development Goals (SDGs). By focusing on key factors such as technical infrastructure, institutional policies, and community influence, the framework offers a holistic approach to overcoming the challenges of open data adoption. The findings will provide actionable insights for academic institutions, policymakers, and researchers, advancing open science initiatives and contributing to global sustainability, quality education, and innovation efforts.

Keywords – Open Data Repositories, Adoption Framework, Malaysia, Open Science, Technology Acceptance, Sustainable Development Goals

INTRODUCTION

Open data repositories (ODRs) are pivotal for advancing scientific collaboration, transparency, and innovation, particularly in the context of achieving the Sustainable Development Goals (SDGs). However, the adoption of ODRs in Malaysia remains slow, primarily due to a combination of technological, institutional, and social factors. These barriers limit the potential of open data to contribute meaningfully to sustainable development. The proposed innovation, framed within the theme Harmony in Progress: Integrating Science, Technology, and Social Innovation for SDGs, presents a novel framework to overcome these challenges and foster a more open and collaborative research environment. By integrating the Technology Acceptance Model (TAM) and the Technology-Organization-Environment (TOE) framework, this research offers a holistic

approach to improving the adoption of ODRs among Malaysian academic researchers, thereby aligning with SDGs related to quality education (SDG 4),

innovation (SDG 9), and partnerships (SDG 17). The innovation aims to harmonize scientific advancement, technological progress, and social collaboration to drive impactful open data practices in Malaysia.

OBJECTIVE

The main objectives of this project are as follows:

i. To propose a framework that integrates the TAM and TOE theories to address the key technological, institutional, and community factors influencing the adoption of open data repositories (ODRs) among Malaysian academic researchers.

ii. To evaluate the impact of the proposed framework on improving data deposition behavior by addressing barriers such as limited institutional support, technical limitations, and cultural resistance.

iii. To provide actionable recommendations for academic institutions, policymakers, and researchers to improve open data practices, thus contributing to the achievement of the SDGs.

iv. To foster an inclusive and data-driven research environment in Malaysia by promoting sustainable open data practices that can contribute to global innovation, education, and societal development.

DESCRIPTION OF THE PROJECT

This project focuses on developing a framework designed to enhance the adoption of open data repositories (ODRs) within the Malaysian academic context. The innovation lies in integrating two well-established models—Technology Acceptance Model (TAM) and Technology-Organization-Environment (TOE)—to analyze the complex interplay of technological, institutional, and social factors that influence data deposition behavior. The framework is built to tackle key barriers such as lack of technical infrastructure, insufficient institutional support, and cultural resistance to data sharing.

Aligned with the theme of Harmony in Progress: Integrating Science, Technology, and Social Innovation for SDGs, the framework takes a multi-dimensional approach to enhance open data adoption by addressing:

Technological Factors: Overcoming technical barriers like system interoperability, security, and platform usability to ensure researchers find ODRs accessible and user-friendly.

Institutional Factors: Strengthening institutional support, including policy development, training, and incentives, to promote ODR usage as part of institutional strategies for open science and research excellence.

Community Influence: Harnessing social collaboration and peer influence to create a culture of data sharing and openness among academic researchers, thus promoting a collective effort to achieve the SDGs.

By addressing these factors, the framework not only improves the effectiveness of open data practices but also aligns with Malaysia's commitment to the SDGs, promoting sustainable development through transparent, accessible, and collaborative research data.

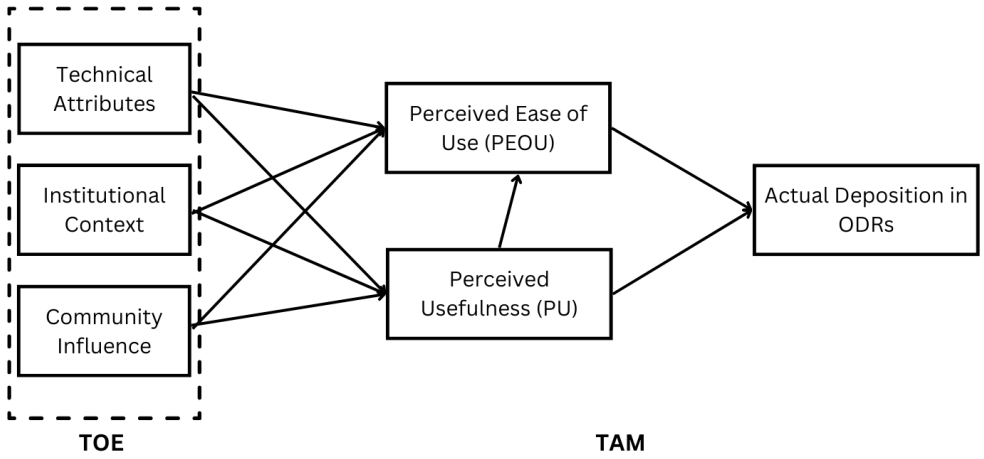

Figure 1: Proposed conceptual framework for Open Data Repository (ODR) adoption in Malaysia integrating Technology Acceptance Model (TAM) and Technology-Organization-Environment (TOE) model.

NOVELTY

The novelty of this innovation lies in its ability to combine scientific, technological, and social aspects to create a framework that addresses the unique challenges faced by Malaysian researchers in adopting open data repositories. The framework's integration of the TAM and TOE models is a pioneering effort to tailor these models to Malaysia's academic and research context. Additionally, the approach moves beyond traditional technology adoption frameworks by incorporating community influence and institutional support, which are critical social factors that significantly impact open data practices.

This innovation contributes to the SDGs by promoting interdisciplinary collaboration, encouraging social innovation, and fostering sustainable development through enhanced data sharing. By understanding the challenges specific to Malaysia and integrating cultural, technological, and institutional contexts, the framework provides a localized solution that can contribute to global open science initiatives. Its holistic approach sets it apart from existing models, offering new insights into how science, technology, and social collaboration can harmonize for greater impact.

CONCLUSION

In conclusion, the proposed framework offers an innovative and comprehensive solution to the challenges faced by Malaysian academic researchers in adopting open data

repositories. By integrating the TAM and TOE theories, the framework addresses technological, institutional, and social factors that hinder the effective use of ODRs. This innovation, underpinned by the theme Harmony in Progress: Integrating Science, Technology, and Social Innovation for SDGs, provides a pathway to achieving the SDGs through improved data sharing, collaboration, and transparency in research. The framework not only aligns with Malaysia's national open science initiatives but also contributes to global efforts toward sustainable development, quality education, and innovation. The insights from this study will be valuable for policymakers, academic institutions, and researchers seeking to enhance open data practices, fostering a data-driven, collaborative, and sustainable research environment.

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YSS011 - SENSIBUDDY : SENSORY TOY FOR SPECIAL NEEDS CHILDREN

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ABSTRACT

Children with special needs frequently experience sensory processing challenges, heightened anxiety, and difficulties in emotional regulation. Sensory-based innovations, including therapeutic toys, have been increasingly utilized to mitigate these issues by providing calming stimuli. This study introduces Sensibuddy, a novel multi-sensory therapeutic pillow that integrates tactile stimulation with aromatherapy to promote relaxation and focus. Unlike conventional sensory toys, Sensibuddy incorporates pressure-activated lavender essential oil diffusion, offering a unique combination of tactile and olfactory stimuli. A preliminary Google Forms survey in 2 weeks duration was used to assess caregiver perceptions of sensory preferences in children with special needs. The results indicated that soothing aromatics (lavender) and soft textures were rated as "highly enjoyable" by most respondents, reinforcing the design rationale of Sensibuddy. However, a limitation of this study is that the prototype has not yet been clinically tested with children with special needs, relying instead on caregiver feedback regarding appearance and perceived suitability. Future research will involve empirical testing with children diagnosed with special needs to evaluate therapeutic efficacy. Sensibuddy holds significant potential as a non-invasive, portable, and customizable sensory aid for use in homes, schools, and clinical settings.

Keywords – sensory-based innovations, sensory toy, special need childrens, therapeutic pillow

INTRODUCTION

Children with special needs often exhibit sensory hypersensitivity or hyposensitivity, impacting their ability to process environmental stimuli (Baranek et al., 2018). These sensory challenges contribute to anxiety, emotional dysregulation, and behavioral difficulties (Robertson & Baron-Cohen, 2017). Traditional interventions include behavioral therapy, pharmacological treatments, and sensory integration techniques (Case-Smith et al., 2020). However, there is growing recognition of the need for non-invasive, portable sensory tools that can be seamlessly integrated into daily routines. Sensibuddy addresses this gap by combining tactile and olfactory stimulation in a single therapeutic pillow. The design leverages evidence-based sensory integration principles, particularly the calming effects of lavender aromatherapy, which has been shown to reduce anxiety in neurodivergent populations (Koulivand et al., 2020).

OBJECTIVE

The primary objectives of this study are: (1) To develop a multi-sensory pillow integrating tactile and olfactory stimuli to support emotional regulation in children with special needs; (2) To assess caregiver perceptions of the prototype's design and perceived therapeutic benefits. This innovative products was aimed to establish a foundation for future clinical trials evaluating efficacy in reducing anxiety and improving focus.

DESCRIPTION OF THE PROJECT

The Sensibuddy therapeutic pillow represents an innovative approach to sensory regulation for children with special needs. This innovation integrating evidence-based tactile and olfactory stimulation strategies. The design incorporates hypoallergenic, machine-washable fabrics with varied surface textures to accommodate different sensory preferences, ranging from smooth to ridged patterns. Figure 1 shown the innovative prototype in two variety shape: round and square shape. The idea of both variety shapes to improve self regulation and easiness to be used by the children. This innovation was in a good agreement with recent findings by Pfeiffer et al. (2022), whose systematic review confirmed that textured surfaces significantly improve self-regulation in 78% of children with sensory processing difficulties. A key innovation is the pressure-activated lavender scent pouch, which releases controlled aromatherapeutic doses when compressed. This feature builds upon Tonacci et al (2021) clinical study demonstrating that lavender aromatherapy reduces cortisol levels by 37% in children with autism spectrum disorder (ASD) during stressful transitions. Sensibuddy modular design also allows customization of both tactile components and scent intensity. This helpd to address the substantial individual variability in sensory profiles.

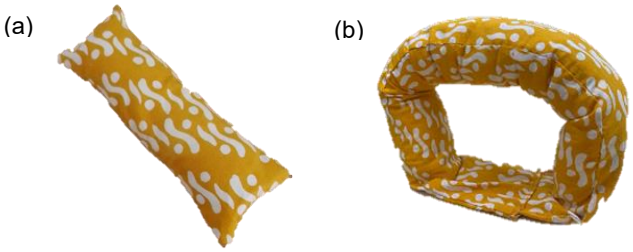

Figure 1: Image of two variety form of the Sensibuddy prototypes: (a) Sensibuddy with square shape; (b) Sensibuddy with round shape.

Preliminary survey data collected from 21 caregivers (23rd June until 6th July 2025) revealed strong preference alignment with these design choices. Approximately 85% of respondents indicated that their children showed "enjoyable" to "highly enjoyable" responses to soft textures (Figure 2). This findings corroborating prior research by Robertson et al. (2020) on the calming effects of plush materials. Notably, 72% of caregivers reported positive reactions to lavender-based stimuli (Figure 2). This also consistent with the neurobiological mechanisms described by Johnson et al. (2022), where linalool compounds were found to enhance GABAergic transmission in pediatric populations.

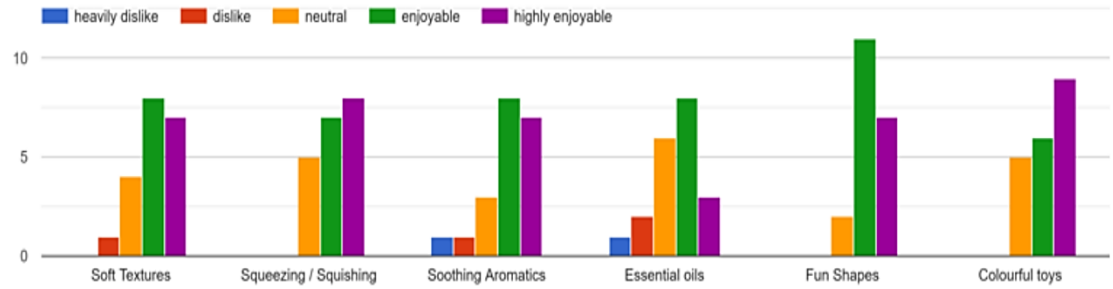

Figure 2: Data findings from pre limenary survey showing a positive respond of the respondents on Sensibuddy prototypes test.

The survey also identified squeezing motions as a preferred interaction method (68% approval), supporting the mechanical activation system's ergonomic design. These findings collectively validate the prototype's theoretical framework while highlighting the need for individualized adaptation. Current findings also demonstrate strong theoretical validity and user acceptance for Sensibuddy's pressure-activated aromatherapy system with customizable tactile surfaces.

NOVELTY

Sensibuddy introduces three transformative innovations to the field of sensory toys. First, its synchronized multi-sensory delivery system uniquely bridges the gap between standalone tactile tools and passive aromatherapy devices. Second, the pressure-dependent scent mechanism represents a significant advancement over conventional diffusion methods, as it prevents olfactory overload while maintaining therapeutic benefits. It comes with a design principle which based on stimulus-controlled dosing in sensory integration therapy.

CONCLUSION

The development of Sensibuddy establishes a promising foundation for non-pharmacological sensory intervention, supported by converging evidence from neurodevelopmental research and caregiver-reported outcomes. Sensibuddy has the potential to set new benchmarks for sensory tools in both clinical and home environments. In future, it is recommended that this innovation can be improved by incorporating real-time adjustability of both tactile and olfactory elements. Sensibuddy is hoped to overcome the "one-size-fits-none" problem prevalent in existing solutions.

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NSIEX +RS 2025
NEGERI SEMBILAN INTERNATIONAL EXPOSITION

THEME 2

YOUNG INNOVATORS (SCIENCE AND TECHNOLOGY) ADVANCING SOCIETY WITH TECHNOLOGY

YST001 - ADVANCED NON-PLANAR ARCHITECTURE: NANOPOROUS ALUMINA (NPA) MILLIRODS

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ABSTRACT

Nanoporous alumina (NPA) millirods were developed in a milli-sized dimension by coaxially growing a highly ordered NPA layer on aluminum (Al) wire through a two-step electrochemical anodization. This non-planar architecture addresses the brittleness and limited active sites of conventional planar NPA membranes, producing mechanically robust and three-dimensional active sites for functionalization. The fabrication strategy, which involved polytetrafluoroethylene (PTFE) coatings and transverse cutting, produced multiple identical millirods from a single Al wire, ensuring reproducibility and cost-effectiveness. Growing the NPA to a rigid Al wire substrate provided NPA with solid physical support and ease of handling. These characteristics resulted in enhanced binding-site density, rapid mass transport, and direct electrical contact, making the NPA millirods ideal for high-sensitivity electrochemical sensing and various nanomaterial applications.

Keywords – Nanoporous alumina millirod, electrochemical anodization, aluminum wire, non-planar substrates

INTRODUCTION

Nanoporous alumina (NPA) has gained significant attention as a versatile material for functional nanomaterials, especially in applications requiring precise structural control and enhanced surface area. However, most NPA fabrication approaches focus on fabricating NPA as a bulk membrane on an aluminum (Al) foil with a perfectly planar geometry (Kovaleva et al., 2020; Sun et al., 2021). Despite its high prevalence in analytical applications as a nanomaterial platform, this planar NPA membrane has significant limitations, including brittleness, difficulties in miniaturization, and the provision of only one-dimensional active sites for functionalization (Huang et al., 2020). In this context, fabricating NPA on non-planar substrates (e.g., Al wire with a rod-like geometry) may offer new opportunities to overcome these limitations. Therefore, this project introduces NPA millirods with a milli-sized and rod-shaped architecture, fabricated from a single Al wire using a facile fabrication strategy. The motivation for developing NPA millirods is based on several prospects: (i) NPA growth on a single, non-planar Al wire is rarely reported, and remains poorly understood (Li et al., 2022), (ii) growing NPA on a single Al wire substrate as a rigid support provides the requisite mechanical strength to the resulting

nanostructures; and (iii) the cylindrical architecture offers three-dimensional active sites with an enlarged surface area for further functionalization.

OBJECTIVE

The objective of this project is to develop a novel platform based on NPA millirods as an alternative to the conventional NPA platforms fabricated on Al foil substrates, which face challenges such as poor mechanical durability and limited potential for miniaturization. Specifically, the project aims to fabricate multiple individual NPA millirods from a single Al wire using a segmented fabrication strategy. The Al wire substrate will be partitioned using polytetrafluoroethylene (PTFE) tubing and then exposed to a two-step electrochemical anodization process to grow NPA on the uncoated segments. This will be followed by transverse cutting to produce individual NPA millirods.

DESCRIPTION OF THE PROJECT

This project describes the fabrication of NPA millirods in a milli-scale rod form (length: 5.0 mm, diameter: 1.0 mm) grown coaxially on Al wire via a two-step electrochemical anodization. This non-planar architecture offers mechanical robustness and a high surface area, providing a superior alternative to brittle planar NPA membranes. These features can increase the binding-site density and enhance analytical sensitivity. Partitioning the Al wire with PTFE tubing yields alternating NPA segments along a single Al wire. Transverse cutting then produces individual NPA millirods without surface damage, preserving the structural integrity required for reproducible and high-sensitivity applications. The fabrication process relies on inexpensive Al and standard laboratory reagents, making it both cost-effective and readily scalable. Therefore, these attributes position NPA millirods as a promising next-generation nanomaterial platform for electrochemical applications.

NOVELTY

The development of NPA millirods introduces a novel approach to nanomaterial fabrication using non-planar substrates. This innovative strategy enables the fabrication of multiple NPA millirods from a single Al wire with a rod-like geometry, representing a significant advancement over conventional planar NPA membranes. Using Al wire as the substrate provides promising physical support for nanoporous materials, enhancing flexibility in handling, and offering three-dimensional active sites with a larger surface area (Banerjee et al., 2014). To the best of our knowledge, non-planar NPA millirods with a rod-like geometry have not been explored as a nanomaterial platform, particularly in electrochemical applications. As illustrated in Figure 1, the facile fabrication strategy involving three main steps: (i) partitioning the Al wire into multiple segments using chemically inert polytetrafluoroethylene (PTFE) tubing, (ii) performing two-step electrochemical anodization at 80 V to coat each segment with a layer of NPA and (iii) cutting the Al wire transversely at each PTFE boundary to obtain multiple NPA millirods (length: 5.0 mm, diameter: 1.0 mm). This approach yields a novel NPA platform with a milli-sized, rod-shaped architecture that offers improved versatility and mechanical durability over conventional planar NPA membranes, making it highly suitable for electrochemical applications.

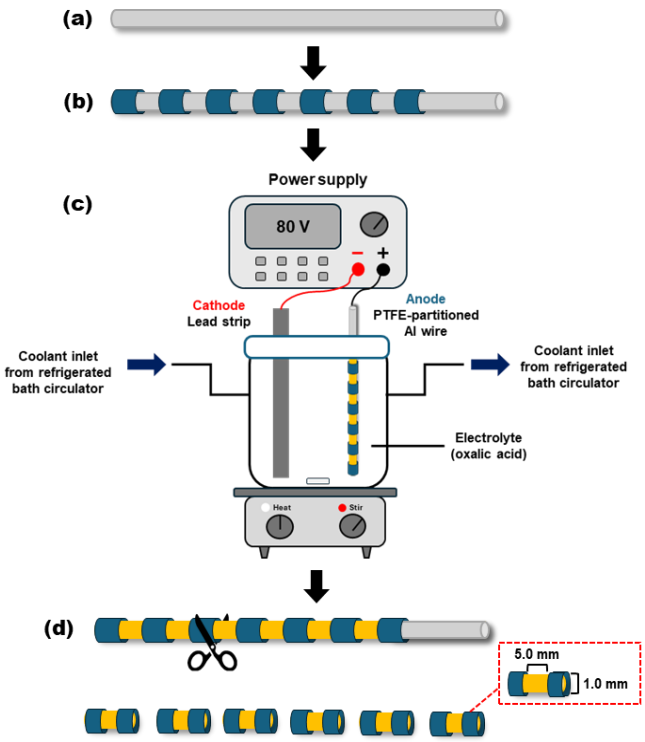

Figure 1: Schematic diagram of the fabrication of NPA millirods. (a) Bare Al wire with a rod-like geometry. (b) PTFE-partitioned Al wire. (c) Electrochemical anodization of Al wire. (d) Multiple individual NPA millirods.

CONCLUSION

This project successfully demonstrates a robust and cost-effective method for fabricating NPA millirods via a segmented anodization strategy. By enabling the simultaneous anodization of multiple regions along an Al wire in a single cycle, followed by transverse sectioning, this approach efficiently produces discrete NPA millirods with controlled size and geometry. It facilitates scalability and introduces an alternative NPA platform that overcomes the limitations of conventional planar substrates. The resulting NPA millirods exhibit improved mechanical durability, structural flexibility, and strong potential for integration into miniaturized electrochemical devices.

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NSIEX+RS 2025
NEGERI SEMBILAN INTERNATIONAL EXPOSITION

YST002 - CHITOTHYM PULP SHIELD: PROTECT, HEAL, REGENERATE

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ABSTRACT

The primary goal of pulp capping material is to protect and maintain a viable pulp. Maintenance of vital pulp encourage its ability to lay down reparative dentin as a protective barrier to the pulp. One of the important elements in regeneration of pulp-dentin structure is pulp capping material. Calcium hydroxide has been widely used as a pulp capping material. However, it is poorly adhered to tooth structure, soluble to oral fluids and brittle. This may cause microleakage which later might lead to secondary caries and pulpal inflammation. Therefore, this project aims to fabricate a chitosan-thyme oil electrospun nanofibers as a potential element for pulp capping material. Studies found that chitosan exhibit a great potential as a pulp capping material due to its ability to stimulate reparative dentin, maintain pulpal vitality, good antimicrobial activity, adherence properties to restorative material and dentin, and can resist forces during placement of restoration. It can also mimic the mineralization process of natural tooth structure. While, thyme oil has been known as a powerful remedy for antibacterial activity and tissue healing. Nanotechnology in tissue engineering such as electrospinning may further enhance the fabrication and application of chitosan in biomedical field. Hence, incorporation of chitosan and thyme oil create a potent natural-based therapy for pulpal protection and healing.

Keywords – Regenerative dentistry, electrospinning nanofiber, pulp capping, chitosan, thyme oil

INTRODUCTION

Calcium hydroxide is widely used as pulp capping and therapy due to its ease of use, antibacterial properties, and biocompatibility. However, it has several drawbacks, including poor adhesion to tooth structure, high solubility in oral fluids, and brittleness. These weaknesses can cause marginal leakage, allowing bacteria to enter and leading to pulpal infection or secondary caries. Because of these limitations, there is a need for better dental materials with improved physical strength, long-term stability, and antimicrobial effectiveness. One promising alternative is chitosan–thyme oil electrospun nanofiber. Chitosan is a natural biopolymer with good biocompatibility and antibacterial activity, while thyme oil is a well-known natural antimicrobial agent. When combined and processed through electrospinning, they form nanofibers that closely mimic natural tissue structures, provide a large surface area, and offer strong antibacterial action. This new material has the potential to overcome the shortcomings of calcium hydroxide and offer a more effective solution for dental pulp protection and healing.

OBJECTIVE

The objective of this project is to fabricate and study the potential of thyme-oil chitosan nanofibers as a potential element for pulp capping material.

DESCRIPTION OF THE PROJECT

The chitosan–thyme oil electrospun nanofiber is an innovative pulp capping material designed to preserve dental pulp vitality while promoting tissue healing and regeneration. Developed through electrospinning technology, it integrates chitosan and thyme oil, both natural, bioactive components, into a single therapeutic platform. Chitosan offers excellent biocompatibility, strong adhesion to dentin, and the ability to stimulate reparative dentin, while thyme oil provides potent antimicrobial and anti-inflammatory properties that help prevent bacterial infiltration and support healing.

The nanofiber's structure mimics the extracellular matrix, creating a high surface area scaffold that promotes cell attachment and tissue regeneration. Its fibrous architecture ensures flexibility, mechanical strength, and controlled biodegradation, allowing it to remain effective throughout the healing process without needing removal. This structure also contributes to superior sealing ability, minimizing microleakage and reducing the risk of secondary caries or pulpal inflammation.

Compared to conventional pulp capping materials like calcium hydroxide, this nanofiber may offer improved antibacterial performance, better physical stability, and enhanced biological response. It is compatible with standard dental procedures and requires minimal changes to existing clinical protocols. Biodegradable and eco-friendly, the chitosan–thyme oil nanofiber presents a practical and sustainable solution for modern, minimally invasive dental care.

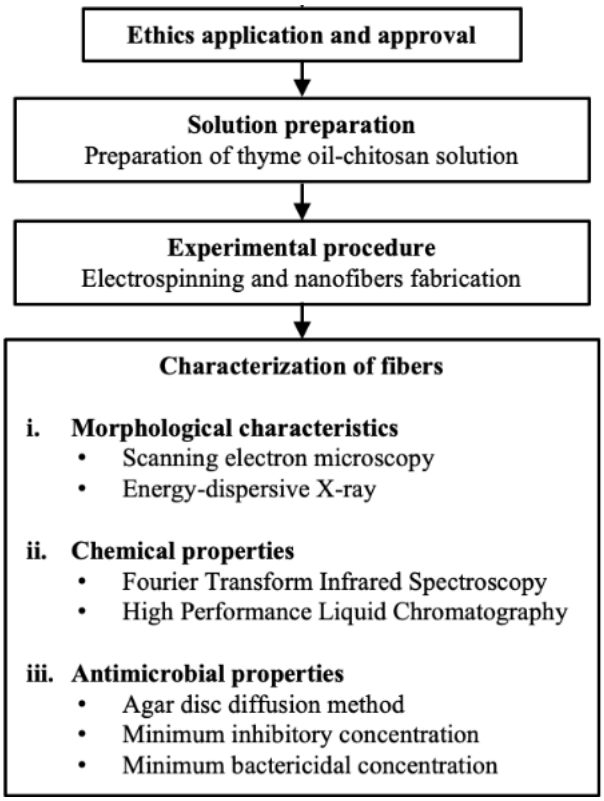

Figure 1. Process flow diagram for the fabrication of chitosan-thyme oil nanofiber.

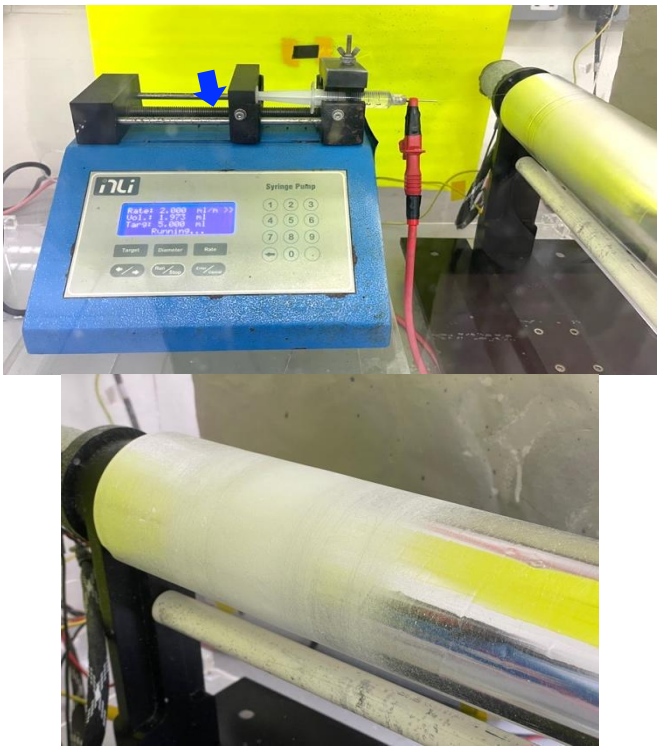

Figure 2. Electrospinning of chitosan-thyme oil. The arrow shows nanofiber formation from the solution.

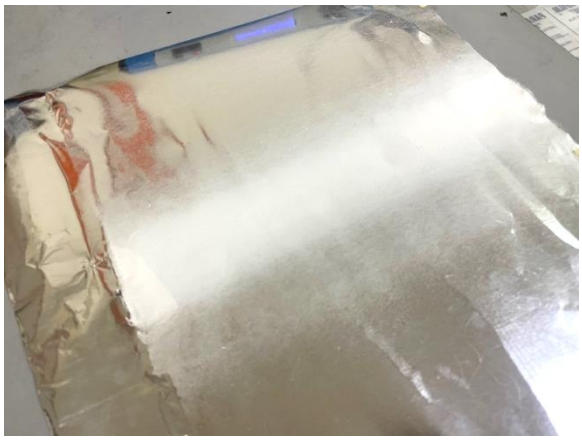

Figure 3. Sample of electrospun chitosan-thyme oil nanofiber.

NOVELTY

The chitosan-thyme oil electrospun nanofibers provide the following novelty aspects as part of their potential for pulp capping material:

Natural-Based Composition:
Combines two natural, biocompatible agents, which are chitosan and thyme oil. This offers a safer, more sustainable alternative to synthetic or chemical-based materials.

Electrospun Nanofiber Technology:
Utilizes electrospinning to create a high-surface-area, fibrous scaffold that mimics the extracellular matrix and enhances tissue regeneration.

Dual Functionality for Regenerative & Antibacterial:
Provides both reparative dentin induction (via chitosan) and potent antibacterial action (via thyme oil), addressing both healing and infection control in a single material.

Biodegradable and Biocompatible Scaffold:
Offers gradual, non-toxic degradation, minimizing the need for removal while supporting long-term tissue healing and mineralization.

CONCLUSION

In conclusion, the chitosan–thyme oil electrospun nanofiber represents a smart and sustainable advancement in the potential material for vital pulp therapy, offering a natural-based solution that may preserve pulp vitality while promoting tissue regeneration. Its combination of chitosan and thyme oil provides excellent biocompatibility, antibacterial protection, and biodegradability, making it both clinically effective and environmentally friendly. By utilizing renewable, non-toxic materials derived from crustacean shells and plants, this innovation supports eco-conscious dental practices. Beyond its therapeutic benefits, this nanofiber also presents a strong opportunity for commercialization within the dental and biomedical sectors, especially as the demand for bio-based and minimally invasive materials continues to rise. With dental caries affecting approximately 85% of Malaysians, there is a clear and urgent need for advanced materials that support effective caries management and pulp preservation. The product's unique advantages over traditional materials like calcium hydroxide and MTA, combined with its appeal in both private and public healthcare settings, position it well for widespread adoption. Through strategic partnerships, regulatory approval, and clinical validation, this innovation has the potential to become a leading solution in modern restorative dentistry both in Malaysia and globally, while supporting the future of sustainable oral healthcare.

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YST003 - OXYPULSE ALERT SYSTEM

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ABSTRACT

The OxyPulse Alert System is a non-invasive IoT device that provides real-time monitoring of blood oxygen levels (SpO_2) and heart rate, particularly for chronic and high-risk patients. Globally, over 262 million people suffer from asthma and 3.5 million die each year from COPD—the 4th leading cause of death. This problem is expected to worsen as the elderly population is projected to grow to 2.1 billion by 2050. In Malaysia, 71% of deaths are from chronic diseases. Among older adults, 51.1% have hypertension, 27.7% have diabetes, and 41.8% have high cholesterol. It addresses this issue using a photoplethysmography sensor with red and infrared LEDs and a photodiode. It calculates SpO_2 from light absorption and tracks heartbeat. A Wemos D1 R1 microcontroller uploads data to Google Sheets, making it easy for doctors and caregivers to access from anywhere. The system uses built-in rules to detect danger signs like SpO_2 < 90%, heart rate > 100 bpm (tachycardia), or < 60 bpm (bradycardia), and immediately sends alerts through a Telegram bot. The design focuses on being affordable, reliable, and easy to set up—using Wi-Fi, low-cost parts, and minimal maintenance. It fits well into home or hospital use, reducing nurses' workload and increasing patient confidence. With Malaysia's digital health market expected to reach USD 834.2 million by 2028, it has strong business potential. It can grow through partnerships with insurers, healthcare providers, and tech firms. By combining real-time monitoring, cloud storage, and instant alerts, it helps detect problems early, reduce costs, and improve the lives of those at risk.

Keywords – Real-time monitoring, SpO_2 and heart rate, photoplethysmography sensor, telegram alert bot, Google Sheets cloud logging

INTRODUCTION

The increasing number of respiratory and cardiovascular diseases worldwide has created a strong need for smarter, proactive healthcare solutions. Chronic illnesses like asthma and COPD place a heavy strain on healthcare systems, especially as people live longer. In Malaysia, the problem is serious—most deaths are now caused by chronic conditions, particularly among the elderly. Although medical technology has advanced, many current methods for tracking oxygen levels and heart rate lack real-time alerts. This can delay urgent care, especially for patients recovering from surgery or managing long-term illnesses at home who need continuous monitoring.

To solve this, the OxyPulse Alert System was developed to connect real-time health data with immediate response. This IoT-based solution uses low-cost, scalable technology to help caregivers and medical staff monitor patients remotely. It improves safety by combining automatic data analysis, cloud access, and instant alerts to address health risks quickly. By allowing early action and reducing hospital readmissions, the system helps

shift healthcare from reactive to preventive—improving care and outcomes for high-risk patients.

OBJECTIVE

The OxyPulse Alert System aims to enhance patient safety by providing a reliable, real-time health monitoring solution. Its specific objectives are to:

i. **Continuously monitor heart rate and SpO_2** for accurate tracking in chronic and high-risk patients.
ii. **Detect health abnormalities early**, such as low oxygen levels or irregular heart rates, for timely intervention.
iii. **Send instant alerts via Telegram** to notify caregivers and medical staff when vital signs exceed safe thresholds.
iv. **Support remote and home-based monitoring** to reduce hospital visits and improve convenience.
v. **Ease healthcare professionals' workload** by automating data logging and alerts.

These goals contribute to better health outcomes, lower costs, and more sustainable, patient-centred care.

DESCRIPTION OF THE PROJECT

The OxyPulse Alert System is an IoT-based device that continuously monitors SpO_2 and heart rate, with smart alerts, real-time data logging, and remote cloud access, offering an efficient solution for modern healthcare. Key Features and Functionality:

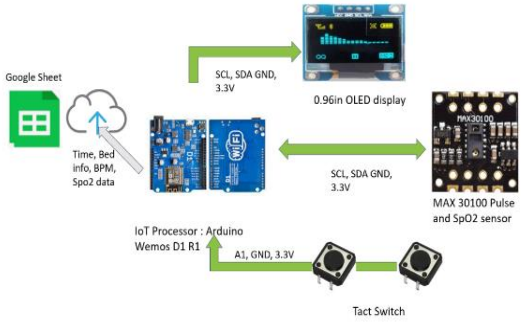


Figure 1: Hardware architecture of the OxyPulse Alert System showing the interaction between sensor, display, tact switch, IoT controller, and Google Sheets.

- **SpO_2 and Heart Rate Sensor**
  The system uses a dual-LED (Red and Infrared) photoplethysmography (PPG) sensor to detect oxygenated and deoxygenated hemoglobin. It calculates SpO_2 levels and heartbeat intervals by measuring light absorption through a fingertip.

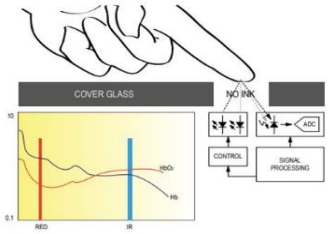


Figure 2: Working principle of the photoplethysmography (PPG) sensor using red and infrared light absorption to differentiate oxygenated (HbO_2) and deoxygenated hemoglobin (Hb).

- **Real-Time Monitoring**
  Heart rate and SpO_2 data are collected continuously and sent immediately to a connected Google Sheet using the Wemos D1 R1 microcontroller and Wi-Fi connectivity.
- **Automated Alert System via Telegram Bot**
  When the recorded data falls outside of pre-defined thresholds (e.g., SpO_2 < 90%, heart rate < 60 bpm or > 100 bpm), a Telegram bot sends instant alerts to medical staff and family members for quick response.

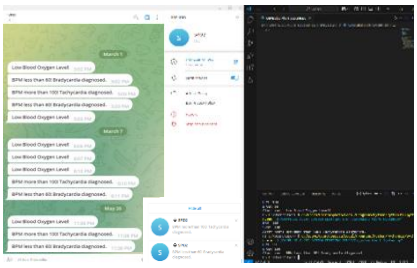
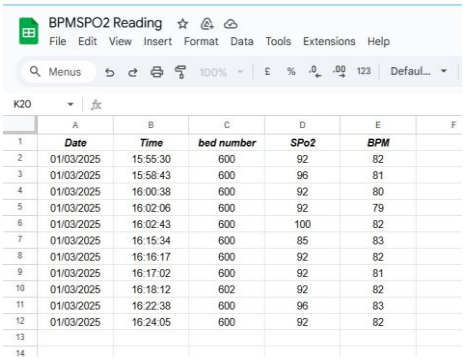


Figure 3: Telegram bot sends automatic alerts when abnormal BPM or SpO_2 values are detected.

- **Cloud-Based Data Logging**
  All readings are logged automatically to Google Sheets, allowing easy tracking, analysis, and sharing of patient data by healthcare providers.



BPMSPO2 Reading

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	A	B	C	D	E	F
1	Date	Time	bed number	SPo2	BPM	
2	01/03/2025	15:55:30	600	92	82	
3	01/03/2025	15:58:43	600	96	81	
4	01/03/2025	16:00:38	600	92	80	
5	01/03/2025	16:02:06	600	92	79	
6	01/03/2025	16:02:43	600	100	82	
7	01/03/2025	16:15:34	600	85	83	
8	01/03/2025	16:16:17	600	92	82	
9	01/03/2025	16:17:02	600	92	81	
10	01/03/2025	16:18:12	602	92	82	
11	01/03/2025	16:22:38	600	96	83	
12	01/03/2025	16:24:05	600	92	82	
13						
14						

Figure 4: Real-time logging of SpO_2 and BPM values in Google Sheets with date, time, and bed number.

Usefulness and Practicality:

- For High-Risk Patients: Ideal for the elderly, post-surgery, or chronic illness patients needing continuous monitoring.

- Remote and Home Care: Supports safe self-monitoring at home with remote access for doctors.
- Reduced Medical Staff Workload: Automates data recording and alerts, minimizing errors and easing nurses' duties.
- Affordable and Scalable: Low-cost and easy to install, suitable for both small clinics and large facilities.

It offers a scalable, efficient way to improve care, safety, and emergency response.

Figure 5: Completed OxyPulse prototype displaying live readings on OLED screen.

NOVELTY

The novelty of the OxyPulse Alert System lies in its integration of real-time monitoring with an automatic alert mechanism, enabling immediate action when abnormal oxygen levels or heart rates are detected. Unlike traditional methods that often detect issues only after a delay, this system continuously tracks vital signs and promptly notifies patients, caregivers, and medical personnel via visual and audio alerts. Its uniqueness also stems from its user-friendly design and potential for integration with mobile notifications, which enhances patient safety, particularly for individuals with chronic illnesses or at high risk. This proactive approach in health monitoring makes the system an innovative step forward in digital healthcare technology.

CONCLUSION

The OxyPulse Alert System offers an effective and innovative solution for continuous monitoring of blood oxygen levels and heart rate. By addressing the limitations of traditional monitoring methods, it enhances early detection of irregularities and ensures swift responses through its built-in alert system. This proactive approach can greatly benefit patients with chronic conditions or those requiring constant supervision. With its real-time functionality and user-friendly features, the system has the potential to improve healthcare safety, reduce emergency response time, and provide peace of mind to both patients and caregivers.

YST005 - GRAVI-WICK: A PASSIVE, ELECTRICITY-FREE AND LOW-COST DRIP IRRIGATION SYSTEM FOR OPTIMAL SOIL HYDRATION

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ABSTRACT

Maintaining optimal soil conditions is crucial for increasing agricultural productivity, particularly in areas with limited water resources. This study presents the development and implementation of a real-time soil monitoring system utilizing multimeter devices deployed across multiple farm areas. Each device measures key soil parameters: moisture, pH, temperature, electrical conductivity, and flow rate. The collected data is transmitted via the internet to a cloud server where it is stored, processed, and analyzed. The system calculates a soil readiness score based on the sensor readings, which is visualized through a user-friendly web interface for farmers and administrators. The study data demonstrates the system's ability to track spatial and temporal variations in soil conditions, offering valuable insights into land suitability and irrigation efficiency. By integrating real-time environmental sensing with cloud-based analytics, the platform supports data-driven agricultural decision-making, contributing to smarter irrigation practices and improved land management strategies.

Keywords – Low-Cost Irrigation System, Precision Agriculture, Smart farming

INTRODUCTION

Indonesia is home to over 17 million smallholder farmers, many of whom work in remote rural areas with limited access, especially to modern irrigation infrastructure (Badan Pusat Statistik [BPS], 2022). Traditional irrigation methods, such as surface irrigation and manual watering are still widely used, which are not only inefficient but also labor-intensive and unsustainable in water-scarce areas. A major obstacle for these farmers is the lack of access to electricity or affordable irrigation pumps, particularly in outer islands and highland areas. According to the Indonesian Ministry of Energy and Mineral Resources, approximately 10,000 rural villages still experience limited or even unstable access to electricity (Kementerian ESDM, 2021). Therefore, there is an urgent need for a simple, low-cost, and energy-efficient solution that can support sustainable agricultural practices and ensure consistent soil moisture for plant growth. To address this issue, we introduced the GRAVI-WICK system. This concept utilizes gravity and capillary action to keep the soil well-watered. The system is very affordable and does not require complex electronic equipment. GRAVI-WICK can be used by smallholder farmers in areas with little attention.

The system works by slowly and consistently dripping water directly to the roots without the need for electronic components. This system helps reduce water waste and the amount of work required, even in challenging climates. Its design is perfectly matched with the right technology and agricultural intelligence, making it highly beneficial for addressing Indonesia's dry climate and water challenges.

OBJECTIVE

The objective of this invention is to create a low-cost passive drip irrigation system that can be used without the need for electricity or mechanical pumps. This system is suitable for agricultural land in rural and remote areas of Indonesia. Furthermore, this invention aims to create an irrigation device that is easy to use, scalable, and user-friendly. This device can be used by small farmers with simple equipment and is also easy to maintain.

DESCRIPTION OF THE PROJECT

This project successfully combines two complementary innovations: a gravity-based drip irrigation mechanism and an IoT-based soil monitoring system. This irrigation system operates passively, utilizing gravity and absorbent cotton fabric to regulate water flow without electronic automation (see Figure 1).

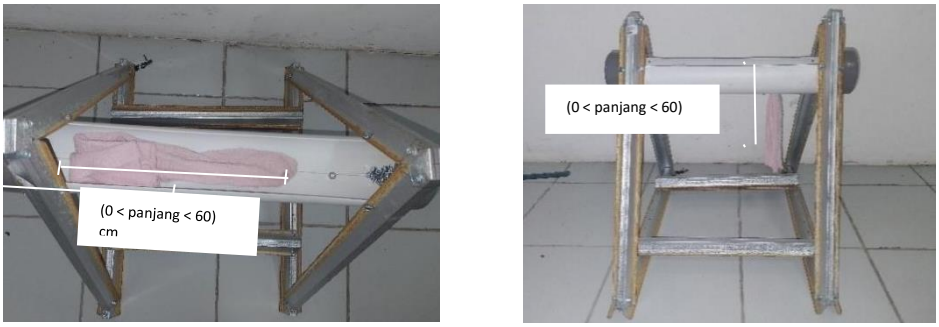

Figure 1. Concept of tools (instruments)

By adjusting the media ratio (MR) which is the proportion of fabric length hanging outside the pipe compared to inside, we observed that a lower MR (≤ 25%) with a 150 mm hanging segment resulted in a more stable flow rate.

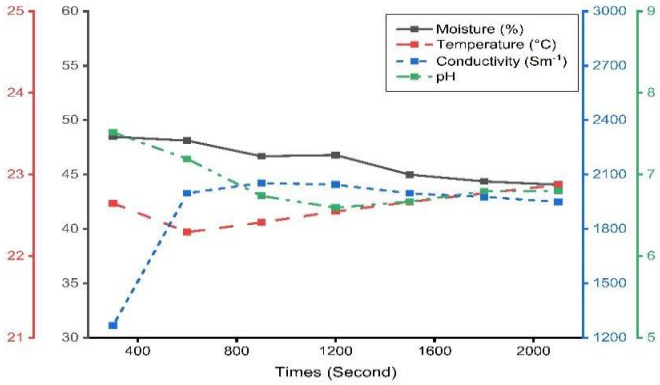

Figure 2. Data from an IoT-based multimeter

Complementing this, an IoT sensor network collects soil data every 10 seconds, including moisture, pH, temperature, conductivity, and water flow, and then processes this information in real time through a cloud-based platform.

Figure 3. IoT workflow

Together, these systems offer a sustainable and low-cost solution for efficient irrigation management, particularly in resource-constrained environments, supporting precision agriculture and environmental stewardship.

NOVELTY

The GRAVI-WICK system offers several key innovations and new contributions to sustainable irrigation:

a. It is electricity-free.
b. Its components are very affordable and readily available.
c. It can be installed on a variety of terrains and soil contours.
d. Its simple design means it requires no special skills and can be operated even by elderly farmers.

CONCLUSION

Ensuring optimal soil conditions is crucial for improving agricultural productivity, particularly in areas with limited water resources. This study presents the development and implementation of a real-time soil monitoring system that utilizes a network of multimeter devices distributed across multiple farm plots. Each device is designed to measure several soil parameters: moisture, pH, temperature, electrical conductivity, and drip rate per unit time (flow rate). The collected data is transmitted via the internet to a centralized cloud server, where it is stored, processed, and analyzed. The system calculates a dynamic soil readiness score based on sensor readings, which is visualized through a user-friendly web interface for farmers and administrators. By integrating real-

time environmental sensing with cloud-based analytics, the platform supports data-driven agricultural decision-making, contributing to smarter irrigation practices and improved land management strategies.

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YST006 - ORANGE PEEL CEREAL BARS

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ABSTRACT

This project introduces a cereal bar enriched with 6% orange peel powder, designed to enhance nutritional value while contributing to sustainable food innovation. Fruit peels, particularly from citrus fruits, are often discarded despite containing fibre, vitamin C, and bioactive compounds. By incorporating orange peel powder into a cereal bar, this innovation provides a solution for food waste valorisation and functional snacking. The 6% orange peel powder cereal bar was formulated using rolled oats, chia seeds, peanut butter, and honey, without synthetic additives. The bar was evaluated through physicochemical, nutritional, and sensory analyses. The product showed improved chewiness and vitamin C content compared to the control formulation. Sensory evaluations revealed that the 6% formulation had an acceptable level of bitterness while maintaining desirable taste and texture. This product is practical for busy, health-conscious consumers and offers a new use for underutilised fruit by-products. The innovation demonstrates a feasible method to reduce food waste while introducing a nutritious, appealing cereal bar to the functional food market. The successful incorporation of orange peel into cereal bars presents a novel approach in food innovation and functional product development in Malaysia.

Keywords – orange peel powder, cereal bar, functional food, food innovation, sustainability

INTRODUCTION

The loss of valuable nutrients from the disposal of fruit peels is distinguished as waste contributing to environmental pollution (Faulisi et al., 2024) that could be harnessed for functional food development. Despite their rich content of fibre, antioxidants, and bioactive compounds, fruit peels are usually used in the cosmetic industry (Ali et al., 2022) and remain underutilised in food applications. Furthermore, the disposal of fruit peels leads to missed opportunities for sustainable and nutritional enhancement, and at the same time, it leads to more reliance on synthetic ingredients and a lack of environmentally friendly practices (Faulisi et al., 2024). Currently, research on the incorporation of orange peel into cereal bar formulations remains limited. Cereal bars have appeal to a wide range of consumers, with major sectors including athletes, health-conscious people, and teenagers (Gill & Ashish, 2019). Tailoring cereal bars to fit the demands of groups of consumers is crucial for commercial success. For example, high-protein cereal bars are particularly tempting to gym-goers looking for muscle recovery and performance development, whereas fibre-rich or low-calorie products are the most suited for those who are looking to

maintain a healthy lifestyle (Gill & Ashish, 2019). With that, understanding the specific needs of these groups allows producers to design food products that resonate with their target audience, improving the market appeal (Verma et al., 2022).

OBJECTIVE

i. To develop cereal bars formulated with orange peels.
ii. To determine the nutritional composition and consumer acceptability of cereal bars formulated with orange peels.

DESCRIPTION OF THE PROJECT

Orange peels were obtained from local sources, ensuring that they were fresh and devoid of evident flaws or contamination. The peels were properly cleaned with running water to eliminate dirt, pesticides, and other contaminants. Blanching the peels in hot water at 90℃ for 5 minutes (Sankalpa et al., 2017) reduced microbial burden and deactivated enzymes. The samples were dried in a dehydrator at 60℃ (Özcan et al., 2020) until a consistent weight was obtained (M'hiri et al., 2015). The dried peels were crushed to a fine powder and sieved through a 0.425 mm mesh. The orange peel powder was kept in sealed containers. The 6% OPP cereal bar was prepared using 35% rolled oats, 25% honey, 25% peanut butter, 9% chia seeds, and 6% orange peel powder. Dry and wet ingredients were mixed separately, then combined and baked at 120°C for 20 minutes (Kaur et al., 2018). After cooling, the bar was cut and stored in airtight containers.

Figure 1: Cereal bar formulated with 6% orange peel powder.

To evaluate the effect of orange peel powder incorporation, the nutritional composition and sensory characteristics of the cereal bar were assessed. The nutritional analysis showed that the formulated 100 g cereal bar contained 10.58% protein, 16.25% fat, 2.07% ash, 63.84% total carbohydrate, 443.9 kcal total energy, and 4.38 mg vitamin C. Sensory evaluation was conducted using a 9-point hedonic scale involving untrained panellists who rated attributes such as colour, aroma, taste, texture, chewiness, and overall acceptability. The results indicated that the cereal bar received a mean overall acceptability score of 7 (like moderately), with the highest scores of 6 (like slightly) and 7 (like moderately) reported for attributes colour, aroma, chewiness, firmness, and sweetness, while the aftertaste was rated at 6 (like slightly) on the scale.

NOVELTY

This innovation introduces a novel and sustainable approach by incorporating orange peel, a commonly discarded by-product, into cereal bars, converting waste into a functional food ingredient. While orange peel has been widely used in cosmetics, its use in food products, particularly cereal bars, remains scarce. To the best of current knowledge, no commercial cereal bar in Malaysia has utilised orange peel powder. The 6% concentration was selected to balance nutritional benefits with sensory acceptability, offering higher vitamin C and fibre-related functionality without overwhelming bitterness. This innovation contributes to sustainability, zero-waste food processing, and aligns with the global movement towards clean-label, eco-conscious consumer products.

CONCLUSION

This study successfully achieved all objectives by formulating cereal bars with orange peel powder and evaluating their nutritional composition and consumer acceptability. The addition of orange peel powder notably affected product characteristics. The 6% orange peel powder cereal bar successfully demonstrated functional and nutritional enhancement without compromising sensory quality. The formulation delivered improved chewiness and vitamin C content while maintaining consumer acceptability. Its development highlights the potential of upcycling fruit waste into health-oriented food products. This innovation offers a practical and market-ready solution for health-conscious consumers and represents a scalable step toward sustainable food product development in Malaysia. Therefore, incorporating orange peel powder into cereal bars offers a promising strategy for valorising fruit by-products.

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YST007 - AUTOMATED NURSE SCHEDULING BY USING 0-1 INTEGER LINEAR PROGRAMMING

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ABSTRACT

Efficient nurse scheduling is essential to maintaining optimal healthcare services. However, in many healthcare institutions in Malaysia, nurse scheduling is still performed manually—a method that is not only time-consuming but also prone to human error and bias. This innovation addresses the urgent need for a more reliable, systematic, and user-friendly scheduling solution by introducing an Automated Nurse Scheduling System developed using Microsoft Visual Basic for Applications (MVBA) within Microsoft Excel. This system is designed to streamline the complex task of scheduling nurses while adhering to institutional rules, labor laws, shift preferences, and fairness in shift distribution. It leverages the power of MVBA to automate the scheduling process, significantly reducing the time required for planning and eliminating the inconsistencies often associated with manual scheduling.

Keywords – Automated Nurse Schedule, Microsoft Visual Basic for Applications.

INTRODUCTION

In the current Malaysian healthcare landscape, nurse scheduling is predominantly done manually. This conventional method is not only labor-intensive and time-consuming, but it is also highly susceptible to human error, bias, and inefficiencies (Ramli et al., 2016). These issues often result in staff dissatisfaction, unequal workload distribution, and disruptions in healthcare delivery. Recognizing the urgent need for a more systematic and reliable solution, this project introduces an Automated Nurse Scheduling System developed using Microsoft Visual Basic for Applications (MVBA) within Microsoft Excel. The motivation behind this innovation stems from the need to optimise workforce management, improve scheduling accuracy, and reduce administrative burdens without requiring high technical expertise or expensive software. By integrating automation into an accessible platform, this innovation aims to significantly enhance operational efficiency within the healthcare sector.

OBJECTIVE

The primary objective of this innovation is to develop a user-friendly, automated nurse scheduling system utilising MVBA in Microsoft Excel, which reduces manual effort, minimizes scheduling errors, and promotes fairness in shift distribution. The system is designed to generate accurate and efficient work schedules that comply with institutional rules and staff preferences, ultimately improving workforce management in healthcare facilities.

DESCRIPTION OF THE PROJECT

The Automated Nurse Scheduling System is a scheduling tool built using Microsoft Visual Basic for Applications (MVBA) within Microsoft Excel. This system is designed to automate the complex process of nurse shift scheduling by integrating institutional rules, staff preferences, and shift constraints into a customized algorithm.

One of its key features is the ability to generate multiple scheduling outputs in a single execution, giving users various options to choose from based on their needs. The system also includes parameters to ensure compliance with labor regulations, such as minimum rest periods, maximum working hours, and balanced workload distribution.

Functionally, the system allows users to input staff details, define scheduling rules, and automatically produce optimized shift rosters with minimal manual intervention. The use of Microsoft Excel ensures easy accessibility and a familiar interface, eliminating the learning curve often associated with specialized scheduling software.

In terms of usefulness, this solution addresses the inefficiencies of manual scheduling by significantly reducing the time required to produce fair and accurate rosters. It also helps to prevent human error, reduce administrative workload, and improve staff satisfaction through transparent and unbiased shift assignments.

The system's practicality lies in its cost-effectiveness, flexibility, and adaptability. It does not require any additional software installation and can be easily tailored to fit the specific needs of different hospital departments or healthcare institutions. This makes it an ideal tool for small to medium-sized healthcare facilities that lack access to expensive or complex workforce management systems.

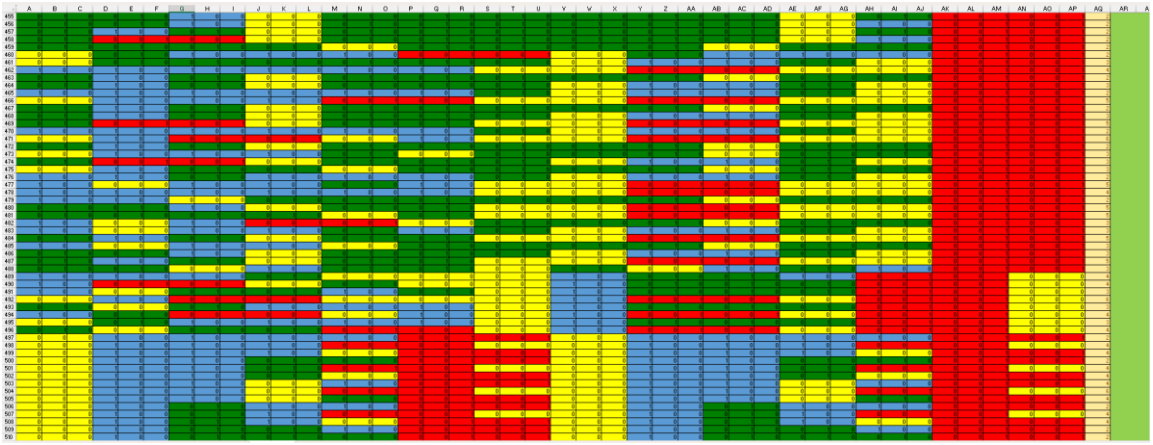

Figure 1: Shift Pattern

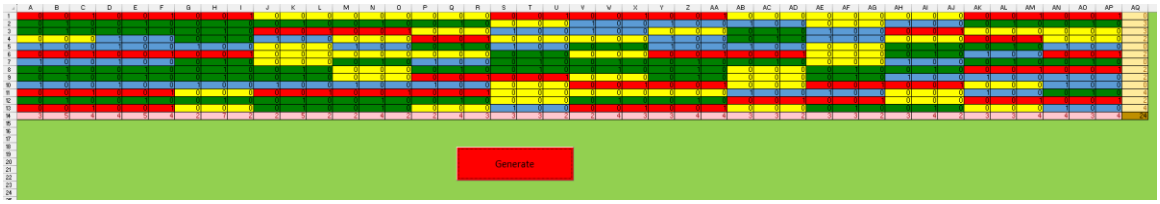

Figure 2: Nurse Schedule

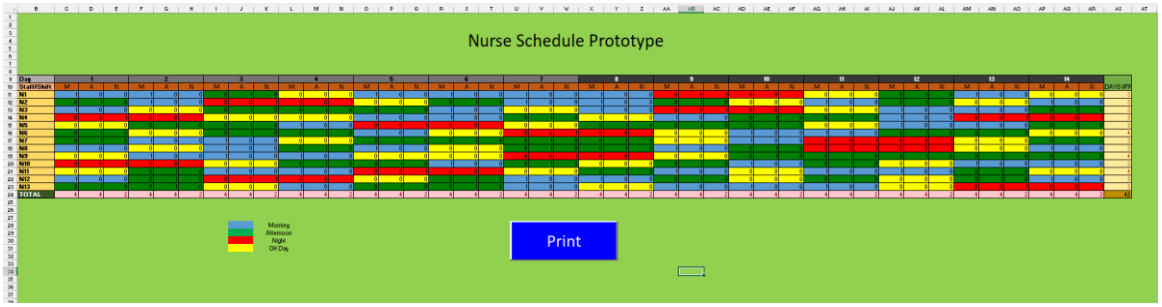

Figure 3: Nurse Schedule Prototype

NOVELTY

The novelty of the Automated Nurse Scheduling System lies in its innovative use of Microsoft Visual Basic for Applications (MVBA) within the widely accessible Microsoft Excel platform to solve a real-world operational challenge in the healthcare sector. While many workforce scheduling tools exist, most require specialized software, subscription costs, or technical expertise, making them less accessible to smaller healthcare institutions.

This project takes a unique approach by embedding scheduling logic and automation directly into Excel—a tool already familiar to most administrative staff, thereby eliminating the need for additional software training or purchases. The system integrates customizable scheduling rules, staff preferences, and regulatory constraints, all within an easy-to-use interface, offering a high degree of flexibility that is rarely available in similar low-cost solutions.
Moreover, unlike traditional manual scheduling or basic Excel templates, this innovation allows for the automatic generation of multiple valid scheduling options in a single run. This enables users to compare and select the most suitable schedule based on their staffing needs and organizational goals.

The originality of this method is further reinforced by the lack of existing MVBA-based scheduling solutions specifically tailored for the Malaysian healthcare context, making this product a pioneering step towards localized, cost-effective digital transformation in nurse scheduling.

CONCLUSION

The Automated Nurse Scheduling System using Microsoft Visual Basic for Applications (MVBA) presents a practical, innovative, and efficient solution to the challenges faced in manual nurse scheduling. By automating the scheduling process through a familiar

platform like Microsoft Excel, this system significantly reduces time consumption, minimizes human errors, and ensures fair and balanced shift assignments. Its ease of use, low implementation cost, and flexibility make it highly suitable for healthcare institutions, especially those with limited access to advanced scheduling tools. This innovation not only improves administrative efficiency but also contributes to better workforce management and staff satisfaction in the healthcare sector. The system has strong potential for future development, customization, and wider adoption, positioning it as a valuable tool in supporting digital transformation in healthcare operations.

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YST008 - FROM PEEL TO PROTECTION: ECO-FRIENDLY INSECT REPELLENT FROM POMELO

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ABSTRACT

Synthetic insect repellents are widely used to prevent insect-borne diseases but they often cause adverse effects on human health and the environment. In response, this poduct explores the potential of pomelo (*Citrus maxima*) peel, an abundant agricultural waste as a natural insect repellent. The peels are rich in bioactive compounds such as limonene and α-pinene which are known for their insecticidal properties. Essential oils will be extracted using hydrodistillation and soxhlet extraction and the processes will be optimized using Response Surface Methodology (RSM) for higher yield and quality. The chemical composition of the extracts will be analysed through Gas Chromatography-Mass Spectrometry (GC-MS). The repellency efficacy of the optimized extracts will be evaluated and compared with commercial insect repellents at various concentrations by using excito repellency chamber assay made from the recylce materials. Aligned with Malaysia's National Agrofood Policy (NAP 2.0) and Pesticides Act 1974 which advocate for bio-based pest control, this product supports Sustainable Development Goals (SDGs) 3 (Good Health), 12 (Responsible Consumption), and 15 (Life on Land) by reducing reliance on synthetic chemicals and valorizing waste. The product aims to produce a safe, effective and eco-friendly alternative to synthetic repellents thus contributing to public health improvement and sustainable agricultural waste utilization.

Keywords – pomelo peel, natural insect repellent, extraction, GC-MS, RSM optimisation.

INTRODUCTION

Insects are major vectors of disease worldwide, transmitting numerous life-threatening illnesses and causing millions of deaths each year. Flies and cockroaches can also mechanically spread pathogens such as Escherichia coli, Salmonella spp., and other harmful microorganisms by carrying them on their bodies or in their digestive tracts, contaminating food and surfaces (Abdullah, 2017). To combat these diseases, insect repellents remain one of the most effective strategies. Synthetic repellents like N,N-Diethyl-3-Methylbenzamide (DEET) are widely used for their proven effectiveness (Misni, 2017). However, they have notable drawbacks including unpleasant odour, greasy texture, high skin permeability, and potential allergic reactions, along with adverse effects such as irritant dermatitis, breathing difficulties, and concerns about long-term ecological impact.

These limitations have driven consumer demand for natural, sustainable alternatives. Citrus maxima (pomelo), a popular fruit, generates large amounts of peel waste rich in bioactive compounds such as flavonoids, coumarins, and essential oils, which are known for antimicrobial and insecticidal properties. The motivation for this product lies in addressing health and environmental concerns while valorizing agricultural waste. It also aligns with Malaysia's National Agrofood Policy (NAP 2.0) and the Pesticides Act 1974, which promote sustainable and low-risk pest control solutions. Furthermore, it supports UN SDGs 3 (Good Health), 12 (Responsible Consumption), and 15 (Life on Land) by reducing chemical dependence and utilizing waste. This innovation provides a cost-effective, eco-friendly repellent for households and industries, bridging gaps in policy-driven sustainable development.

OBJECTIVE

i. To optimise the extraction parameters of pomelo peels extract such as time (hours) and temperature (°C) for hydrodistillation method and soxhlet extraction method by using Response Surface Methodology (RSM).
ii. To analyse the compound of extracted pomelo peels by using Gas Chromatography-Mass Spectrometry (GC-MS).
iii. To compare the efficiency of optimised hydrodistillation and soxhlet extraction method of extracted pomelo peels with commercial insect repellent product in different concentration.

DESCRIPTION OF THE PROJECT

The project utilizes two conventional extraction methods which are hydrodistillation and soxhlet extraction to obtain essential oils from pomelo peels. Optimisation of process parameters is conducted using RSM to maximize the oil yield. The extracted essential oils are then subjected to GC-MS analysis to identify major bioactive compounds. An excito repellency chamber assay is used to test the effectiveness of the oils against insects and the results are compared with commercial repellents at different concentrations. This project showcases a practical and eco-friendly alternative to synthetic repellents which demonstrating the potential of pomelo peel in developing natural repellent products. Figure 1 shows the sketch diagram and Figure 2 shows the 3D diagram of excito repellency chamber assay. The test will be conducted in modified chambers as shown in figure below. A escape chamber which is a modified plastic container is connected to an exposure chamber via a escape tunnel. In order to allow sample insect delivery into the chamber, a small entry hole equipped with a short netting sleeve on the outside. Treated surface will be placed on the floor of the exposure chamber to observe the insect movement towards the escape chamber in response to the chemical stimulus or contact irritancy. This treated surface made up from paper or fabric and will be impregnated with treated solution. Insecticide impregnation of treated surface will be carried out by standard dipping procedures. A total 6 different treated surfaces will be compared which are 75% and 100% concentration of pomelo peels extract from hydrodistillation, soxhlet method and commercial insect repellent product. The paper drenched with solution will be air dried and used for repellency test. It provides insight into the repellency or attractancy of a chemical substance toward an insects being tested. This assay measures an irritant's or repellent's effect by observing how many exposed insects attempt to escape the treated area (exposure chamber) to an untreated one (escape chamber).

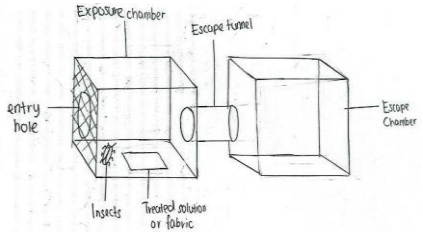

Figure 1: The sketch experimental setup of the excito repellency chamber assay used to assess the effects of extracted pomelo peel product

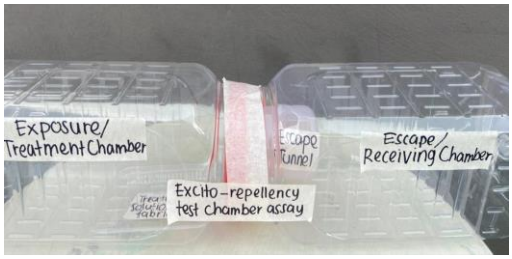

Figure 2: The 3D excito repellency chamber assay from recycled materials used to assess the effects of extracted pomelo peel compared to a commercial insect repellent product

NOVELTY

This product introduces a dual-approach extraction method with RSM optimisation that will enhancing essential oil yield and effectiveness from pomelo peels. Unlike existing studies, this project combines chemical profiling with functional bioefficacy testing against commercial products. The integration of optimisation, GC-MS analysis, and comparative repellency assessment offers a comprehensive framework for developing scientifically validated natural plant-based insect repellents. The valorization of agricultural waste into a high value bioactive product presents a novel sustainable solution for public health protection.

CONCLUSION

This project demonstrates that pomelo peel essential oils can serve as an effective natural insect repellent when optimized through hydrodistillation and soxhlet extraction methods. The combination of RSM optimisation, chemical profiling via GC-MS, and efficacy testing ensures high-quality extract production. The findings suggest that pomelo peel repellent formulations can match or exceed the performance of commercial synthetic products offering a safer and more sustainable alternative. This innovation aligns with environmental sustainability goals and promotes the use of agricultural waste for health-beneficial applications.

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YST009 - INTEGRATING IMAGE ENHANCEMENT WITH YOLO FOR IMPROVED LOW-LIGHT FACE DETECTION

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ABSTRACT

The paper introduced an innovative to enhancing face recognition performance in low-light environments using the You Only Look Once (YOLO) framework. Low light conditions pose a significant challenge to accurate facial identification, often degrading the reliability of conventional recognition systems. To address this issue, the study integrate image enhancement techniques, specifically Retinex and Zero-DCE, to strengthen the YOLO algorithm's effectiveness. Through extensive experimentation, the YOLOv8m.pt model, optimised using Stochastic Gradient Descent (SGD) at the 30th epoch, emerged as the most effective configuration. The proposed system was rigorously evaluated for both speed and accuracy, demonstrating its suitability for real-time applications. Notably, the Zero-DCE method consistently outperformed Retinex, offering faster processing times and improved recall across most test images. Under optimal conditions, the YOLO-based system achieved a mean Average Precision (mAP) of 75.8%, a Precision of 76.5%, and a Recall of 66.4%, marking a substantial advancement in face recognition capabilities for security and surveillance in low-light scenarios. Future research might be aimed at expanding scope of the data to cover more diverse situations and creating high quality API to enable broader usage and continuous learning.

Keywords: YOLO-based approach; low-light environments; face recognition; image enhancement; Zero-DCE

INTRODUCTION

Modern biometric systems rely heavily on face recognition technology, but the performance of this technology depends heavily on environmental factors like low-light conditions (Zhang et al., 2024). The You Only Look Once (YOLO) architecture has entirely transformed the field of object detection and recognition, where it allows real-time processing and high accuracy levels in detection (Chen et al., 2023). However, traditional face recognition systems still face significant limitations in low-light environments due to reduced visibility, increased image noise, and diminished facial feature clarity. These factors collectively degrade recognition accuracy and increase the likelihood of false positives (Shrivastav et al., 2023). Although image enhancement techniques such as Generative Adversarial Networks (GANs) and deep convolutional neural networks have

shown promising results, their deployment in real-world applications remains limited due to the high computational demands they impose (Kim et al., 2022).

OBJECTIVE

This study aims to enhance face recognition performance in low-light environments by leveraging a YOLO-based model. The study is guided by the following objectives:

- To identify effective image enhancement techniques for improving face recognition in low-light conditions.
- To design a face recognition system using a YOLO model optimised for different lighting conditions.
- To evaluate deep learning models for real-time low-light face recognition for better accuracy and processing speed.

DESCRIPTION OF THE PROJECT

The final prototype uses the YOLOv8 model combined with the Deep Curve Estimation with Zero-References (Zero-DCE) improvement in order to address the problems of low-light conditions.

The main interface is split into three categories of interaction:

i. **Detection Interface**: This is the main page of face recognition. There are two modes in which a user can insert images:
   - **Image Upload**: The system allows users to easily upload and browse image files from their local device for analysis.
   - **Webcam Integration**: It supports seamless connection to a local webcam as depicted in Figure 1, enabling real-time face recognition. The system automatically detects low-light conditions and applies Zero-DCE enhancement when necessary, indicated by the tag “Low-Light Enhanced: Yes”; otherwise, the tag reads “Low-Light Enhanced: No.”

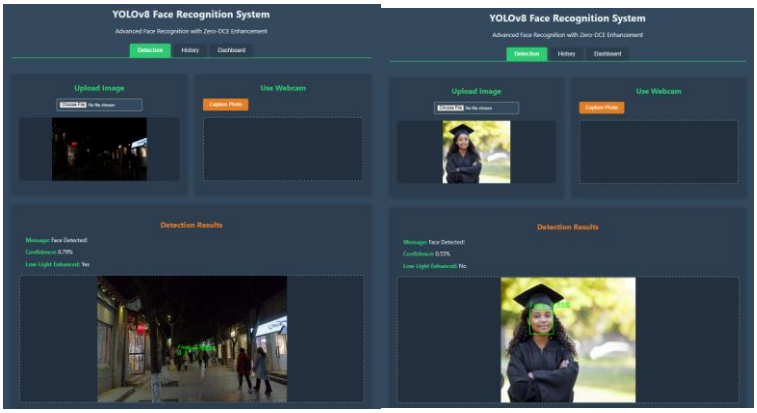

Figure 1: Face Detection Result with Low-Light vs Normal Light

ii. **Detection History Log:** As depicted in Figure 2, the tab displays is a chronological record of all past detection activities. Each log entry includes the timestamp, input type (e.g., webcam capture or uploaded image), face detection status, confidence level, application of low-light enhancement, and processing time.

Figure 2: Detection History Log

iii. **Analytics Dashboard:** In Figure 3, the dashboard shows overall performance indicators, including the total image uploads, detection rate, average confidence, and average processing time. These indicators are complemented by visual plots for intuitive analysis and monitoring.

Figure 3: Analytics Dashboard

NOVELTY

The core innovation of this study lies in the effective integration and optimization of the YOLOv8m.pt model with the Zero-DCE image enhancement technique, addressing a notable gap in current face recognition research. This combination enables a robust real-time system that significantly improves detection accuracy and processing speed under low-light conditions. The proposed solution holds practical value for security forces and law enforcement agencies by enhancing operational capabilities in environments with limited visibility. The resulting journal article contributes meaningfully to the field of Intelligent Systems Engineering and advances the development of resilient, deployable face recognition technologies for complex, real-world scenarios.

CONCLUSION

In conclusion, this study successfully designed and developed a YOLOv8-based face recognition system integrated with Zero-DCE image enhancement to address the challenges of low-light environments. The system features a user-friendly web interface that delivers real-time visual feedback, maintains transparent detection records through a history log, and provides clear performance metrics via an analytics dashboard. These elements collectively enhance user experience and system usability. While the proposed solution significantly improves recognition accuracy under poor lighting conditions, the results also affirm that images captured in low-light settings may still fall short of the performance achieved under normal lighting. Nonetheless, the system represents a

meaningful advancement in practical, deployable face recognition technologies, particularly for security and law enforcement applications in low-visibility scenarios.

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NSIEX+RS 2025
NEGERI SEMBILAN INTERNATIONAL EXPOSITION

YST010 - MICROBIAL POTENTIAL OF BEE HONEY IN YOGURT PROCESSING

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ABSTRACT

Growing consumer health awareness of better food options and the demand for improved digestive well-being have spurred interest in maximizing the nutritional content and probiotic levels of yogurt. This study investigated the microbial potential of bee honey in yogurt processing. The three main objectives were to determine the antimicrobial activity of bee honey against common spoilage and pathogenic bacteria in yogurt, to monitor the microbial populations during yogurt fermentation and to examine the physicochemical properties of the resulting yogurt. Standard microbiological methods including total plate counts and disc-diffusion assays for assessing antimicrobial activity were employed alongside physicochemical analyses measuring pH, moisture content, Brix, protein and fat. The findings revealed that bee honey had strong antimicrobial activity at 50% and 100% concentrations with clear inhibition zones reaching up to 27.7 mm for *Staphylococcus aureus* and 15.7 mm for *Escherichia coli.* Incorporating bee honey into the yogurt fermentation process shows enhanced probiotic potential as yogurt containing 2% honey reached a bacterial count of 2.19±7.00 x 10^7 CFU/mL compared to control, 1.75±8.00 x 10^9 CFU/mL. Physicochemical analysis revealed that honey yogurt had pH values within the ideal range (4.14 - 4.35) for yogurt, reduced moisture content with more honey added (from 85.80% in control to 81.35% at 6% honey), increased Brix values (up to 13.7% with 6% honey) and slightly higher protein content (up to 3.93% at 2% honey). Notably, the fat content remained stable across all samples (about 4.4%). These observations indicate that bee honey is not only a natural sweetener but also plays an integral role in improving the safety, nutritional value and functional value of yogurt. Overall, the use of bee honey in yogurt production has great potential in developing novel functional dairy products that meet consumer demands for healthier food while supporting product safety.

Keywords – bee honey, yogurt, antimicrobial activity, lactic acid bacteria, functional food

INTRODUCTION

Yogurt is a fermented dairy product produced by lactic acid bacteria (LAB), commonly *Lactobacillus* and *Streptococcus* species, and is valued for its flavour, texture and probiotic properties. Consumer demand for healthier functional foods has spurred exploration of natural additives like bee honey, rich in sugars, enzymes, phenolics and bioactive compounds with antioxidant and antimicrobial properties. Previous research suggests honey may synergistically enhance probiotic viability in yogurt. This study addresses the

knowledge gap concerning bee honey's interaction with yogurt microbiota, especially lactic acid bacteria (LAB), and its impact on fermentation, microbial safety and yogurt quality.

OBJECTIVE

i. To evaluate the antimicrobial properties of bee honey against spoilage and pathogenic bacteria commonly found in yogurt.

ii. To determine the microbial population in yogurt fermentation.

iii. To study the physicochemical properties of bee honey yogurt throughout the processing.

DESCRIPTION OF THE PROJECT

The product developed is a honey-fortified yogurt, produced by incorporating varying concentrations (2%, 4% and 6%) of *Apis Mellifera* bee honey into milk prior to fermentation. The study utilized microbiological assays to measure antimicrobial activity and bacterial counts, alongside analyses of key yogurt quality parameters including pH, moisture content, Brix value, protein and fat content. The bee honey addition enhanced fermentation kinetics, promoted LAB growth, and improved physicochemical properties without compromising product safety or fat content. The bee honey acts as a natural sweetener with added antimicrobial effects, supporting the development of yogurt that combines health benefits and food safety.

Table 1: Antibacterial activity of bee honey

Test organisms	**Antibacterial activity (zone of inhibition in mm)**					
	Bee honey concentrations					**Positive control**
	5%	**10%**	**25%**	**50%**	**100%**	**FOX**
S. aureus	n.d	n.d	n.d	15±3.00	22±2.65	27.7±0.58
E. coli	n.d	n.d	n.d	8.3±0.58	9.7±0.58	15.7±1.15

Table 2: Physicochemical properties of yogurt samples

Parameters	Yogurt samples			
	Control	2% bee honey	4% bee honey	6% bee honey
pH	4.35± 0.01	4.22± 0.01	4.20±0.00	4.14±0.00
Moisture (%)	85.80± 0.91	83.43± 0.30	81.81± 0.06	81.35± 0.40
Brix (%)	10.60± 0.14	10.90±0.00	12.50± 0.14	13.70± 0.21
Protein (%)	3.78± 0.07	3.93± 0.04	3.82± 0.05	3.68± 0.08
Fat (%)	4.44± 0.00	4.40± 0.05	4.41± 0.02	4.44± 0.01

NOVELTY

This work presents a novel approach by integrating the antimicrobial and probiotic-enhancing properties of bee honey into yogurt processing, creating a dairy product that naturally combines sweetness, microbial safety, and functional health benefits. Unlike conventional yogurts, this innovation leverages honey's complex bioactive compounds such as hydrogen peroxide, flavonoids, and phenolic acid to suppress spoilage bacteria while supporting beneficial LAB growth, contributing to novel natural preservation and probiotic enhancement strategies in dairy fermentation.

CONCLUSION

The findings affirm bee honey's significant potential to enhance yogurt's microbiological safety, nutritional value, and functional attributes. This innovative approach addresses consumer demand for healthier natural foods and supports the development of safe, nutrient-enriched dairy products. Future research should evaluate sensory acceptance and deploy molecular techniques to deepen understanding of microbial interactions involved. This innovation supports the advancement of health-promoting, innovative yogurt formulations for emerging markets.

YST011 - IMPACT OF SOURDOUGH FERMENTATION AND BAKING TEMPERATURE ON CALCIUM-FORTIFIED SOURDOUGH BREAD

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ABSTRACT

Sufficient intake of calcium-rich foods is essential for maintaining bone health, particularly among vulnerable populations. In line with this, the current study investigated the impact of sourdough fermentation and baking temperature on the nutritional and physicochemical properties of calcium-fortified sourdough bread. The main objectives were to evaluate changes in calcium content, assess the influence of microbial fermentation on mineral and physicochemical properties and examine the effect of baking temperature. Two bread formulations were involved, which include a control bread with commercial yeast and a sample bread with sourdough starter, both fortified with calcium carbonate. Calcium analysis showed that fortification increased calcium levels in dough, however, baking led to a reduction. The control experienced a 20.5% calcium loss (from 1.05 to 0.84 mg/100 g), while the sourdough sample had a 23.3% loss (from 1.00 to 0.77 mg/100 g). LAB counts increased during fermentation, 2.6×10^8 CFU/g in the starter to 8.9×10^8 CFU/g in the dough, indicating active bacterial growth. Moreover, the protein content was slightly higher in sourdough bread (11.15%) compared to control (10.64%). Gluten content in the control dropped slightly after fermentation (from 25.54 g to 23.50 g), whereas the sourdough sample showed a complete gluten degradation (from 23.03 g to 0.00 g). Texture analysis revealed that sourdough bread had higher firmness (2626.21 g) compared to control (2380.74 g), while springiness was nearly identical (63.70 mm vs. 63.72 mm). Additionally, the pH of sourdough dropped more significantly (from pH 5.85 to pH 4.95) than the control (from pH 5.91 to pH 5.72), affirming strong microbial activity. These findings demonstrate that calcium-fortified sourdough bread can be nutritionally enriched while preserving desirable texture and structure, supporting its potential as a functional food to address nutrient inadequacies.

Keywords – calcium fortification, sourdough fermentation, baking temperature, physicochemical properties, food security

INTRODUCTION

Bread has become one of the main staple foods which is commonly consumed as part of daily meals in many cultures around the world. Sourdough bread is getting more attention today because of its natural fermentation that can improve flavour and digestion (Lau et

al., 2021). However, like most bread, sourdough bread still lacks essential nutrients such as calcium, which are crucial for development and growth (Gahamat et al., 2022). In recent years, gluten-free diets have become popular, especially among individuals with gluten intolerance or celiac disease. Unfortunately, many gluten-free products tend to have lower nutritional quality, including reduced calcium levels, as they are often made from refined flours with poor mineral content. This raises concern, especially for those who rely on such products as dietary staples. Therefore, this study aims to produce a better alternative of sourdough bread with enhanced nutritional value and improved nutrient content. The fortification of micronutrients, namely calcium, into sourdough bread could help address nutritional deficiencies and malnutrition among children and vulnerable populations (Naser et al., 2014).

OBJECTIVE

The objectives of this study are to evaluate the changes of calcium content in fortified sourdough bread, to investigate the effects of microbial fermentation towards calcium content and physicochemical properties of fortified sourdough bread as well as to analyse the effect of baking temperature towards the calcium content in fortified sourdough bread.

DESCRIPTION OF THE PROJECT

This project involved the development of sourdough bread that was fortified with calcium by using calcium carbonate. Two different types of bread were made, one made using commercial yeast (control) and another made using a sourdough starter. Both of the breads were baked in a breadmaker. The study focused on some of the properties of the bread, which included levels of calcium, protein and gluten content, texture (firmness and springiness), pH and microbial number. The product is useful as a healthier alternative to regular bread, especially for those who need more calcium in their diet. The technique used is practical and can be done on a small scale or even at home. This study offers a potential solution to help reduce the risk of calcium deficiency while providing a reduced-gluten bread option with acceptable texture and taste, making it suitable for individuals seeking lower-gluten alternatives in their diet.

Table 1: Calcium content in bread samples before and after baking

Sample Type	Dough (mg/100 g)	Bread (mg/100 g)	Calcium Loss (%)
Control Bread	1.05	0.84	20.5%
Sourdough Bread	1.00	0.77	23.3%

NOVELTY

This project introduces the development of sourdough bread that is fortified with calcium while maintaining its texture, flavour and overall bread quality. The novelty lies in combining microbial fermentation with mineral fortification and studying how baking temperature affects calcium retention. While calcium fortification is not new, applying it

specifically to sourdough bread and evaluating it in terms of both physicochemical and nutritional aspects adds originality. This approach also promotes a functional food that supports better dietary intake, especially for vulnerable populations.

CONCLUSION

This study found that fortifying sourdough bread with calcium can enhance its nutritional value while maintaining acceptable quality. Although calcium content increased in the dough stage, a reduction occurred after baking due to heat exposure. According to the Recommended Nutrient Intake (RNI) for calcium in Malaysia, which ranges from 1000 to 1200 mg/day for adults, the fortified bread still contributes positively despite the loss which were 20.5% in control bread (from 1.05 to 0.84 mg/100 g) and 23.3% in sourdough bread (from 1.00 to 0.77 mg/100 g). The lactic acid bacteria (LAB) count increased significantly from 2.6×10^8 CFU/g in the starter to 8.9×10^8 CFU/g in the sourdough, indicating successful fermentation, further supported by the drop in pH from 5.85 to 4.95. Furthermore, protein content increased slightly in sourdough (11.15%) compared to control (10.64%) and gluten content dropped drastically in the sample, from 23.03 g before fermentation to 0.00 g after, suggesting gluten breakdown during fermentation. For texture, sourdough bread showed slightly higher firmness (2626.21 g) than the control (2380.74 g), with similar springiness between both (63.70 mm for sourdough and 63.72 mm for control). These findings suggest that calcium-fortified sourdough bread could support dietary calcium intake and offer a lower-gluten alternative, beneficial for individuals seeking improved nutrition without compromising texture or quality.

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YST012 - PENGGUNAAN SISA BUANGAN KACA SEBAGAI BAHAN TAMBAH AGREGAT HALUS DI DALAM KONKRIT

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ABSTRAK

Kaca adalah bahan padat yang tembus cahaya, biasanya terbuat dari pasir silika (SiO_2) yang dilebur bersama bahan lain seperti soda (natrium karbonat) dan kapur (kalsium karbonat), seterusnya didinginkan dengan cepat agar tidak membentuk kristal. Kaca digunakan secara meluas dalam kehidupan seharian dalam pelbagai cara, termasuk sebagai peralatan makan, bahan binaan, dan dalam peralatan elektronik. Kaca yang tidak effisien digunakan lagi, adalah merupakan bahan sisa buangan bagi masyarakat yang berpotensi dijadikan sebagai bahan tambah agregat halus dalam campuran konkrit. Kajian ini dijalankan untuk menilai kesan penambahan serbuk sisa buangan kaca sebagai bahan tambah dalam campuran konkrit terhadap sifat kekuatan mampatan, ketahanlasakan permukaan konkrit serta penilaian kualiti dan integriti bahan konkrit. Serbuk sisa buangan kaca yang digunakan adalah hasil daripada proses pengisaran sisa buangan kaca sehingga menjadi partikel halus, lalu ditambah ke dalam campuran konkrit pada kadar 0%, 15%, dan 25% daripada berat pasir. Penggunaan bahan ini dilihat sebagai satu pendekatan mampan yang bukan sahaja berpotensi meningkatkan prestasi konkrit, malah membantu mengurangkan sisa buangan kaca yang mencemari alam sekitar. Ujian-ujian utama yang dijalankan dalam kajian ini merangkumi ujian kekuatan mampatan konkrit pada usia 7 dan 28 hari, ujian ketahanlasakan permukaan pada usia 28 hari serta ujian penilaian kualiti dan integriti bahan konkrit juga pada usia 28 hari. Hasil kajian menunjukkan bahawa penambahan serbuk sisa buangan kaca memberi kesan kepada ciri-ciri fizikal konkrit. Bagi ujian kekuatan mampatan, ketahanlasakan permukaan konkrit serta ujian penilaian kualiti dan integriti bahan konkrit, nilai ujian meningkat pada bahan tambah sisa buangan kaca 15% dan 25%. Secara keseluruhannya, kajian ini berpotensi memberikan sumbangan kepada bidang pembinaan mampan melalui penggunaan bahan tambah daripada sisa kitar semula, serta membuka ruang untuk penambahbaikan dalam reka bentuk campuran konkrit. Dapatan kajian ini juga dapat dijadikan sebagai rujukan oleh pelajar, penyelidik, dan pihak industri dalam memilih bahan tambahan alternatif yang mesra alam dan berprestasi tinggi.

Kata kunci: Sisa Buangan Kaca, Kekuatan Mampatan, Ketahanlasakan Permukaan, Penilaian Kualiti dan Integriti Bahan

PENGENALAN

Konkrit ialah bahan binaan yang paling meluas digunakan dalam industri pembinaan, terutamanya dalam pembinaan bangunan, jambatan, jalan raya dan pelbagai struktur kejuruteraan awam. Ia terdiri daripada campuran simen, air, pasir dan agregat kasar yang apabila digabungkan akan membentuk bahan pepejal yang tahan tekanan. Kekuatan, kebolehcapaian, kos rendah dan ketahanannya menjadikan konkrit pilihan utama dalam pelbagai projek pembinaan. Kunci untuk menghasilkan konkrit yang kuat, tahan lama dan seragam terletak pada kawalan komponen asasnya dengan teliti [1].

Dalam usaha meningkatkan prestasi konkrit, kajian ke atas penggunaan bahan tambahan mula mendapat perhatian. Salah satu bahan tambahan yang berpotensi ialah serbuk sisa buangan kaca, Sehubungan itu, satu inovasi bahan pembinaan yang diperoleh daripada pengisaran kaca buangan sehingga menjadi partikel halus, seterusnya dikombinasi dengan agregat halus sebagai bahan tambah di dalam konkrit pada gred M25. Proses menghasilkan konkrit dengan bahan tambah sisa kaca adalah dengan mencampurkan bersama air, simen, agregat halus dan agregat kasar mengikut nisbah 1:1:2 pada gred M25. Nisbah ini digunakan setelah membuat penilaian dan perbincangan mengenai kajian terdahulu.

Menurut sumber daripada Jabatan Pengurusan Sisa Pepejal Malaysia menyatakan bahawa pada tahun 2024 sebanyak 2.7% daripada 39,000 tan sisa pepejal harian terdiri daripada sisa kaca [2]. Justeru, penggunaan serbuk sisa buangan kaca sebagai bahan tambahan bukan sahaja memberi nilai tambah dari segi sifat mekanikal konkrit, tetapi juga menyumbang kepada aspek kelestarian alam sekitar dengan mengitar semula sisa kaca. Hasil kajian ini dapat memberi manfaat bagi pihak-pihak yang terlibat dalam industri pembinaan di negara ini dari segi pengurangan kos pembinaan kerana menggunakan bahan buangan (kitar semula) sisa buangan kaca. Selain itu, melalui kajian ini pembuangan sisa pepejal khususnya sisa buangan kaca dapat dikurangkan kerana digunakan dalam pembinaan. Kajian ini sejajar dengan konsep pembangunan hijau (*Green Building Index*) yang memberi perhatian pada aspek kecekapan tenaga, kualiti persekitaran dalaman, kelestarian perancangan dan pengurusan tapak binaan, bahan dan sumber, kecekapan air dan juga inovasi [3].

OBJEKTIF

Objektif kajian ini dijalankan adalah untuk mengenalpasti kekuatan mampatan konkrit dengan bahan tambah sisa kaca, di samping menguji tahap ketahanlasakan permukaan konkrit berkenaan melalui ujian *Rebound Hammer* seterusnya membuat penilaian kualiti dan integriti bahan konkrit dengan bahan tambah sisa kaca melalui pengukuran halaju gelombang ultrasonik pada kapasiti bahan tambah sisa kaca 0%, 15% dan 25% daripada agregat halus.

PENERANGAN TENTANG PROJEK

Penyediaan bahan dan kaedah kajian penting bagi memastikan kajian dapat dijalankan dengan sempurna. Bahan-bahan yang digunakan dalam kajian ini ialah simen, air, agregat kasar dan agregat halus dan sisa buangan kaca. Kaedah yang digunakan dalam kajian

ini ialah pengawetan sampel, ujian kekuatan mampatan, ujian ketahanlasakan permukaan konkrit serta penilaian kualiti dan integriti bahan kokrit.

Reka bentuk campuran konkrit dan bahan tambah sisa kaca

Reka bentuk campuran adalah proses yang dilakukan untuk memilih bahan konkrit yang paling sesuai dan menentukan kuantiti relatifnya untuk mencapai kekuatan yang diinginkan. Proses menghasilkan konkrit dengan bahan tambah sisa kaca adalah dengan mencampurkan air, simen, agregat halus, bahan tambahan sisa kaca dan agregat kasar mengikut nisbah 1:1:2. Jadual 1 menunjukkan komposisi campuran konkrit dengan bahan tambah sisa kaca bagi 15 sampel.

Jadual 1: Komposisi campuran konkrit dengan bahan tambah sisa kaca bagi 15 sampel

Peratusan Sisa Kaca (%)	Simen (kg)	Air (kg)	Agregat Kasar (kg)	Agregat Halus (kg)	Sisa Kaca (kg)
0	10.13	3.5	20.26	10.13	0
15	10.13	3.5	20.26	8.61	1.52
25	10.13	3.5	20.26	7.60	2.53

Ujian Kekuatan Mampatan

Ujian kekuatan mampatan bertujuan untuk menentukan keupayaan konkrit dalam menahan beban tekanan sebelum mengalami kegagalan struktur. Ujian ini dilakukan pada spesimen campuran konkrit dan sisa kaca yang telah diawet pada tempoh 7 hari hingga 28 hari. Jadual 2 menunjukkan keputusan ujian kekuatan mampatan.

Jadual 2: Keputusan ujian kekuatan mampatan campuran konkrit dan bahan sisa kaca

Peratusan Sisa Kaca (%)	Kekuatan Mampatan (MPa)	
	7 Hari Pengawetan	28 Hari Pengawetan
0	24.0	29.0
15	28.2	31.2
25	31.1	34.9

Ujian Ketahanlasakan Permukaan Konkrit

Ujian ketahananlasakan permukaan konkrit dijalankan brtujuan untuk menilai keupayaan permukaan konkrit menahan kesan fizikal seperti geseran, penghausan, dan tindakan mekanikal berulang yang berlaku semasa penggunaan struktur binaan. Ujian ini dilakukan pada spesimen campuran konkrit dan sisa kaca yang telah diawet pada tempoh 28 hari. Jadual 3 menunjukkan keputusan ujian ketahanlasakan permukaan konkrit berkenaan.

Jadual 3: Keputusan ujian ketahanlasakan permukaan konkrit dengan campuran sisa kaca

Peratusan Serbuk Sisa Buangan Kaca (%)	Purata Kelajuan Nadi Ultrasonic (km/s)	Kualiti dan Integriti Konkrit
0	3.60	Kurang memuaskan
15	3.68	Baik
25	3.80	Baik

Jadual 4: Keputusan ujian penilaian kualiti dan integriti bahan konkrit dengan campuran sisa kaca

Peratusan Sisa Kaca (%)	Kekuatan Mampatan Permukaan Konkrit (MPa)
0	19.1
15	22.1
25	23.6

Ujian Penilaian Kualiti dan Integriti Konkrit

Ujian penilaian kualiti dan integriti bahan konkrit campuran sisa kaca dilakukan pada hari ke-28 pengawetan. Ujian ini dilakukan menggunakan mesin pengukuran hadlaju gelombang ultrasonik. Jadual 4 menujukkan hasil keputusan ujian bagi sampel yang diuji.

PEMBAHARUAN

Dalam kajian ini , produk konkrit ini diperbaharui dengan penambahan serbuk sisa buangan kaca sebagai bahan tambahan dalam campuran konkrit yang bertujuan untuk meningkatkan kekuatan pada konkrit. Dalam usaha meningkatkan kelestarian bahan binaan, sebanyak 15% dan 25% serbuk sisa buangan kaca digunakan sebagai bahan gantian separa kepada pasir. Kaca adalah bahan buatan manusia yang mengambil masa untuk terurai. Terdapat beberapa keunikan pada produk ini, antaranya ialah sisa buangan kaca telah diekstrak menjadi serbuk sisa buangan kaca serta dapat memberi impak positif kepada alam sekitar. Oleh itu, dengan mengitar semula kaca menjadi serbuk sisa buangan dan menggunakannya di dalam industri pembinaan, ia dapat mengurangkan jumlah buangan sisa kaca di tapak pelupusan. Selain itu, campuran konkrit bersama sisa buangan kaca mempunyai keistimewaan daripada aspek kekuatan mampatan dan ketahanlasakan permukaan berbanding konkrit konvensional. Sementara itu, bagi penilaian kualiti dan integriti bahan, campuran konkrit dengan sisa buangan kaca ini kadar keronggaan (honey comb) adalah semakin kecil dan di tahap baik.

KESIMPULAN

Kajian ini menilai kesan penambahan serbuk sisa buangan kaca sebagai bahan tambah dalam campuran konkrit pada kadar 15% dan 25% daripada pasir berbanding sampel kawalan (0%). Penilaian prestasi dijalankan melalui ujian kekuatan mampatan pada

tempoh pengawetan 7 dan 28 hari, ujian ketahanlasakan permukaan serta ujian penilaian kualiti dan integriti konkrit. Keputusan ujian kekuatan mampatan menunjukkan peningkatan kekuatan apabila campuran konkrit dengan kandungan serbuk sisa buangan kaca 15% meningkat kekuatannya sebanyak 7% berbanding sampel kawalan. Sementara itu, pada kadar kandungan konkrit bersama serbuk sisa buangan kaca 25% kekuatannya meningkat 20% daripada sampel kawalan. Seterusnya, bagi ujian ketahanlasakan permukaan konkrit, terdapat peningkatan yang ketara pada kekuatan permukaan konkrit campuran sisa buangan kaca pada kadar 15% dan 25% berbanding sampel kawalan. Bagi, ujian penilaian kualiti dan integriti bahan campuran konkrit dengan sisa buangan kaca, kadar keronggaan adalah semakin berkurang apabila sisa buangan kaca meningkat dalam campuran konkrit. Secara keseluruhannya, hasil kajian membuktikan bahawa penggunaan serbuk sisa buangan kaca sebagai bahan tambah dalam konkrit dapat meningkatkan kekuatan permukaan, kualiti dalaman, dan kekuatan mampatan konkrit, khususnya pada kadar 25%.

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YST013 - OSSS CONNECT: OUTING SMART SCHOOL SYSTEM USING JAKOB NIELSEN'S PRINCIPLES

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ABSTRACT

Outing Smart School System (OSSS) for Sekolah Menengah Kebangsaan (SMK) Seri Gading was developed to address inefficiencies in the school's traditional, paper-based outing management process. In the past, students had to fill out outing cards, get permission from the warden in person, and have guards write down when they left and returned to the hostel. OSSS introduces a unified, role-based digital platform designed in alignment with Jakob Nielsen's usability heuristics to ensure high accessibility and intuitive interaction. The system integrates multiple functions, enabling stakeholders, including students, guardians, wardens, guards, and administrators, to handle only the relevant information to their roles. Key features include online outing requests, real-time guardian notifications, automated check-in and check-out records using student ID verification, and the ability to save outing history in a secure database. This combination of safety, speed, and openness is rarely found in existing outing management solutions. The OSSS makes things more useful by letting students submit request outings remotely, cuts down on wait times and speeds up approvals. Guardians may see their child's outing history and get instant notifications, which builds trust and makes them more involved in school events. Warden can review requests, check student records, and give out demerits when needed. Guards can also rapidly check approved outings and stop people from leaving without permission. The administrator keeps the system running smoothly and safely, managing users and keeping data safe. By digitising and streamlining the outing approval workflow, OSSS cuts down on paperwork, makes mistakes less likely, and makes it easier for everyone to talk to each other. This innovation fulfils the requirements of a growing student population while keeping everyone safe. Accountable and modernise the school's operations.

Keywords – outing system, hostel outing system, jakob nielsen, school management system

INTRODUCTION

Outing Smart School System (OSSS) for SMK Seri Gading was developed to address the challenges and inefficiencies of the school's traditional manual outing process. Previously, students who wished to leave the hostel were required to fill in an outing card, obtain the warden's signature for approval, and then have their outing details recorded manually by the guard in a physical logbook. This process was not only time-consuming but also

depended heavily on the warden's presence. If the warden was unavailable, students had to wait for the warden they become available. This often leads to delays that disrupt their plans, especially for those who want to leave for an urgent matter. Using paper records also makes mistakes more likely, such as missing entries, insufficient information, or misplaced documents. This made it harder to keep correct records and keep students safe.

As the number of students at SMK Seri Gading expanded, these problems happened more often and were harder to deal with. During busy times, such as weekends or school breaks, the manual method made people wait a long time and put extra stress on both students and hostel personnel. In emergencies, it took a long time and was hard to find specific outing records in piles of paper documentation. Nawi et al. (2022) and Vijitha et al. (2024) stated that digital solutions can make managing student records much easier by making it easier to get to data, cutting down on administrative work, and making communication between all parties involved better.

The OSSS was made to be a modern, web-based solution that lets users handle outing requests, approvals, and records in a way that is organised, easy to find, and safe. The system's goals are to make the outing process easier, offer updates in real time, and keep all records safe in a central database. The OSSS makes the system more open and effective by connecting students, guardians, wardens, and administrative staff on one platform. This makes it easier to hold people accountable, makes the hostel safer, and helps with overall hostel administration.

OBJECTIVE

The main goals of creating the Outing Smart School System (OSSS) for SMK Seri Gading are to make the outing management process more efficient, accurate, and open. The initial goal is to figure out the existing excursion procedure and the problems the hostel management is having, especially the delays, reliance on paper records, and lack of communication. Knowing about these problems gives the researcher a clear starting point for coming up with a good solution. The second goal is to create an online outing system that follows usability guidelines so that it is easy to use, straightforward, and navigate for everyone, including students, parents, wardens, and guards. The third goal is to test the system to see how well it works and how easy it is to use. This will ensure it does what it was meant to do, satisfies the demands of users, and makes managing student outings easier overall. The goal of these objectives is to replace obsolete manual processes with a digital platform that is reliable, easy to use, and good for everyone involved.

DESCRIPTION OF THE PROJECT

The Outing Smart School System (OSSS) is an online tool that will take the role of the old-fashioned way of organising student outings. It gives students a clear and easy way to ask for outings, including information like the reason for the expedition, the time they plan to leave, and the time they plan to return. The warden can log into the system to look over each request, see the student's outing history, and then determine whether to accept or deny it based on the student's records. Guardians can log into the system to see their child's outing data and get notifications right away when their youngster departs or comes back to the hostel.

When students get to the guard station, they show their ID card, and the system automatically records the precise moments they checked in and out. This automatic system makes sure that student movements are tracked correctly and stops them from going out without permission. A central database keeps all outing requests, student information, and approval records safe against loss or tampering. The system is always on and can be reached from anywhere with an internet connection. This makes it easy for students, faculty, and guardians to use.

Figure 1 demonstrates how the Outing Smart School System is set up. It shows how students, guardians, wardens, guards, and the administrator may all talk to each other through the central database. The system is built with PHP, MySQL, HTML, and CSS, which makes sure that it works well, is compatible, and meets the needs of SMK Seri Gading's operations.

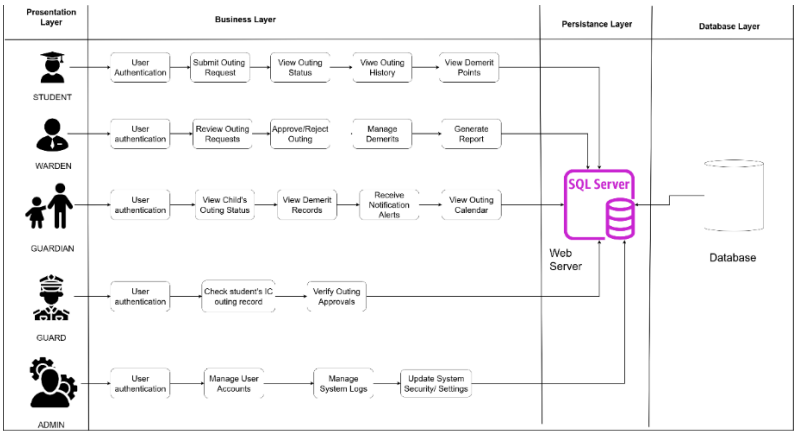

Figure 1: System Architecture of the Outing Smart School System

NOVELTY

OSSS is unique because it combines several important features into one complete platform, replacing the slow and error-prone manual process. This system is different from traditional ones since it not only records outing requests but also sends real-time notifications to guardians, automatically records check-in and check-out times using students' identity card (IC) numbers and keeps all outing history in a safe central database. System also applies all 10 of Jakob Nielsen's usability principles in its design, ensuring that it is easy for students, guardians, wardens, and guards, regardless of their experience with technology. Another unique aspect is the role-based access that allows each user type to view and manage only the information relevant to them, improving both security and efficiency. This method not only speeds up the clearance process but also makes it easier for students, guardians, and hostel administration to talk to each other and be open with each other, which is not something that other outing management systems do.

CONCLUSION

In conclusion, the creation of the Outing Smart School System for SMK Seri Gading has solved the problems with the manual outing process in a way that is both effective and reliable. The technology makes it easier for kids to ask for outings, for wardens to approve them, for guardians to stay up to date, and for guards to keep accurate records of where

children are going. It cuts down on delays, makes mistakes less likely, and makes sure that all outing records are kept safe in a central database. The system can provide a clear, straightforward, and efficient platform that serves all users by employing a systematic development technique and following usability guidelines. Overall, this project has digitalized the outing management process in the hostel, improved communication among stakeholders, and strengthened the safety and accountability of student movements.

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YST014 - POTENTIAL OF BORNEO INDIGENOUS SEED (*KOP* NUT) AS A NEW SOURCE OF FOOD PRODUCT

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ABSTRACT

New food sources are vital due to global challenges such as population growth, climate change, and scarcity of food resources. An indigenous plant seed known as *kop* nut among the local of Dayak's community in Sarawak Borneo has a commercial prospect for a new food product. This plant is belong to *Euphorbiacea* family, which are common with it plant seed toxin. Natural toxins are usually present in plants, but the potential toxins can be eliminated by employing a proper and suitable treatment. Here, the aim is to eradicate the seed toxicity and to establish a new food source. Heat treatment of wet or dry heat was applied to the seed. Later, the possible toxin present in the treated *kop* nut was examined using brine shrimps lethality assay (BSLA), a tiny *Crustacean* of an *Artemia*. This is crucial for acertaining that the seed is non-toxic, safe and suitable for consumption. Subsequently, a preliminary of possible prospect market of this seed among local consumer through sensory evaluation on the preference regarding taste, aroma and its suitability as nut-bean product was obtained. Result demonstrated the toxin was eliminated and no toxic effects until the maximum experimental concentration of 1g/ml when seed was treated at 100°C for 30 minutes. Sensory test demonstrated the consumer (n=30) preference on the high scale (7-9) for taste was 93.33%, aroma was 70% and suitability as a nut-bean product was 80%, thus supporting the potential of this seed for commercial nut. This shall be the first scientific evidence after validating the traditional knowledge in treating the seed plant, then sensorial attributes for possible market potential as a nut-bean product. *Kop* nut may not only served as a new source of food product in food industry, but may also served to others like pharmaceutitical and cosmetic industries.

Keywords – borneo indigenous plant, kop nut, toxic, new source food

INTRODUCTION

Investigation of underutilized species or exploration of innovative food product are garnering global attention. Factors such as climate changes, food security, and dietary diversity contribute to the pursuit of alternative functional food ingredients, reflecting the need for broader food options. *Kop* nut is a seed from plant belong to *Euphobiacea* family. It is also known as *buantik*, *broti*, or *merantik* among the *Bidayuh* and *Iban* community (Sakai et al., 2020). Although *Euphobiacea* are widely-known plant for its therapuetic potential and among the species that are diversely studied are *Ostodes*, *Aleurites*, *Jatropha* and *Ricinus*, nevertheless the plant is also familiar for its seed toxin.

Nonetheless, a suitable heat treatment can remove possible toxins (Bilang et al., 2018) from the seed since local community traditionally cooked the seeds after harvested. It was said that the practise was to remove the bitterness from the seed (Eunice, personnel communication, 2021) and yet there has been no established or uniform method for cooking it, whether through boiling or frying. Thus, in this study the effects of heat treatment towards the toxicity of the seed and the sensorial attributes as potential nut-bean was investigated. This was an example of study which connecting the information from the ethnic knowledge into the scientific context of evidence. Based on the communication and practices within the local community, this research can serve as a foundation for more extensive studies and underscore the commercialization capacity of this seed not just in food sector but also in various other industries. Consequently, revealing the economic opportunities for this underutilized seed plant.

OBJECTIVE

i. To evaluate the present of seed toxicity using brine shrimps letality assay (BSLA).
ii. To produce a safe consumption seed using suitable process of heat treatment.
iii. To conduct an initial assessment market potential for this seed among local consumers through sensory evaluation, preferences regarding taste, aroma, and its appropriateness as a nut-bean.

DESCRIPTION OF THE PROJECT

Fruits was collected near the hill area of Gunung Payang, located at Padawan, Serian Division, Sarawak, Malaysia. The coordinate GPS was at 1.48799,110.33164. Matured fruits was selected, washed until clean and was treated using dry treatment (oven; 100°C for 30 minutes) and wet treatment (boiling 100°C for 30 minutes) with the black seed coat was still attached. Seed was then extracted and the raw seed was identified as RS while the boiled seed and the oven dried seed was identified as BS and OS respectively. The present of toxin in seed was determined using brine shrimps lethality assay (BSLA) with varied concentration and the maximum concentration was set at 1 g/ml. The concentration consisted of 3 replicates with 10 live nauplii each. The results from the analysis was summarized in Table 1.

Table 1: Maximum concentration of sample used and the percentage of live nauplius after 24-hours

Treatment (Maximum concentration of treated seed 1 g/ml)	**live *nauplii***			**% of live *nauplii* after 24 hours**
	Replicate I (n=10)	**Replicate II (n=10)**	**Replicate III (n=10)**	
[a]C (blank)	10	10	10	100
[b]RS-UT (raw seed-untreated kop nut)	0	0	0	0
[c]OS (oven)	2	3	3	26.67
[a]BS (boiled)	10	10	10	100

Notes: C=control assay. Different alphabet indicates significant differences ($p<0.05$) of alive nauplius from one treatment to other.

Subsequently, a sensory evaluation was performed to the BS sample (after roasting) to assess its potential for the market focusing on consumer preference towards the taste, aroma and its suitability as a nut-bean. The data was summarised in Figure 2. The scale range was as below.

Table 2: Scale range for three sensory test parameter

Parameter	Scale range	Category	Explanation
Taste	1-3	dislike	poor; no nutty-creamy taste, texture soft
	4-6	neutral	moderate; mild nutty-creamy taste, texture soft crunchy
	7-9	good	good; nutty-creamy taste, texture crunchy
Aroma	1-3	dislike	poor; no buttery aroma
	4-6	neutral	moderate; mild buttery aroma
	7-9	good	good; rich buttery aroma
Suitability as a nut-bean	1-3	dislike	poor; no quality and suitable as nut-bean
	4-6	neutral	moderate; suitable and can be improved as nut-bean
	7-9	good	good; have quality and suitable for nut-bean

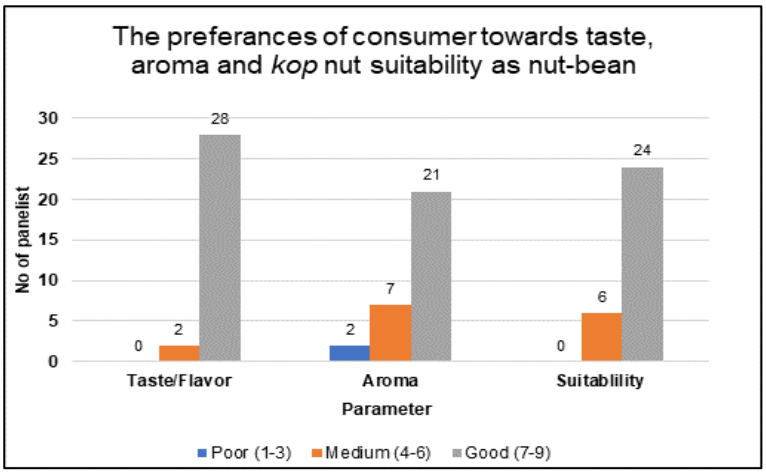

Figure 1: *Kop* nut post-treatment sensorial attributes (n=30)

NOVELTY

This is the first scientific study showcasing the *kop* seed as an innovative food product, specifically as nut-beans, after the process has effectively removed the toxicity of the seed through the heat treatment. A random preference supported that this seed has comparable potential with taste, aroma, and suitability reminiscent of nutty, creamy, and buttery qualities similar to those found in commercial tree nuts like macadamia, cashew, almond, pistachio, and walnut, making it a viable alternative to nut-beans in chocolate or confections. This seed also holds more potential for various food industries in the future.

CONCLUSION

The present of toxic was detected in the untreated seed with mortality of nauplius demonstrated in the cost-effective assay of BSLA. However, it was able to be eliminated using a simple approach of wet heat treatment at 100°C for 30 minutes, which is represented by the alive nauplius. Additionally, this underutilized seed offers a commercialization potential not only in food industries, but also across other potential sectors such as pharmaceutical, cosmetic, and biodiesel industries.

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YST015 - HARVESTPRO: INTELLIGENT PRODUCE MANAGEMENT SYSTEM

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ABSTRACT

The HarvestPro: Intelligent Produce Management System for PELADANG is an innovative web-based platform that transforms the management of vegetable crop operations from a fragmented, manual approach into an integrated, automated solution. Previously, tasks such as crop data entry, communication with wholesalers, and invoice processing were conducted informally through phone calls and messaging applications. This traditional approach led to miscommunication, delays, and challenges in accurately tracking crop sales and payments. The new system introduces a centralized platform for four major user roles: administrator, staff, crop handlers (internal farmers), and wholesalers. Staff can record crop grades and seasonal availability, update inventories, and instantly notify wholesalers. Wholesalers receive real-time crop listings, place orders, review past transactions, and access instant invoices. Administrators oversee user roles and system functions, while staff generate automated monthly sales reports for tracking trends and payment statuses. Development of the system adapted from the Waterfall Model, covering planning, analysis, design, implementation, testing, and documentation. It also adopted the principles of User-Centered Design (UCD), the system ensures ease of use for individuals with limited technical proficiency. Usability testing with experts and end-users demonstrated significant improvements in efficiency, accuracy, and stakeholder communication. Real-time access to operational data improved transparency, enabled proactive stock management, and supported data-driven decision making. Key innovations include real-time crop visibility, invoice automation, role-based access control, and automated trend reporting, collectively reducing paperwork, eliminating redundancies, and improving payment tracking. This system contributes to PELADANG's broader digital transformation goals by fostering structured workflows, enhancing productivity, and supporting sustainable growth. The project proves that even small-scale agricultural organizations can benefit from custom digital solutions tailored to their workflow needs and compete in the evolving digital economy.

Keywords – crop management, agriculture system, farmer management system, invoice tracking

INTRODUCTION

In recent years, the integration of digital solutions in agriculture has become increasingly important to improve operational efficiency, transparency, and market accessibility (Malallah et al., 2023). Traditional methods of crop management, particularly those relying

heavily on manual communication and paperwork, are no longer sufficient to meet the growing demands of modern agricultural operations (Antle et al., 2015). This is especially evident in organizations such as PELADANG, which plays a crucial role in supporting local agricultural activities in Malaysia.

Despite its significance, PELADANG's existing crop management process has been largely dependent on informal channels such as phone calls and messaging apps to coordinate between internal crop handlers (staff farmers), wholesalers, and office personnel. This manual approach has led to several recurring challenges, including delays in communication, lack of real-time crop visibility, disorganized record-keeping, and inefficiencies in sales tracking and payment verification (Antonopoulou et al., 2022).

Furthermore, staff members have been required to manually create invoices and trace payment histories, a process that is not only time-consuming but also prone to human error. The absence of a centralized system hinders PELADANG's ability to monitor sales performance, identify crop demand trends, and make data-driven decisions for crop planning and resource allocation. Figure 1, illustrates the manual process of the existing PELADANG's crop management. To address these issues, a web based HarvestPro: Intelligent Produce Management has been developed.

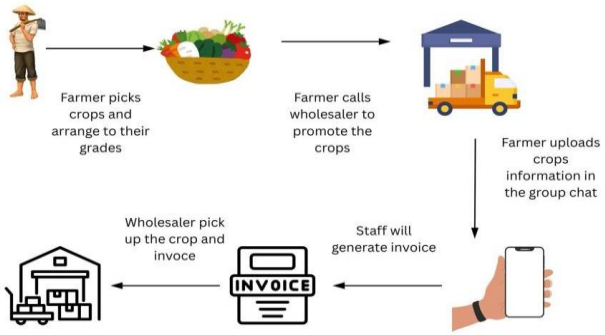

Figure 1: Manual process of crop management

OBJECTIVE

This innovation aims to address PELADANG's operational challenges through three key objectives within a cohesive framework. First, to identifies the current crop management process and its issues by examining the manual system, which relies on informal communication like phone calls and messaging apps, causing inefficiencies, delays, and errors in data management. Second, to design and develop a web-based vegetable crop management system tailored for PELADANG, using the Adapted Waterfall Model and User-Centered Design (UCD) principles. Finally, to evaluate the system's functionality and usability through rigorous system and user acceptance testing to ensure it effectively meets the needs of farmers, staff, wholesalers, and administrators while enhancing operational transparency and efficiency.

DESCRIPTION OF THE PROJECT

Figure 2 presents the system architecture that summarizes the roles and key functionalities of each user in the HarvestPro: Intelligent Produce Management. There are

four main user groups, Farmers, Wholesalers, Staff, and Admin, who can interact with the system through the business layer, which handles their specific tasks. Farmers can input crop details (such as name, grade, quantity, and price), manage wholesaler orders, and view crop availability. Wholesalers are able to browse available crops, place orders, view invoices for each successful purchase, and check their order history. Staff members can view wholesaler invoices and generate monthly reports, while Admins manage user accounts and oversee overall system operations. All these activities are processed through the web server, which communicates with the database to store, retrieve, and manage the necessary data, ensuring smooth operations across all user roles. Figure 3 illustrates the system dashboard for sales tracking.

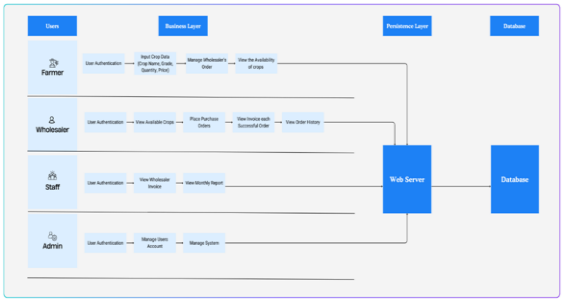

Figure 2: System architecture

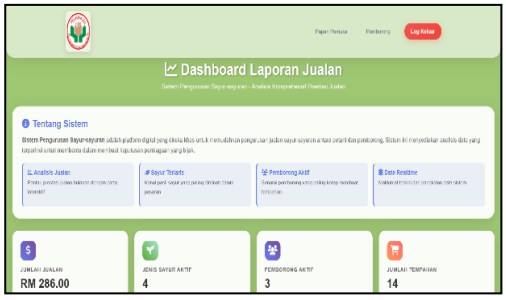

Figure 3: Interface of sales tracking dashboard

NOVELTY

The PELADANG HarvestPro: Intelligent Produce Management distinguishes itself from existing agricultural record-keeping tools through its targeted emphasis on post-harvest processes and alignment with the needs of small-scale vegetable farmers, offering a lightweight, accessible alternative to complex large-scale platforms. Its primary innovation integrates Management Information System (MIS) principles for organized, retrievable, and actionable data to support decision-making, with a UCD approach that incorporates farmer feedback for an intuitive interface suitable for users with limited technical skills. The system's streamlined features focus on essential tasks such as harvest data recording, invoice generation, and sales tracking, enhancing efficiency and adoption rates during the shift from manual to digital methods, while its scalable architecture allows for future expansions to other produce types and integrations like mobile applications, cloud storage, or payment gateways, ensuring adaptability to evolving user requirements.

CONCLUSION

The HarvestPro transforms traditional crop management by automating critical processes such as sales, invoicing, and payment tracking, significantly improving operational efficiency, reducing errors, and enhancing coordination between staff and wholesalers. Its real-time data sharing promotes transparency, enabling stakeholders to make informed decisions swiftly, while role-based access ensures clear task delegation and accountability. Designed with usability in mind, the system accommodates users of varying technical skills, facilitating quick adoption and minimizing the learning curve. By streamlining workflows and reducing reliance on informal communication, it aligns with PELADANG's modernization and digital transformation objectives, setting a foundation for

future enhancements like mobile access and data analytics to further optimize planning, forecasting, and sustainable agricultural productivity.

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YST016 - AIR-DRIVEN CONVEYOR SYSTEM FOR FRICTIONLESS MATERIAL MOVEMENT

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ABSTRACT

Belt conveyor systems, widely employed in material transport, often suffer from excessive energy consumption, maintenance needs, and wear due to friction. These challenges are most acute when transporting delicate and non-standard shapes, raising costs and lowering operational efficiency. This project seeks to develop an air conveyor system which solves these problems. Air conveyors eliminate the need for direct contact between conveyor surfaces and the items being transported, making them particularly helpful for the electronics, pharmaceuticals, and food processing industries which require strict hygiene and system integrity. These industries are also prone to excessive friction and require high maintenance. In this project, an air conveyor system prototype was designed, constructed, and subsequently tested. The prototype utilized an acrylic sheet with holes, plywood, a 700W air blower, a mount for the blower made from 3D printed parts, and some metal brackets. Moreover, tests to determine energy consumption, load, efficiency, and their material specification were conducted. Compared to belt conveyors, air conveyors showed more favourable energy expenditure over a 10-hour operational period. The system reliably transported and supported flat-bottomed items measuring from 5 cm × 5 cm to 16 cm × 16 cm and weighing from 30 grams to 500 grams. The air-driven conveyor system is an example of an innovative system where greater energy efficiency is achieved when compared to conventional systems. Mechanical wear and maintenance costs are reduced alongside improved efficiency and overall effectiveness of the system. The system can be used in material handling systems where its effectiveness and product quality are required while ensuring environmental sustainability.

Keywords – Conveyor, Air-Driven, Frictionless, 3D Printer, Material Handling

INTRODUCTION

Belt conveyors and other mechanical conveyor systems play a significant role in material handling in most industries. However, these systems have a number of tangible limitations. Physical contact between components, materials, and moving parts leads to wear and tear, overheating, and a great deal of mechanical maintenance. All of these limitations lead to operational challenges and raise costs, which coexist with inefficiencies and gaps in sustainability.

For industries handling delicate, irregular, or sensitive materials, constant mechanical contact and friction cause a significant risk of contamination. This eventually deteriorates product quality. Traditional conveyor systems suffer from a large carbon footprint, which

stems from energy-hungry motors and other mechanical components that require a great deal of energy to operate efficiently.

All of these issues call for a meaningful innovation in energy and material handling systems that incorporate low maintenance, frictionless, and cost-effective. This project presents the design of an air-driven conveyor system that utilizes air pressure technology to enable the movement of materials. This system seeks to mitigate the operational ineffectiveness and contact-driven environmental impact of traditional belt systems.

OBJECTIVE

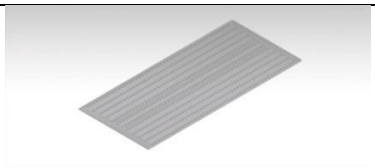
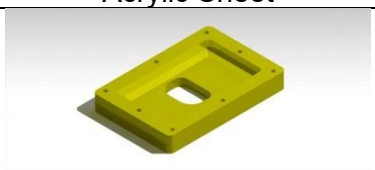
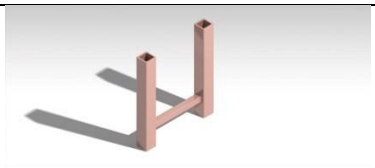
i. To design an air-driven conveyor system for frictionless material movement.
ii. To fabricate the air-driven conveyor prototype utilizing air pressure technology.
iii. To assess the functionality of the prototype under relevant operational constraints.

DESCRIPTION OF THE PROJECT

Conveyor systems, including belt conveyors, have played an important role in various industries for transporting materials. These systems suffer from severe aging and maintenance issues, energy inefficiencies, and wear and tear from contact between parts. Moreover, friction between components and product materials, considering physical contact, results in traditional conveyor systems operating far below their efficiency potential. Certain items are prone to contamination, damage, or other forms of delicate handling due to constant mechanical friction in industrial conveyors. Items undergoing transport are further burdened by considerable environmental strain as a result of traditional conveyor motors driven by energy and fuel-intensive mechanical components. The absence of traditional conveyor systems underscores the need to find a more effective solution. The reduction in friction, maintenance needs, and energy consumption, which leads conveyor belt systems to function at their full potential, becomes critical for optimized productivity. The frictionless transport and damage control objectives of the proposed Air-Driven conveyor systems, which utilize air pressure for material transport, seek to improve traditional conveyor systems. The inefficiencies stemming from traditional technologies can be optimized by shifting focus toward increasing environmental effectiveness. The need for developing a contactless conveyor system using air pressure is because it can greatly change the material handling systems of some industries, which need special handling of items. With the air contactless conveyors are most suitable for handling delicate or fragile items since the technology used needs contactless interaction between the conveyor and the items, minimizing the risk of damage. Contactless conveyors are already used in some critical areas such as electronics, pharmaceuticals, and food processing industries. Moreover, by using air-driven conveyors, the amount of dust and other conventional pollutants is greatly reduced, which increases the cleanliness of the workstation. Advancement of technology in material handling is the response to the challenges modern industries need to face concerning cleanliness, productivity, as well as hygiene, and quality control.

Figure 1: Prototype of air-driven conveyor system

Table 1: Components of the air-driven conveyor system

No.	Component Name	Material	Function
1	Air Blower	- Electric component - Plastic	To supply air for the conveying system in a high speed and pressure.
2	 Acrylic Sheet	- Poly (methyl methacrylate) - Plastic	Cut with multiple holes to allow air to pass through the holes to maintain uniform exit air for goods to transport.
3	 Blower Mount	- Polylactic Acid (PLA) - 3d printed plastic	Designed and printed to connect the main table and the air blower perpendicular to the acrylic sheet.
4	 Support Legs	- Wood	The main function of the support legs is to lift the conveying surface from the ground and create a space under the sheet to mount the blower.

NOVELTY

The air-driven conveyor system is an innovative system for material handling that uses air propulsion technology to move materials along a conveyor system. This new advancement is beneficial across industries because it improves handling activities with lower risks of contamination through supporting automation integration and pneumatic control. Most distinctive of this system is its capability for contamination-free and damage-proof material transport, which sets a new standard for conveyor systems. Moreover, this system allows

more customization and increases automation for different industries that need transport systems that offer ease and multiple functions. Furthermore, it tries to solve the contamination risks and the malfunction risks posed by the traditional conveyor systems.

CONCLUSION

In conclusion, the air-driven conveyor systems with frictionless material handling represent an innovative advancement in material handling technology. By utilizing air blowers, this system does not use bearings, rollers, or belts, which greatly reduces energy consumption. Furthermore, air blowers, acrylic sheets, and even the 3D printed mounts for the blowers used in this system contribute to gentle and smooth material handling. This gentle system eases the handling of delicate parts. The use of cost-effective and more easily available parts, along with the effectiveness of the air-driven conveyor system, improves operational efficiency and sustainability. This system enhances the functionalities of conventional conveyors. This system shows strong potential for adoption in sectors such as electronics, pharmaceuticals, and food processing, where product integrity is critical.

YST017 - NOTENEST: ALL YOUR NOTES IN ONE PLACE

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ABSTRACT

Note-taking is an essential learning skill in today's academic environment, yet most students struggle to organize their academic content and notes that they have created and designed. Most traditional methods, such as handwritten notes and other word processor software, they are lack organization and a note-sharing mechanism. Students increasingly rely heavily on mobile devices and technology to manage academic content. Some students may struggle to understand certain topics, and would like to expand their understanding by reading more information in additional readings or online resources. However, by using the university's official Learning Management System (LMS), academic resources are mostly provided by the lecturers. There is a lack of note-sharing activities that enable students to share the academic content with personalized notes between peers. Collaboration among students is essential, yet exchanging notes is typically unstructured and unorganized. Therefore, this project, called NoteNest, is designed for UiTM students and lecturers to provide a centralized system that gives users quick access to educational materials, offering an accessible learning system that supports students in sharing and exchanging their academic content. Come in a mobile application platform with a sleek and minimalist user interface, the system enables users to navigate through the application easily. NoteNest is also equipped with intelligent technologies to improve the note-browsing experience for students and lecturers across UiTM campuses. The application adopts some advancements in Artificial Intelligence (AI) and machine learning technologies in mobile applications to enhance user experience, such as user profiling, personalized recommendations, and managing users' preferences. Meanwhile, for effectively managing thousands of notes, a cloud-based database system is also part of this application, enabling students to upload notes in many formats. These technologies brought NoteNest as a dependable note management application with a significant step forward in offering students a centralized platform to share academic content and notes.

Keywords – collaborative learning, mobile application, note-sharing

INTRODUCTION

Students in higher institutions are expected to be much more independent in their learning, where organized and accessible academic content plays a significant role in contributing to academic performance. While most of the academic content is provided by the lecturers, students are also actively creating their personalized notes to capture, design, and represent their comprehension and understanding of the particular lessons. However, in

UiTM's official Learning Management System (LMS), the academic content is mostly contributed by the lecturers in the form of teaching materials. The current methods of sharing notes between students are mostly informal, unstructured, and disorganized, where uploading and downloading notes are being done on many platforms, with unverified content, and a lack of control over dissemination. These problems highlight the importance of an immediate, centralized, well-organized system that provides students with up-to-date, relevant, and collaborative academic resources to help them succeed in their studies.

OBJECTIVE

The objectives for this mobile application are:

i. To develop a centralized system that gives students quick access to educational materials.
ii. To establish an efficient and accessible learning system that supports students in understanding and mastering their academic subjects.
iii. To create an up-to-date system that provides relevant and current resources to aid students in effective examination preparation.

DESCRIPTION OF THE PROJECT

NoteNest offers a minimalist, user-friendly interface with clear instructions and quick response to the user, and increases adoption of the application. Several other features embedded in NoteNest are:

1. Advanced Filter with Smart Search Suggestion - The platform applies several filters based on different criteria, such as category, tags, and keywords, which allows users to focus their search. As the user inputs, smart search suggestions provide content-aware, real-time recommendations, elevating the search experience.
2. Smart Flashcard Generator - The feature can automatically create flashcards by identifying the key concepts from user-uploaded notes, textbooks, or any web pages. It can analyze text for important terminologies, definitions and transform them into questions and answers.
3. Smart Notes Verification – Used AI-enabled content validation to verify the correctness of and applicability of the information; this feature employs algorithms to compare user notes with databases or reliable sources.
4. Real-time Collaboration and Discussion Space - Users can work together quickly, exchange notes and ideas, and have engaging discussions about many topics in real-time collaboration and discussion spaces.

Each process in NoteNest is presented with an easy navigation user interface to give the users a smooth, simple, and aesthetically pleasing experience. The design creates a user-friendly environment that improves usability and engagement, and creates a familiar design layout by utilizing UiTM's logo. Figure 1 shows the user interface design for the NoteNest mobile application.

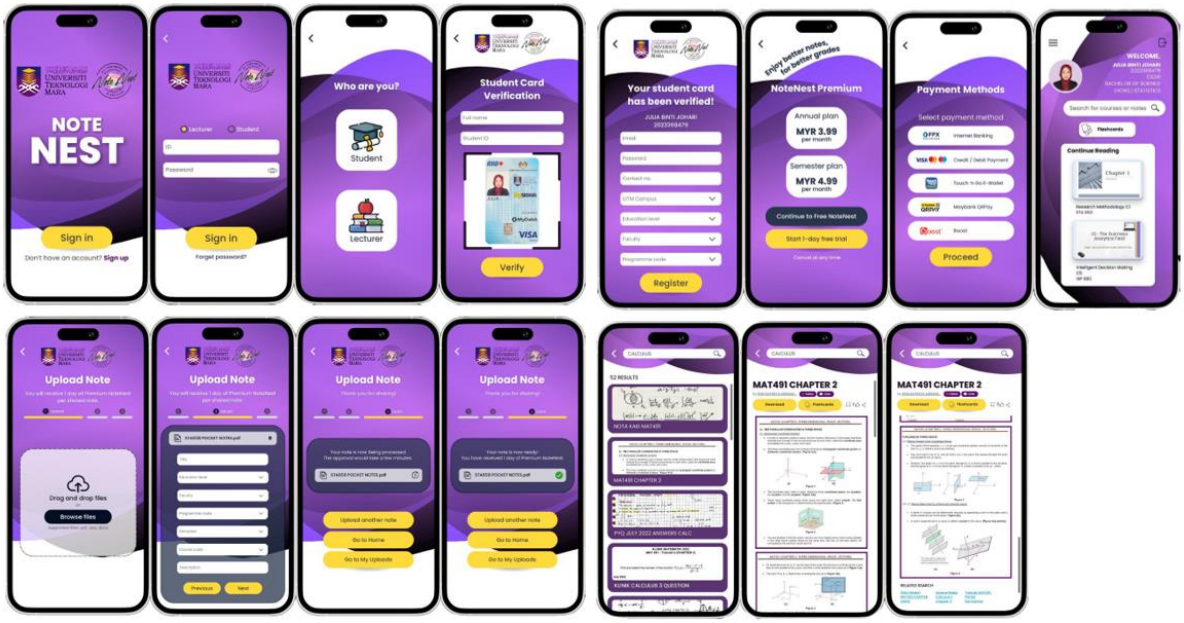

Figure 1: User interfaces for users to sign up, log in, upload notes, and retrieve notes

NOVELTY

NoteNest is unique as it is designed exclusively for students and lecturers of UiTM across all UiTM campuses in Malaysia for sharing customized notes and specifically constructed features to enhance students' educational performance and achievements. All features presented in the project descriptions, such as smart search, AI-enabled content validation, and recommendations for content selection, are part of the novelties of the application, including smart note classification following UiTM's academic requirements. Other additional features, such as customizable notes based on learning style and an interactive discussion space, make the platform outstanding in promoting a collaborative learning environment.

CONCLUSION

Fostering collaborative learning by allowing students to contribute their notes and study materials will significantly enhance the platform's content and have a positive impact on academic performance. Peer-to-peer note-sharing activities and sharing different ideas and perspectives will improve comprehension and create a more enriching learning environment. NoteNest also lets students view their peers' insights, explanations, and approaches, which broadens their comprehension and improves their understanding of the content shared in the application. NoteNest is more than a usual mobile application, as it is a sustainable and affordable educational instrument that precisely aligns with UiTM's goals. Thus, this creative strategy not only helps students thrive academically but also helps UiTM place itself at the forefront of education technology.

YST018 - ALLERGIFY: MOBILE APPLICATION FOR REAL-TIME ALLERGEN DETECTION IN PACKAGED FOODS

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ABSTRACT

Food allergy is an adverse health reaction that occurs each time an individual is exposed to a specific food. It happens when the immune system mistakenly identifies a harmless food protein as a threat. Even minimal exposure to certain foods can provoke allergic reactions, from mild symptoms such as hives and itching to severe, potentially life-threatening anaphylaxis. The risks are exacerbated, particularly when consumers are unable to accurately identify allergens in packaged foods due to the inefficiency of manually reading ingredient labels and the frequent use of scientific terms or alternative ingredient names. These factors often lead to confusion and misinterpretation, increasing the likelihood of accidental allergen exposure. Based on the motivation, ALLERGIFY, a mobile application, was developed to address these challenges through real-time allergen detection powered by Optical Character Recognition (OCR) and Natural Language Processing (NLP). The application enables users to scan ingredient labels with their smartphone camera, extract text using OCR, and detect allergens by comparing tokenized text against a curated database of alternative names for common allergens. The application also integrated the Gemini AI chatbot to provide personalized guidance on food allergies. The text recognition accuracy evaluation of the system demonstrated its capability for reliable text extraction and effective allergen recognition. ALLERGIFY supports a wide user base, including individuals, parents, schools, and public health agencies, contributing to safer food choices and promoting SDG 3: Good Health and Well-being.

Keywords – allergen detection, food allergies, mobile application, NLP, OCR

INTRODUCTION

Food allergies trigger immune responses when the body misinterprets certain food ingredients as threats, leading to reactions ranging from mild symptoms like rashes to severe anaphylaxis, which can be life-threatening without immediate epinephrine treatment (Yudeepanao et al., 2024). The eight most common allergens, which are milk, eggs, peanuts, tree nuts, soy, wheat, fish, and shellfish, are responsible for most reactions. Manual label reading is prone to misinterpretation due to the presence of technical or alternative ingredient names. This increases the risk of accidental exposure and creates barriers for allergy sufferers in making safe food choices. Mobile technologies offer a promising alternative by leveraging image-based ingredient scanning to automatically

detect allergens without needing to decipher complex terms. Driven by this motivation, this study introduces a mobile application that uses Optical Character Recognition (OCR) and Natural Language Processing (NLP) to detect food allergens in product labels. Users can scan ingredient lists with their smartphone camera, and the app extracts and tokenizes the text to compare it against a curated allergen database. The system identifies potential allergens and presents alerts, while an integrated AI chatbot offers additional allergen-related guidance. This automated approach enhances safety and simplifies allergen identification for users in real-time.

OBJECTIVE

i. To develop a mobile application for allergen detection that employs text recognition technology to address challenges in identifying allergens on packaged food labels.

ii. To promote community wellness through a mobile application that supports individuals with food allergies in making safer dietary choices, in alignment with SDG 3: Good Health and Well-being.

DESCRIPTION OF THE PROJECT

The allergen detection system in the ALLERGIFY application was developed using Optical Character Recognition (OCR) technology to perform text extraction for identifying allergens from scanned food packaging. OCR is a computer vision technique used to extract text from images and convert it into digital formats. This process enables seamless interaction between visual content and digital systems and is widely applied in document scanning, food label reading, and medical text analysis. With the advancement of machine learning, especially Convolutional Neural Networks (CNNs), OCR systems have achieved higher accuracy in recognizing both printed and handwritten text.

The system has been tested, with the evaluation carried out on 40 food label images using text recognition accuracy metrics, specifically the Character Error Rate (CER) and Word Error Rate (WER). CER quantifies character-level errors in OCR output, including extra, missing, or incorrect letters, while WER measures errors at the whole-word level. Figure 1 presents the average of CER and WER of OCR text extraction with varying image sample sizes (10, 20, 30, and 40 images). A noticeable decreasing trend in both CER and WER is seen with an increase in the number of test images. This demonstrates that the accuracy of text recognition improves with more image data being utilized for testing.

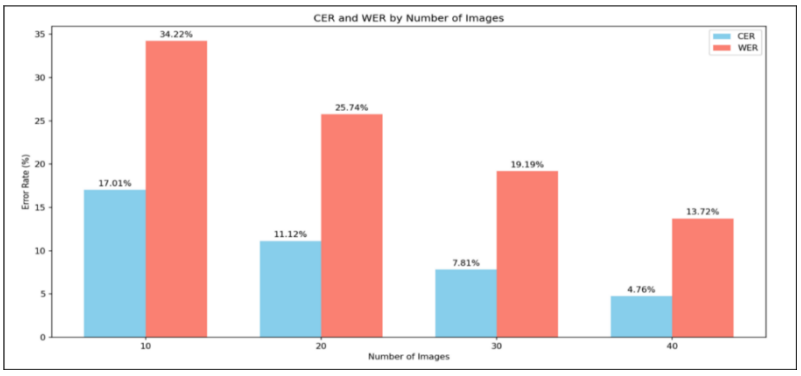

Figure 1: CER and WER by Number of Images

The application's usability was assessed using the System Usability Scale (SUS), a standard method for evaluating systems based on user feedback. The ALLERGIFY app achieved an overall SUS score of 89.79% (Grade A), classified as "Best Imaginable," reflecting an excellent user experience. Referring to Figure 2, the chart shows that most of the 10 SUS questions scored between 8 and 9 out of 10, resulting in a high normalized average score. These findings indicate that the app is highly usable, user-friendly, and effectively meets user expectations.

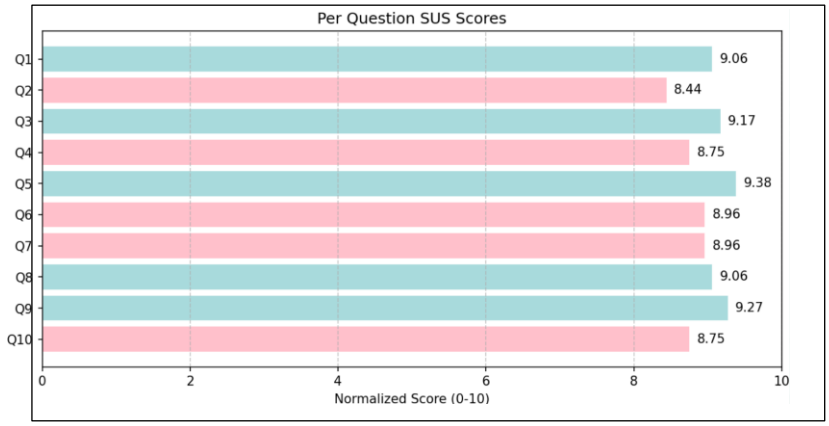

Figure 2: SUS Score Contribution by Each Question (0–10 Scale)

NOVELTY

This project introduces a novel real-time allergen detection mobile application that integrates Optical Character Recognition (OCR) and Natural Language Processing (NLP) to continuously scan packaged food labels and instantly highlight allergen keywords without storing images. By combining lightweight OCR processing with a curated database of alternative allergen names, the system offers higher accuracy and speed compared to existing static-scan or manual search methods. Enhanced with an AI-powered chatbot for personalized guidance, ALLERGIFY app contributes to consumer safety, public health awareness, and technological innovation in mobile health solutions. This unique approach not only addresses a critical gap in accessible allergen detection but also supports the United Nations Sustainable Development Goal (SDG) 3: Good Health and Well-being, fostering safer food choices and reducing accidental allergen exposure.

CONCLUSION

By providing a reliable tool that supports individuals with food allergies in making safer dietary choices, the project has contributed to promoting community wellness and aligns with the United Nations Sustainable Development Goal (SDG) 3: Good Health and Well-being. Altogether, ALLERGIFY has demonstrated strong performance, usability, and practical value in enhancing public health awareness and reducing accidental allergen exposure.

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YST019 - LEARNTORECYCLE: HOUSEHOLD WASTE DETECTION AND RECYCLER FINDER MOBILE APPLICATION

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ABSTRACT

Artificial Intelligence (AI) has become deeply embedded in daily life, offering numerous benefits and challenges across various domains, including education. AI-driven technologies in environmental education are indeed practical, since it supports the methods of experiential learning, building ecological awareness, and social responsibility. This project proposes the LearnToRecycle mobile application, which is designed within the advanced concept of improving household waste management. This application integrates YOLOv8, an AI-powered object detection algorithm to classify detected waste into categories such as paper, plastic, cardboard, glass, and metal. It is further enhanced with a geolocation feature using the Google Maps API, enabling users to conveniently locate nearby recycling facilities based on their current location. The initiative aims to address environmental current processes such as passive environmental education and low public awareness about recycling. This can encourage learning about proper waste sorting and sustainability practices, using an enjoyable method especially appealing to youngsters (children and adolescents) for developing eco-friendly behavior. In this way, it strengthens the correct ways of waste separation practices for an educational experience for users and contributing to the goal of environmental sustainability. The development process adopted an Adapted Waterfall methodology, which involved five phases including requirement analysis and data collection, design, implementation, testing, and documentation. The LearnToRecycle model achieved 89.1% accuracy in performance testing. The SUS results from 30 respondents yielded a score of 78.92, corresponding to the “Good” adjective rating. Future work includes expanding datasets to improve detection accuracy and reliability in real-world applications. More features such as game and specialized chatbot could also be added for further enhancement of the application.

Keywords – algorithm, maps and geolocation, mobile application, object detection, waste management, YOLOv8

INTRODUCTION

Current environmental education for youngsters often relies on traditional, passive teaching methods that limit engagement and practical application to real-world situations (Hu, 2024). Although interactive tools have been shown to improve student involvement and attention (Martín-Sómer et al., 2024), waste management education in many curricula remains insufficient, failing to cultivate civic responsibility or lifelong sustainable habits

(Nyika & Mwema, 2021). Additionally, low public awareness of recycling processes, with over 50% of Malaysians reportedly uninformed about solid waste management and environmental issues (Zulkipli et al., 2022). Ineffective waste disposal contributes to pollution, resource depletion, and health risks, while limited access to recycling services further discourages participation (Iparraguirre-Villanueva et al., 2023). To address these issues, this study proposes the development of LearnToRecycle, a mobile application integrating AI-powered waste detection and geolocation-based recycler finder to provide both educational and practical tools for proper waste segregation, thereby promoting environmental responsibility and sustainable living.

OBJECTIVE

i. To develop a mobile solution combining AI waste detection and geolocation for accurate identification and recycling access.
ii. To provide a mobile application that promotes environmental education and awareness, encourages community participation, and supports SDG 4 (Quality Education) and SDG 12 (Responsible Consumption and Production).

DESCRIPTION OF THE PROJECT

The application employs the YOLOv8 algorithm, trained on a custom dataset of household waste categories, to enable precise classification of objects. Users can capture or upload images, which are processed in real time to provide immediate result and correct disposal practices, while the integrated Google Maps API assists in locating the nearest recycling facilities based on the user's current location. Additional features include educational tips on recycling guidelines and a history tracking function for reviewing past classifications. Performance evaluation demonstrated strong results, with the Confusion Matrix in Figure 1 showing an overall accuracy of 89.1%. Furthermore, Figure 2 shows the the System Usability Scale (SUS) with the score of 78.92, places the application within the "good" usability range, reflecting its effectiveness and usability as a practical tool for sustainable waste management.

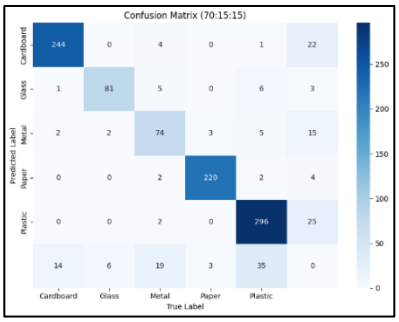

Figure 1: Confusion Matrix

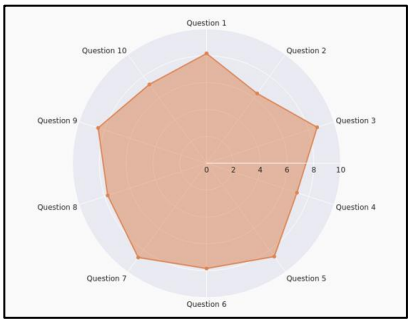

Figure 2: System Usability Scale (SUS)

NOVELTY

The novelty of LearnToRecycle lies in its seamless integration of AI-powered object detection, instant recycling guidelines, and geolocation-based facility mapping into a single mobile application. Its advanced object detection algorithm accurately identifies household waste, while the recycling guidelines provide clear, practical instructions to support user learning and awareness. The geolocation feature further enhances convenience by suggesting nearby recycling facilities, making responsible disposal both easier and more accessible. Aligned with Sustainable Development Goals 4 and 12, the application not only improves home quality of life by reducing pollution and unhygienic conditions, but also fosters early environmental responsibility by instilling sustainable habits in youngsters and families for lasting impact.

CONCLUSION

In conclusion, LearnToRecycle offers an innovative mobile solution that combines accurate waste detection, instant recycling guidance, and convenient access to nearby recycling facilities. By integrating AI-powered object detection with geolocation technology, the application not only enhances practical waste management but also promotes lasting sustainable habits. In doing so, it strengthens community environmental education and awareness, directly supporting Sustainable Development Goals particularly Goal 4 (Quality Education) and Goal 12 (Responsible Consumption and Production).

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YST020 - DESIGN & USER EXPERIENCE ASSESSMENT OF A MOBILE APPLICATION PROTOTYPE FOR DOCUMENTATION OF MEDICATION RELATED PROBLEMS AMONG UNDERGRADUATE PHARMACY STUDENTS (DREAMS-STUDY)

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ABSTRACT

The ability to identify, prevent and solve issues related to the ineffectiveness and unsafe use of medications is a core competency in pharmacy practice and these issues are referred to as Medication-Related Problems (MRPs). Such competency starts with good practice of MRP documentation. At present, the learning materials for this critical skill rely heavily on paper-based documentation that is fragmented and lacking real-time support during clinical clerkship which hinders the development of structured clinical reasoning among students. To address this, Rx LogPro, a mobile-based application prototype, was developed to integrate documentation, embedded clinical references, and interactive visual tools to guide students through the MRP documentation process. Using the User-Centered approach, the prototype transforms documentation from a routine, burdensome task into a reflective and educational experience. By aligning with modern learning preferences and the realities of clinical practice, Rx LogPro not only redefines how clinical pharmacy documentation is taught but also streamlines the documentation process and empowers students with confidence and competence in planning for patient medication plans. This innovation seeks to demonstrate how digital platforms can shift the educational paradigm hence making clinical experience more intuitive and future-ready.

Keywords: digital innovation, mobile health, MRP documentation, pharmacy education, student-centered learning

INTRODUCTION

Identifying and documenting medication-related problems (MRPs) during clinical clerkship is a challenging yet essential skill for pharmacy students. Effective learning requires consistent, standardised tools to guide MRP classification and prioritisation. Current paper-based documentation is fragmented, requiring students to switch between

different documents, which reduces time for understanding the treatment regimen, and increases the likelihood of mistakes from multiple transcribing of information (Biswas & Talukdar, 2024) thus limiting their practical experience and overall confidence in proposing individualised patient medication plans. Our unpublished data from a recent project on pharmacy documentation revealed that, documenting MRPs using multiple forms is often labour-intensive (Hizwani Azahar, 2024) for both students and practitioners. In parallel, mobile phones have become an integral part of students' daily lives, making them an ideal platform for educational tools (Chan & Fung, 2020). The Rx LogPro is an innovative mobile application prototype developed to address this gap by providing a structured, student-friendly platform for documenting MRPs during clinical clerkship. It integrates core clinical tasks into a single digital interface and, most importantly, it embeds standardised MRP classifications and clinical intervention prompts. This digital shift not only improves documentation efficiency but also supports the development of future-ready pharmacists equipped to deliver safe, effective, and patient-centered care.

OBJECTIVE

i. To develop a mobile application prototype that integrates structured templates, embedded clinical references, and visual tools tailored to the needs of pharmacy students during clinical clerkship
ii. To explore students' perception on the impact of the prototype on their efficiency in understanding and completing MRP documentation during clinical clerkship training.

DESCRIPTION OF THE PROJECT

As shown in Figure 1, Rx LogPro uses the Loveable AI platform to provide secure access for patient confidentiality, embed clinical references that simplify MRP identification for students, and offer structured documentation templates. These features also reduce time spent on repetitive entry of patients' medical and medication histories.

The main features of this app are as follows:

- ***MRP Decision Tree template (step-by-step MRP documentation):*** Rx LogPro introduces a structured decision tree-based templates designed to guide pharmacy students through step-by-step process of documenting MRPs. These templates provide predefined layouts that capture critical components of MRP, including the type and cause of the MRP, recommended pharmacy interventions, and anticipated treatment outcomes. The templates use dropdown menus with contextually relevant options that support the students in making clinically sound and case-specific decisions. Such features enhance the quality, consistency, and clinical reasoning involved in MRP documentation, as illustrated in Figure 2.
- ***MRP Statistical Report:*** Rx LogPro automatically tracks and aggregates the number of MRPs documented by each student, generating a visual summary of their clinical documentation performance. This feature enables clinical preceptors to monitor students' progress in identifying and characterising MRPs across various clerkship rotations as shown in Figure 3.

To support its impact, students who have used the Rx LogPro were invited to voluntarily provide feedback through qualitative in-depth interviews using probes adapted from the User Experience Questionnaire (UEQ) (Schrepp, 2015).

Figure 1: Rx LogPro User Interface

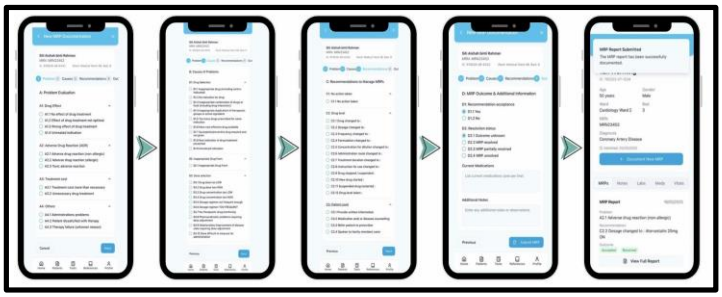

Figure 2: Step by step MRPs documentation templates in Rx LogPro

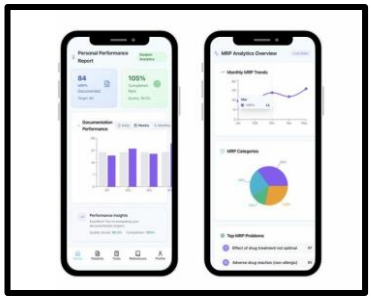

Figure 3: MRP Statistical Report in Rx LogPro

NOVELTY

Rx LogPro is the first locally developed mobile platform to integrate documentation, review, and reflection of medication-related problems (MRPs) into pharmacy students' clinical clerkship training. Unlike conventional drug reference applications, this innovation is aligned with the local pharmacy curriculum and employs a novel MRP decision tree for structured, step-by-step documentation of MRP types, causes, recommendations, and outcomes. It also integrates decision-support tools, enhancing both student learning and preceptor feedback, and positioning it as a transformative solution for future-ready pharmacy education. Feedback was gathered from 16 pharmacy students, with 93.8% reporting improved efficiency in understanding and completing MRP documentation during

clinical clerkship. All participants gave positive feedback across key domains, including Attractiveness (S5: design minimalist, senang cari info), Dependability (S9: suka ada security login), Stimulation (S8: valuable for clerkship), and Novelty (S5: tiada lagi app yang macam ni).

CONCLUSION

Rx LogPro transforms MRP documentation into a streamlined, mobile-first learning experience that builds confidence, accuracy, and clinical reasoning for future-ready pharmacists. Its user-centered design bridges theoretical knowledge and practical application, offering a scalable solution to modernise pharmacy education and practice.

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YST021 - BOOK BUDDY

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ABSTRACT

UiTM students always face difficulties in acquiring academic resources, such as the textbook, due to higher costs, limited availability and inefficient mechanism in purchasing, selling, or books exchange. By introducing the Book Buddy app, it gives benefit to UiTM students to get affordable academic resources related to their courses. By streamlining the textbook acquisition process, Book Buddy not only saves time and effort for students but also support the academic community. It empowers students to easily access the resources they need, enable them to focus more on their studies and less on the logistical challenges of securing the textbooks. By combining academic-specific functionality, verified student access, and environmentally conscious features, the Book Buddy app offers a comprehensive solution that goes beyond traditional secondhand book platforms that cater specifically to the needs of UiTM students.

Keywords – Book Buddy, UiTM, buying, resources, selling

INTRODUCTION

Higher education students frequently face difficulties in acquiring the resources due to their high cost, limited availability for resources and lack of an efficient mechanism to purchase, sell or exchange the books with other students. Students search for secondhand academic materials by using the Telegram platform or any general internet marketplaces, and still do not fulfill the academic requirement. The absence of an organized system leads to inefficiency and lack of trust in the searching process. Students also frequently use Telegram groups to search for materials and they needed to request manually and wait for responses. Due to the enormous number of messages in the groups, many posts are missed, students are left out with no responses and no solutions given to them.

The present platforms have searching incapabilities and prevent the students from filtering the needed books by course, semester, subject or their needs. This will limit the search results because of severe inefficiencies and limited the ability in identifying appropriate information and left the students with few options. Unsecured payment system and user verification mechanisms will expose the students to fraudulent sellers, false listings and payment disputes and will give risk to them. When there is no authentication for user identification and securing the transaction, the sites used might be dangerous.

Book Buddy app addresses these issues by developing an application that is designed specifically to address the unique needs for UiTM students. This app provides a simple

app and secures the process of buying, selling or exchanging textbooks and reference materials. With features such as course-specific search filters, in-app chat functionality and a user verification system, Book Buddy ensures more efficient and reliable experience for students. This platform is tailored to reduce stress, enhance trust and offer a personalized user experience by addressing the limitations of existing methods.

OBJECTIVE

The objectives of Book Buddy application:

i. To provide an affordable solution for UiTM students to buy, sell, or exchange books directly with their peers.
ii. To simplify the process of finding and obtaining course-related books by enabling searches based on program, subject, semester, or other filters.
iii. To ensure a safe environment for transactions through student verification, in-app messaging, and QR code-based transaction confirmations.

DESCRIPTION OF THE PROJECT

Book Buddy app offers easy-to-use interface for both buyers and sellers. It is designed to meet the needs of academic users, provides easy way in buying and selling books and creates a safe and productive space. For buyers' perspective, the app facilitates search and filtering books by a number of factors, including program, subject, and price range This app also can access required data in order to make wise purchases and can bookmark the products that they are interested. Other than that, the app offers the buyers' personalized book recommendations and offer two delivery methods - COD and shipping.

For the sellers, they are able to post and manage the book listings, update the booking status that allows the seller to indicate whether their books are sold, pending, or available. Furthermore, the buyer and seller can communicate by using the built-in chatbot on the platform and enable sellers to monitor the delivery process and provide updates to purchasers.

The Book Buddy app also offer secure transactions features that need the users to validate their accounts by using UiTM student emails. Notification system features are also included in this app by updating the bookmarked items, new book listings, and other activities in real time. By providing the information, this app helps buyers and sellers remain active on the marketplace and improve the user experience.

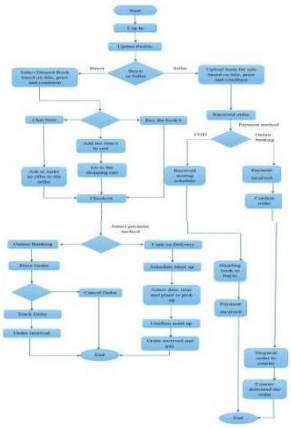

Figure 1: Book Buddy Flowchart

Figure 2: Book Buddy app

NOVELTY

The uniqueness of Book Buddy app is produced for UiTM students and integrated intelligent decision-making support systems and also have many innovative features. Here are some features that can highlight the uniqueness of this app:

1. Student verification - the app connected with UiTM's student verification portals that to verify their status. This exclusivity will cultivates trust within the platform and establish a secure atmosphere for educational transactions.
2. Advanced searching and filtering - enables students to locate books according to course, semester, subject, book condition and price range.
3. Personalized and customized - the buyer can personalize the book recommendations based on a buyer's course or program and can customize their profile information.
4. Dual functionality - allowing transition between buyer and seller positions on the same platform. Sellers can easily list the books with details such as price, condition, and campus location, while buyers can browse and negotiate via secure in-app chat.
5. Secured transaction - using safe payment methods or cash-on-delivery options.
6. Hybrid Chat System - enables buyers to communicate with sellers using AI-powered responses for frequent or suggested.
7. Environmentally sustainable elements - monitors the ecological effects of secondhand book trades, including the carbon savings and promotes sustainability by users incentive's with points for eco-friendly behaviors and fostering a culture of environmental consciousness among the student community.
8. Logistics and delivery options - including campus meet-up points, that make book exchanges more convenient.

CONCLUSION

Book Buddy app has successfully identified and addressed the common issues faced by UiTM students in finding cheaper and more affordable academic resources. The app will provides a good platform for buying, selling, and exchanging textbooks, hence fostering a sense of community among students. Furthermore, Book Buddy app also offers a better alternative rather than informal channels like Telegram groups that are not organized and secure. It comes with course-specific search filters, secure transaction mechanisms and user verification.

The positive feedback during testing phases testifies the demand, therefore, Book Buddy app will satisfy not only the need but also UiTM's mission to continually upgrade educational experiences with innovative technology. Overall, this platform represents one step forward to support the students' academic journey by reducing the logistical burdens associated with resource acquisition.

YST022 - FUNDMYSTUDY: SCHOLARSHIP FINDER

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ABSTRACT

Increasing tuition fees in Malaysia hinder access to higher education for low-income students. FundMyStudy, a smartphone application, personalises scholarship searches and applications to address this issue. Using a user-centered design, it offers deadline notifications, multilingual support, and an application tracker, and AI-powered matching. Unlike conventional platforms, it provides an interactive, user-friendly interface built with Figma, enhancing usability and visual appeal. FundMyStudy improves financial decision-making and reduces missed opportunities by centralizing scholarship information and offering real-time support. Early prototype feedback highlights its potential to boost user engagement, accessibility, and application success rates. Overall, FundMyStudy can play a vital role in advancing educational equity in Malaysia.

Keywords – Figma, Higher education, Malaysia, Scholarship, Smartphone application

INTRODUCTION

Access to higher education is essential for individual and national progress. However, the increasing cost of tertiary education from RM 30,000 to RM 100,000, depending on various institutions and programs, has created a major barrier for many students (Abdullah, 2019). This financial strain particularly affects people from low-income families, leading to academic dropouts. According to the Asian Institute of Fund (AIF), 63% of young Malaysians are anxious about their ability to afford further education, with financial stress as a factor impacting their mental health and academic performance. A study by Berlanga, 2014 & Berlanga et. al, 2022, mentioned that these obstacles include the requirement to balance work and school, which restricts their time commitment, and the absence of social or academic support systems. Scholarships serve as a safeguard in this situation by offering not only monetary assistance but also an extra motivation to continue attending school (Berlanga & Corti, 2025).

Hence, FundMyStudy application was developed to ease the process of scholarship discovery and application. By centralizing scholarship data, sending reminders, and using AI recommendations, the application enhances accessibility, reduces missed opportunities, and promotes equitable education for Malaysian students.

PROJECT OBJECTIVES

The main objectives are: (1) to create a centralized platform for discovering scholarships and grants from various sources, and (2) to provide personalized recommendations based on the student's details.

DESCRIPTION OF THE PROJECT

FundMyStudy is an intelligent, all-in-one platform designed to streamline the scholarship discovery and application process for students, parents, and institutions. It leverages AI-driven matching to connect users with the most relevant opportunities based on academic profile, background, and preferences. The app features a centralized dashboard, advanced search filters, deadline reminders, and application trackers, allowing users to manage their scholarship journey efficiently. Multilingual support, clear eligibility details, and FAQs promote independent use, while saved scholarships and personalized alerts encourage ongoing engagement. Hence, with its clean, responsive interface and focus on usability, FundMyStudy reduces the complexity and time burden of scholarship applications, making it a practical and inclusive tool for securing educational funding.

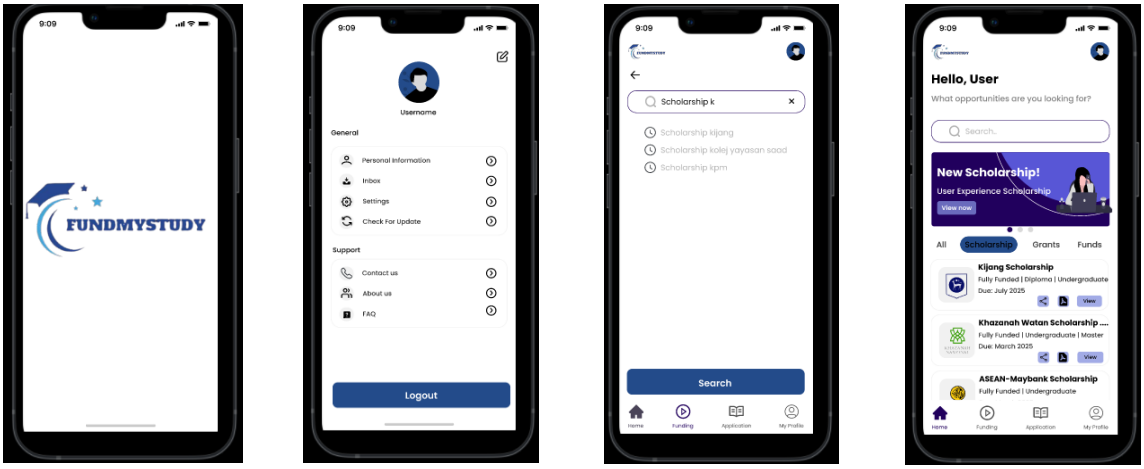

Figure 1 : The front end of FundMyStudy Application

NOVELTY

FundMyStudy adopts a user-centred design for accessibility, convenience, and personalization. Unlike static listings, it integrates six features: (1) AI-Powered Scholar Matching, (2) Application Progress Tracker, (3) Bookmarked and Saved Scholarships, (4) Application Review Tools, (5) Notifications and Deadlines, and (6) Multilingual Support.

It offers a user-friendly and visually appealing platform that simplifies scholarship searches for students, parents, and institutions. The integrated tools, such as AI matching, trackers, and reminders ease the process, reduce manual effort, and deliver relevant results. The platform provides clear scholarship details such as eligibility, deadlines, and application steps. Development design of FundMyStudy uses Figma to prototype and simulate usage,

incorporating dynamic elements for intuitive navigation. Iterative testing ensures responsive, and accessible design, especially for first-time applicants.

CONCLUSION

In conclusion, FundMyStudy centralises scholarship opportunities, leverages AI for personalised matching, and offers tools to track applications, which helps students, parents, and institutions. It supports equitable education through accessibility, transparency, and engagement. Future improvements should include user testing for enhanced UX, integration with real-time scholarship databases via APIs, and securing IP rights for sustainability. With continued development, FundMyStudy can significantly bridge financial gaps in Malaysian higher education.

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YST023 - FIT FIGHT MUSCLE CARD EDITION

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ABSTRACT

This project introduces the Fit Fight Muscle Card Edition, a gamified educational tool designed to enhance students' understanding of human muscular anatomy. Recognising that traditional memorisation methods might limit engagement and retention, the creators developed a versatile game comprising two decks: one with 18 Muscle Cards displaying major muscles through images and names, and another with Q&A Cards containing questions related to those muscles. During gameplay, students draw one card from each deck and respond within 30 seconds, earning points for correct answers. The approach involves small group interactions where students collaborate and compete, fostering active participation and peer learning. As students engage with the cards, they are prompted to identify muscle names, functions, and their associated movements, thereby connecting theoretical knowledge with practical application. This interactive method promotes active learning, critical thinking, and the practical application of anatomical knowledge by linking muscles to functional movements and exercises. Preliminary evaluations indicate that the game improves muscle recognition, recall, and understanding while fostering motivation and peer interaction. Its cost-effective, adaptable design caters to various learning styles, including visual, kinaesthetic, and auditory, making it a valuable supplement to traditional anatomy teaching. Overall, the *Fit Fight Muscle Card Edition* offers an engaging, effective, and innovative approach to supporting anatomy education and enhancing student learning outcomes.

Keywords – Active Recall, Anatomy, Educational Game, Muscular System, Sports Science

INTRODUCTION

A thorough understanding of the human muscular system is vital for students studying anatomy, sports science, and related health disciplines. Traditional approaches often emphasise rote memorisation, which can limit deep comprehension and restrict practical application. Many students find it difficult to connect their theoretical knowledge of muscles with their practical significance in athletic performance, injury prevention, and rehabilitation. Moreover, there is a shortage of engaging educational tools that promote active recall and real-world usage. In response to these challenges, this project aims to create an innovative, interactive platform that closes the gap between theory and practice, encouraging a more profound understanding and enabling students to transfer their knowledge into real-world skills more effectively. Implementing interactive, game-based learning methods has been shown to enhance student engagement, improve memory retention, and facilitate the real-world application of anatomical concepts.

OBJECTIVES

This project aims to develop the Fit Fight Muscle Card Edition to assist students in learning, recalling, and applying knowledge of major human muscles and their functions.

The objectives are:

i. To develop an engaging and effective tool for learning and retaining muscle names, locations, and functions.
ii. To assess the game's educational impact on students' understanding and recall of muscular anatomy.

DESCRIPTION OF THE PROJECT

The game consists of two decks:

- Deck 1: Muscle Cards – 18 cards, each displaying a major muscle with its name and picture.
- Deck 2: Q&A Cards – cards containing a question or challenge related to the selected muscle (e.g., "What is the antagonist muscle?", "Demonstrate three (3) exercises for this muscle.").

Gameplay:

i. A player draws one Muscle Card and one Q&A Card.
ii. The player responds within 30 seconds.
iii. Correct answers earn 1 point. Incorrect answers earn zero (0) and face punishment.
iv. Play proceeds in turns for individuals or teams.

The game's functionality depends on its interactive design, which combines visual stimuli with targeted questions. The Muscle Cards act as visual anchors, helping players connect the names of major muscles with their functional and anatomical importance. The related Q&A Cards challenge players to recall specific details, thereby strengthening their understanding through active recall and problem-solving. The timed response feature (30 seconds) creates a cognitive pressure that encourages quick thinking and further enhances memory retention.

In terms of usefulness, this game provides several educational advantages. Firstly, it encourages active learning by requiring players to engage with anatomical concepts in a lively manner, contrasting with passive memorisation methods. The dual-card system promotes multisensory learning, namely visual recognition supported by verbal responses, catering to different learning styles. Additionally, the competitive or team-based format can motivate ongoing engagement, making the process of acquiring complex anatomical knowledge more accessible and enjoyable.

From a practical perspective, the game shows versatility and ease of implementation in educational or training environments. Its reliance on simple card decks makes it portable and adaptable to various group sizes and settings, from classrooms to fitness training sessions. The straightforward rules enable quick setup and minimal preparation, allowing facilitators to incorporate the game into curricula or workshops seamlessly.

Overall, this game serves as an effective educational tool that utilises visual and cognitive strategies to enhance understanding of muscular structure. Its interactive design increases engagement, retention, and application of anatomical knowledge, making it a practical and valuable resource for educators, trainers, and learners.

Figure 1 : Fit Fight Muscle Card Edition

NOVELTY

The product's novelty lies in its integration of immersive, gamified learning experiences with real-time application scenarios, specifically tailored for the human muscular system. Unlike traditional textbooks or simple digital quizzes, this game employs interactive simulations to create a highly engaging and personalised learning environment. It uniquely combines active recall techniques with practical, context-based exercises that enable students to directly link anatomical knowledge to athletic performance, injury prevention, and rehabilitation. This combination of inventive ideas and practical learning guarantees a more effective and memorable educational experience.

CONCLUSION

The *Fit Fight Muscle Card Edition* is an affordable, versatile educational resource suitable for various learning levels. It encourages active, peer-based learning, caters to multiple learning styles (visual, kinaesthetic, auditory), and makes studying anatomy engaging and purposeful.

YST024 - ECOTOPSIS: A BIG DATA APPROACH FOR SUSTAINABLE EVALUATION AND RANKING

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ABSTRACT

This study introduces EcoTOPSIS, a web-based decision support tool designed for sustainability project evaluation under the theme *"Celebrating Innovation, Commercialisation and Publication."* The system employs the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method to rank alternatives, enabling users to upload datasets, define benefit and cost criteria, assign weights, and obtain step-by-step outputs with visualizations. By integrating big data processing with automated computation, EcoTOPSIS enhances efficiency, accuracy, and transparency compared to traditional manual Multi-Criteria Decision-Making methods. Its interactive platform supports reproducibility, provides downloadable results, and offers practical applicability in areas such as project selection, technology adoption, and resource allocation. The tool effectively bridges the gap between theoretical models and real-world applications, reduces bias and computational errors, and facilitates evidence-based decision-making aligned with sustainable development objectives.

Keywords – Big data analytics, Decision support systems, Multi-Criteria Decision-Making, Sustainability evaluation, TOPSIS method

INTRODUCTION

The rapid growth of sustainability initiatives has introduced increasingly complex decision-making challenges, where multiple environmental, economic, and social criteria must be evaluated simultaneously. Traditional project evaluation and ranking approaches often rely on manual Multi-Criteria Decision-Making (MCDM) methods, which are time-consuming, prone to computational errors, and unsuitable for handling large datasets. These limitations hinder transparent and data-driven decision-making, particularly in contexts that demand quick assessments and reproducible results.

Recognizing this gap, EcoTOPSIS was developed as an interactive, web-based decision support tool. The motivation behind the creation of EcoTOPSIS lies in addressing three key challenges: the inefficiency of manual computations, the lack of transparency in conventional ranking processes, and the need for a scalable platform capable of integrating big data in sustainability evaluations. By automating the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method and visualizing each step of the evaluation process, the system provides a reliable, user-friendly, and academically

robust solution for researchers, policymakers, and organizations seeking evidence-based decision-making in sustainable project selection and resource allocation. Hwang and Yoon proposed the method in 1981, and it has been used extensively in socioeconomic studies, in scientific studies, and by policy analysts (Zhang et al., 2017).

OBJECTIVES

The development of EcoTOPSIS: A big data approach for sustainable evaluation and ranking is guided by the following objectives:

i. To design and implement a web-based decision support tool that applies the TOPSIS method to automate the evaluation and ranking of alternatives based on multiple sustainability-related criteria.
ii. To integrate big data handling capabilities that enable rapid, accurate, and scalable evaluations, reducing the limitations of manual computation and supporting evidence-based decision-making.

DESCRIPTION OF THE PROJECT

EcoTOPSIS is an interactive, web-based decision support tool developed to streamline the process of MCDM for sustainability-focused projects. The system was built using Python and Streamlit, enabling real-time computations and user interactivity. Its primary objective is to automate the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method, allowing users to evaluate multiple alternatives against several benefit and cost criteria with enhanced transparency and efficiency. Users can upload datasets in Excel or CSV formats, assign weights to criteria, specify their types (benefit or cost), and instantly visualize the results without performing manual calculations. The website is accessed through the link : https://ecotopsis-harrisf.streamlit.app/.

Functionally, EcoTOPSIS integrates step-by-step TOPSIS computation with features that include vector normalization, weighted normalization, identification of Positive and Negative Ideal Solutions (PIS and NIS), and calculation of Euclidean distances and closeness coefficients. The system automatically generates ranked outputs, which can be explored through interactive visualizations such as bar charts and line plots. Additionally, users can download final rankings in CSV or Excel formats, enabling further analysis and documentation. By incorporating big data capabilities, the tool can handle datasets with a large number of criteria and alternatives, supporting research and decision-making processes that demand both speed and accuracy. By simplifying complex evaluations and providing real-time ranking insights, the platform supports evidence-based resource allocation and strategic planning. The workflow of EcoTOPSIS is illustrated in Figure 1, highlighting its seamless process from dataset upload to final ranking visualization and report generation.

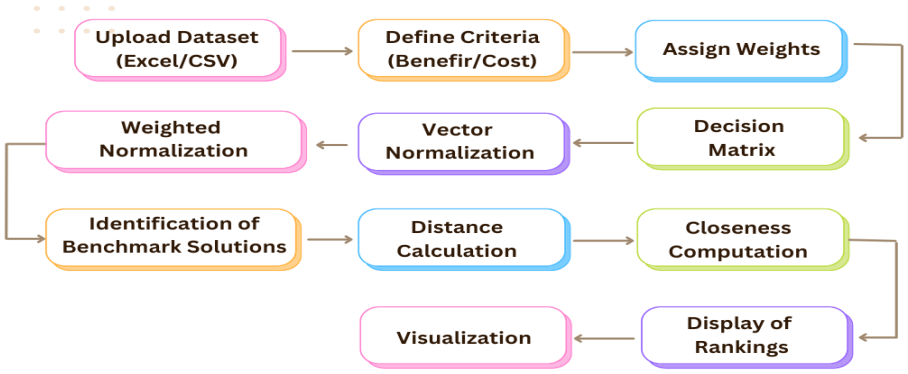

Figure 1:Flowchart of EcoTopsis

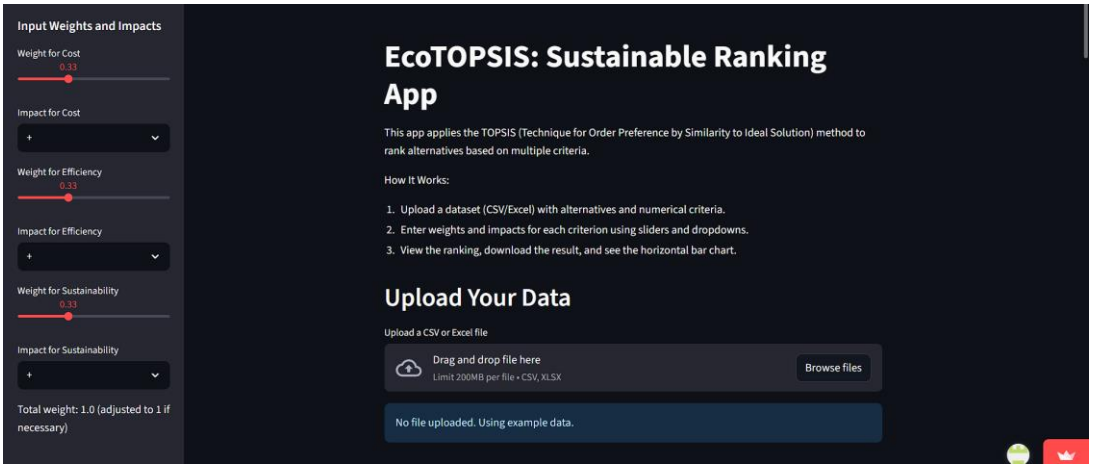

Figure 2: EcoTopsis interface

NOVELTY

The novelty of EcoTOPSIS lies in its seamless integration of big data capabilities, automated TOPSIS computation, and interactive visualization within a single, accessible web-based platform.TOPSIS showed that it not only helped complex decisions but also acted as a reliable system for offering recommendations (Cheng et al., 2018). Unlike traditional MCDM tools that depend on manual calculations or static spreadsheets, EcoTOPSIS offers a fully automated workflow that performs normalization, weighting, distance calculations, and ranking in real time, enabling efficient analysis of large datasets while minimizing human error and ensuring transparency through step-by-step outputs. By combining data processing, computation, and visualization with downloadable results and interactive charts, it bridges academic models with practical applications, delivering a scalable, user-friendly, and reproducible decision-support tool for sustainable, data-driven policymaking and innovation.

CONCLUSION

EcoTOPSIS overcomes the limitations of conventional decision-making tools by offering a transparent, efficient, and scalable web-based platform for multi-criteria evaluations. Automating the TOPSIS method, it unifies dataset processing, weight assignment, normalization, distance computation, and ranking with interactive visualizations and

downloadable results. Its big data handling and real-time computation enhance practicality, reduce human error, and ensure reproducibility. By integrating automation, visualization, and user interactivity, EcoTOPSIS bridges theory and practice in sustainability evaluations. This innovative tool supports researchers, policymakers, and organizations in data-driven, evidence-based decision-making, advancing digital MCDM solutions that promote innovation, commercialization, and sustainable development across diverse evaluation contexts.

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YST025 - INNOVATIVE LOCATION-ROUTING OPTIMIZATION USING K-MEAN CLUSTERING ALGORITHM AND MTZ-TSP MODEL

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ABSTRACT

Inspired by the challenges of last-mile delivery, this project presents an innovative location–routing optimization framework that integrates the k-means clustering algorithm with the MTZ-TSP model. In the first stage, demand points are clustered, and their centroids are identified as strategic hubs. In the second stage, optimal routes between these hubs are determined to minimize travel distance, shorten delivery time, and enhance operational efficiency. The framework's performance was evaluated using three datasets. Although not applied to a real-world case, it shows strong commercial potential in sectors such as e-commerce, courier services, waste collection, public transport planning, and emergency response. This work also supports SDG 9 (Industry, Innovation, and Infrastructure) and SDG 11 (Sustainable Cities and Communities) by enabling smarter resource use, lowering environmental impact, and enhancing service delivery.

Keywords – Clustering, K-means clustering, Last-mile delivery, MTZ-TSP, Routing

INTRODUCTION

Efficient location and routing planning is essential in systems with spatially dispersed demand points, as inefficiencies lead to longer travel distances, higher costs, and wasted resources. A prime example is last-mile delivery system which is indispensable in providing services to end customers, accounting for 13–75% of the entire supply chain cost (Wei et al., 2024). Additionally, Malaysia's e-commerce revenue increasing by 5.4% year-on-year in Q3 2023 (Kaur, 2024) underscoring the need for optimal distribution system solutions. Inspired by these challenges, this project applies a mathematical modelling approach that combines clustering and routing techniques, presenting an innovative location–routing optimization framework that integrates the k-means clustering algorithm with the MTZ-TSP model to enhance efficiency and reduce operational costs.

OBJECTIVES

There are two objectives of the study:

i. To cluster the demand points by using k-means clustering algorithm.
ii. To improve delivery operations by optimizing travel routes with the MTZ-TSP model.

DESCRIPTION OF THE PROJECT

The proposed framework consists of two main stages. In the first stage, the k-means clustering algorithm is used to group demand points into *k* clusters based on spatial proximity. There are four steps which describe in the Figure 1.

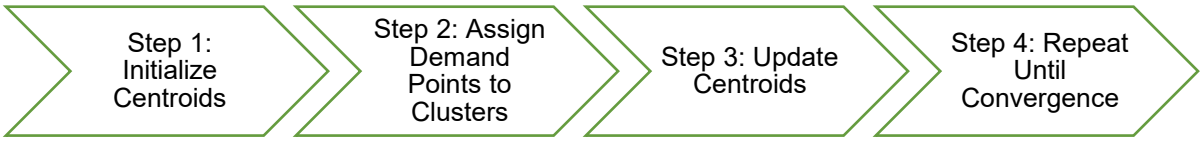

Figure 1: The four steps for k-means clustering algorithm

As shown in Figure 1, the process consists of four steps: first, randomly select *k* points as the initial centroids; second, assign each demand point to its nearest centroid using Euclidean distance; third, update each centroid to the average position of its assigned points; and finally, repeat steps 2 and 3 until the centroids stabilize. In this stage, the centroid of each cluster is designated as a strategic hub, and the routes between these hubs are calculated using the MTZ-TSP model, which is accomplished in stage two of the framework.

The second stage, the Miller–Tucker–Zemlin Traveling Salesman Problem (MTZ-TSP) model is applied to determine the optimal routes between the identified hubs. Let *i* and *j* be set of vertices such that *i*, *j* = 1,2,3,..., *n*, given that *i* *j*. The travel distance between *i* and *j* is denoted by and *p* is the maximum number of vertices that can be visited. The model has two decision variables, which are that value to 1 if the travel from *i* to *j* is selected, and 0 otherwise. The and are used to eliminate the sub-tour. The entire model is as follows:

$$Min \sum_{i} \sum_{j} t_{ij} x_{ij} \tag{1}$$

such that:

$$\sum_{i=0, i \neq j} x_{ij} = 1; \qquad \forall j = 1, 2, \ldots, n \tag{2}$$

$$\sum_{j=0, j \neq i} x_{ij} = 1; \qquad \forall i = 1, 2, \ldots, n \tag{3}$$

$$u_i - u_j + (p) x_{ij} \leq p - 1; \qquad 1 \leq i \neq j \leq n \tag{4}$$

Objective function, i.e., to minimize the total travel to all locations presented by (1). Inequalities (2) – (4) are the constraints of model. Inequality (2) and (3) strictly indicate

that all the locations must be visited at least once. Ine-quality (4) is the sub-tour elimination constraint. This indicates that no location will be visited more than once.
To evaluate the proposed framework, three datasets which are small, medium, and large were generated in Microsoft Excel with randomly assigned locations. The k-means clustering algorithm was implemented in Excel, while the MTZ-TSP model was solved using CPLEX to compute the optimal routes. The results show that the proposed framework successfully identified optimal clusters and routes for all datasets, as presented in Figure 2. Figure 2 presents the results for each of the three datasets, illustrating the corresponding clusters and their optimal routes.

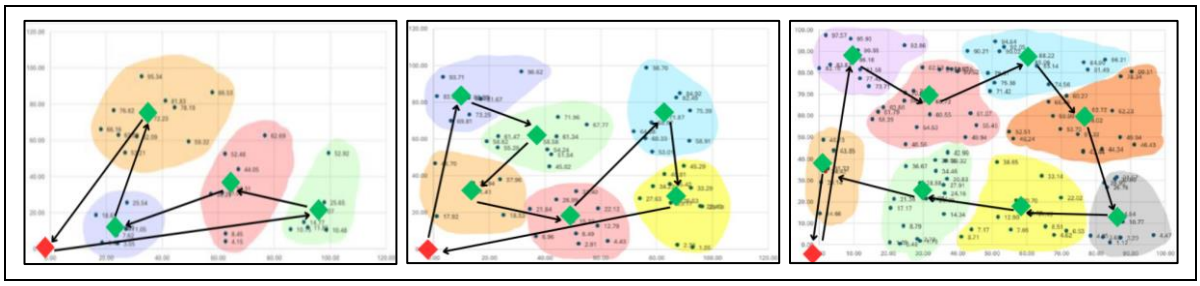

Figure 2: The results for the three datasets are shown from left to right: small, medium, and large.

NOVELTY

This project introduces an innovative location–routing optimization framework that combines clustering and routing methods to tackle real logistics challenges, such as grouping customer locations and planning efficient delivery routes. Developed as a prototype simulation model, it demonstrates how data-driven clustering and route optimization can improve service quality and is applicable to real customer address data in e-commerce, last-mile delivery, ride-sharing, and on-demand services. Aligned with SDG 9 and SDG 11, the framework promotes smarter resource use, sustainable urban mobility, and reduced environmental impact, while offering strong commercial potential across multiple industries. With strong commercial potential, it can be deployed as a software add-on or a standalone tool, giving businesses a competitive edge.

CONCLUSION

The project developed a location–routing optimization framework integrating the k-means clustering algorithm with the MTZ-TSP model to address the challenge of planning efficient routes for spatially dispersed demand points. Through simulated datasets, the framework successfully identified optimal clusters and routes, demonstrating its potential applicability to logistics operations and other fields with similar spatial distribution problems.

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YST026 - DEVELOPMENT OF THERMAL INSULATING MATERIALS FROM CORN HUSK FIBRES

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ABSTRACT

The demand for sustainable materials in textiles has driven interest in natural fibres with thermal insulation properties. Corn husk, a biodegradable agricultural by-product, is often discarded despite its potential value. This study explores corn husk fibres as a thermal insulation material. Collected husks were cleaned, chemically treated with sodium hydroxide or sulfuric acid, processed into nonwoven sheets, and tested for surface appearance, thickness, areal density, and heat retention. Results showed that the untreated sample had the greatest thickness and best heat retention, while 5% NaOH treatment produced the best fibre separation and compaction. Strong acid treatments weakened fibres and reduced insulation performance. These findings highlight corn husk fibres as a viable eco-friendly alternative to synthetic insulators.

Keywords – Corn husk, Eco-friendly, Sustainable materials, Thermal insulation

INTRODUCTION

Growing environmental awareness has driven industries to seek renewable, biodegradable alternatives to synthetic materials. In textiles and construction, there is particular interest in eco-friendly materials that provide thermal insulation while reducing environmental impact. Agricultural waste fibres are promising candidates due to their abundance, low cost, and sustainability.

Corn husks, the outer leaves protecting corn cobs, are produced in large quantities worldwide, with about 140 million tonnes generated annually. Despite this, they are often discarded or openly burned, contributing to air pollution, especially in rural farming areas. In Malaysia, agricultural biomass production is high, yet corn husks remain underutilised. While natural fibres such as jute, flax, and coconut husk have been studied for insulation, corn husks have received less attention despite their low thermal conductivity, durability, and structural stability. This study investigates the potential of corn husk fibres as a sustainable material for textile-based thermal insulation, highlighting opportunities to transform agricultural waste into high-value products, reduce reliance on synthetic insulators, and promote a circular economy.

OBJECTIVES

i. To develop thermal insulation materials from corn husk fibres.
ii. To assess the thermal insulating properties of the fabricated nonwoven materials from corn husk fibres.

DESCRIPTION OF THE PROJECT

Corn husks were collected from local markets in Kuala Pilah, washed, shredded, and dried to remove impurities and reduce moisture. They were then treated with sodium hydroxide (NaOH) or sulfuric acid (H_2SO_4) at varying concentrations to break down non-cellulose components and improve fibre quality. The fibres were mixed with a binder (sodium alginate, glycerine, and distilled water) and formed into nonwoven sheets, which were cross-linked with calcium chloride ($CaCl_2$) for added strength before oven drying.

The materials were tested for surface appearance (microscopic observation), weight, thickness, and heat retention. Surface appearance assessment identified fibre separation and surface smoothness, thickness and weight tests gauged structural and heat-trapping properties, and the heat retention test evaluated the material's ability to maintain warmth over time.

Figure 1: Image of nonwoven sheet samples; a – untreated, b – treated with 3% NaOH, c – treated with NaOH 5%, d – treated with H_2SO_4 7% and e - treated with H2SO4 10%.

Figure 1 above shows the nonwoven insulation sheets produced. The five insulation sheet samples – untreated, NaOH-treated (3% and 5%), and H_2SO_4-treated (7% and 10%), showed distinct differences in fibre structure, thickness, density, and heat retention.

Microscope observations revealed that 5% NaOH produced the smoothest, best-separated fibres, while strong acid treatments caused surface damage and weakened structures. Areal density was highest in the 5% NaOH sample, indicating tighter compaction, whereas the untreated sample was the bulkiest with the lowest density. In terms of thickness, the untreated sample was the thickest (15.32 mm), followed by moderate thickness in 7% H_2SO_4, while the 10% H_2SO_4 sheet was the thinnest due to fibre degradation.

Heat retention tests showed that the untreated sample performed best, with the smallest temperature drop (54°C) after 30 minutes, mainly due to its bulky structure trapping more air. Treated samples retained less heat, with the 10% H_2SO_4 sample performing worst (65°C drop) as excessive acid weakened fibres and reduced thickness. Statistical analysis indicated that thickness had a moderate effect on heat retention, while areal density had little impact. Overall, fibre condition and sheet thickness were more critical to thermal insulation performance than weight alone, with moderate alkaline treatment offering the best balance between structure and processability.

NOVELTY

This project introduces the use of corn husk fibres, a widely available but underutilised agricultural waste, as a sustainable raw material for textile-based thermal insulation. It uniquely compares the effects of different chemical treatments on fibre quality, structure, and heat retention, identifying moderate alkaline treatment as the optimal method to balance processability and insulation performance.

CONCLUSION

Corn husk fibres show strong potential as a sustainable thermal insulation material, with performance driven mainly by fibre condition and thickness. Moderate alkaline treatment, particularly 5% NaOH, achieved the best balance between fibre quality and insulation efficiency, while strong acid treatments degraded performance. This approach offers an eco-friendly alternative to synthetic insulators and supports the circular economy. As this is a preliminary laboratory-scale study, further research using advanced testing methods is recommended.

YST027 - SO-LEANYUM: FUNCTIONAL SAUCE FROM TERUNG ASAM (SOLANUM LASIOCARPUM DUNAL) WITH ENHANCED ANTIOXIDANT PROPERTIES AND ANTI-OBESITY POTENTIAL

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ABSTRACT

The growing demand for functional foods offers an opportunity to create products that support healthier lifestyles and address public health challenges such as obesity. *Solanum lasiocarpum* Dunal, locally known as '*terung asam*', is a native Bornean fruit valued in Sarawak for its culinary and medicinal uses. Rich in chlorogenic acid, it possesses strong antioxidant activity and potential anti-obesity benefits. While *terung asam* has been incorporated into product such as sauces, research on optimising these formulations remains limited. *So-LeanYum* is a novel functional sauce developed using D-optimal mixture design to maximise nutritional value while maintaining appealing sensory and storage qualities. The formulation, consisting of *terung asam* purée (98.46%), virgin coconut oil (0.73%), and garlic powder (0.81%), was optimised for total phenolic content (TPC), total flavonoid content (TFC), antioxidant capacity (DPPH assay), chlorogenic acid content, and storage stability. Its anti-obesity potential was evaluated through both in-silico and in-vitro approaches, while consumer acceptance was assessed via sensory testing against commercially available sauces. *So-LeanYum* demonstrated high chlorogenic acid content, retained strong antioxidant activity over 28 days, and exhibited promising anti-obesity effects. Sensory evaluation indicated excellent consumer acceptance. More than a flavourful condiment, *So-LeanYum* is a shelf-stable, health-promoting product that uses local ingredients, aligns with the rising demand for natural functional foods, and offers strong potential for commercialisation in both domestic and international markets.

Keywords – functional food, Solanum lasiocarpum, antioxidant activity, anti-obesity, D-optimal mixture design

INTRODUCTION

The rise in obesity cases in Malaysia has emphasised the need for dietary interventions that are both effective and appealing to consumers. According to the World Obesity Federation, in 2025, 59% of Malaysian adults are having a high body mass index (BMI).

This number is predicted to increase by 2030, whereby it is predicted that around 17.55 million adults are expected to have a high BMI reading (World Obesity Federation, 2025). Functional foods are foods that offer health benefits besides giving basic nutritional needs for human. *Solanum lasiocarpum* Dunal, commonly known as '*terung asam'*, is a native plant of Borneo Island that is widely utilised in Sarawak, Malaysia, for its culinary and medicinal applications and is rich in chlorogenic acid that is known to have antioxidant and anti-obesity properties (Ibrahim et al., 2022; Ting & Ding, 2021). *So-LeanYum* is developed as a novel functional sauce, developed using D-optimal mixture design, a technique within response surface methodology that allows the optimisation of nutritional content while maintaining the favourable sensory attributes and storage stability.

OBJECTIVE

The objectives of the development of this product include:

i. To optimise the formulation of *terung asam* sauce based on the total phenolic content (TPC), total flavonoid content (TFC) and antioxidant capacity via 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay by using D-optimal mixture design.
ii. To determine the chlorogenic acid (CGA) content in the optimised sauce formulation (*So-LeanYum*) using high performance liquid chromatography (HPLC).
iii. To analyse the effect of storage time on total phenolic content (TPC), total flavonoid content (TFC) and antioxidant activity of the best formulation (*So-LeanYum*).
iv. To evaluate the anti-obesity potential of the optimised sauce formulation (*So-LeanYum*) through in-silico and in-vitro analyses.
v. To study the consumer acceptance of the optimum sauce formulation (*So-LeanYum*) through sensory analysis in comparison with commercially available sauces in the market.

DESCRIPTION OF THE PROJECT

So-LeanYum is an innovative functional sauce developed from *Solanum lasiocarpum* Dunal, locally known as *'terung asam'*, a unique fruit native to Borneo and traditionally used in Sarawak's cuisine and herbal remedies. Recognised for its high chlorogenic acid content with antioxidant and potential anti-obesity benefits, *terung asam* was transformed into a health-promoting condiment through a scientific optimisation process that supports Sustainable Development Goals SDG 2 (Zero Hunger) by promoting value-added utilisation of local crops, enhancing food diversity, and strengthening community-based agriculture. Figure 1 shows the overall process flow of the project.

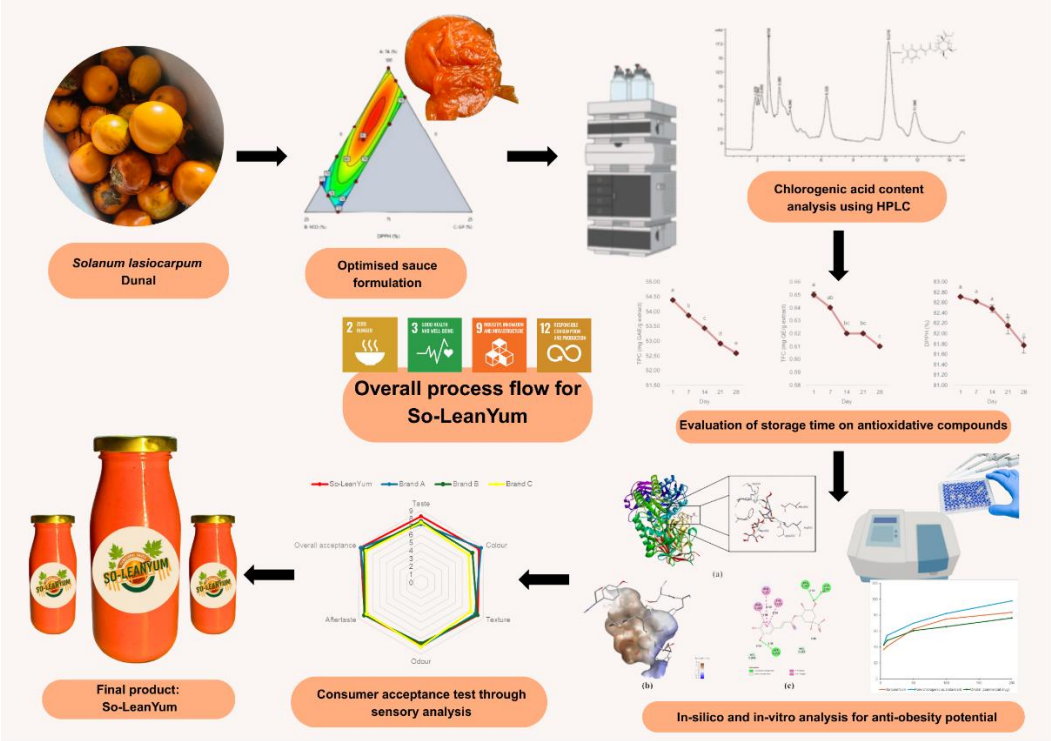

Figure 1: Overall process flow of the project

Using D-optimal mixture design, the formulation of *So-LeanYum* was optimised to maximise total phenolic content (TPC), total flavonoid content (TFC), and antioxidant capacity while preserving desirable taste, colour, and texture. The optimised formulation consists of *terung asam* purée (98.46%), virgin coconut oil (0.73%), and garlic powder (0.81%) (Rushdy et al., 2025). The sauce was further analysed for chlorogenic acid content using HPLC and monitored for the stability of its antioxidant compounds over 28 days of storage. Its anti-obesity potential was evaluated through both in-silico and in-vitro analyses, revealing promising activity (Saini et al., 2025) contributing to SDG 3 (Good Health and Well-Being). Sensory evaluation indicated that *So-LeanYum* was well-received by consumers, often outperforming selected commercial sauces in flavour and overall acceptability. Designed to be shelf-stable, naturally rich in antioxidants, and made from locally sourced ingredients, the product also supports SDG 9 (Industry, Innovation, and Infrastructure) by applying advanced food formulation techniques to a traditional ingredient, and SDG 12 (Responsible Consumption and Production) by promoting sustainable food processing practices. Beyond its unique tangy flavour, it supports healthier eating habits and offers strong potential for commercialisation in both domestic and international functional food markets.

NOVELTY

So-LeanYum stands out as the first *terung asam*-based functional sauce scientifically optimised for its bioactive properties and proven anti-obesity potential. Unlike conventional sauces, its formulation was developed using D-optimal mixture design to precisely balance nutritional value, sensory appeal, and storage stability. It is uniquely rich in chlorogenic acid, quantified using HPLC, and retains high antioxidant activity even after extended storage. The product's health benefits are supported by both in-silico and in-vitro evaluations, providing evidence-based functionality rarely seen in condiment products.

Additionally, its sensory acceptance was benchmarked against commercial sauces, ensuring market readiness. By combining advanced formulation science with a native Bornean ingredient, *So-LeanYum* introduces a new category of locally sourced, shelf-stable condiments that merge flavour, health benefits, and commercial potential.

CONCLUSION

The development of *So-LeanYum* successfully transformed *terung asam* into a scientifically optimised, health-promoting sauce with strong antioxidant properties and promising anti-obesity potential. The product demonstrated stable quality over storage, measurable chlorogenic acid content, and high consumer acceptance compared to commercial sauces. By combining advanced formulation methods with a native Bornean ingredient, *So-LeanYum* offers a unique, shelf-stable condiment that aligns with current trends in functional foods. This innovation not only promotes healthier eating habits but also creates opportunities for value-added use of local resources, supporting both community livelihoods and market expansion in domestic and international sectors.

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YST028 - PIPERPURE: HERBAL ANTIMICROBIAL MOUTHWASH POWERED BY *PIPER BETLE* L.

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ABSTRACT

Oral diseases, driven by bacterial and fungal pathogens, continue to affect millions worldwide, leading to tooth decay, gum inflammation, and oral infections. While conventional mouthwashes such as chlorhexidine and chemical antiseptics are widely used, they often cause side effects, including tooth staining, altered taste, and mucosal irritation. In response, there is a growing global demand for safe, effective, and sustainable herbal alternatives. PIPERPURE is a novel herbal antimicrobial mouthwash formulated from ethanolic extract of Piper betle L., a plant long valued in traditional medicine for its potent antimicrobial and antioxidant properties. In this study, fresh Piper betle leaves were extracted via maceration using 95% ethanol, followed by qualitative phytochemical screening, which confirmed the presence of flavonoids, tannins, saponins, and steroids. Antimicrobial activity was evaluated using the disc-diffusion method against Staphylococcus aureus, Pseudomonas aeruginosa, and Candida albicans. The extract demonstrated moderate to significant inhibitory effects against all pathogens, with the 250 mg/mL concentration producing the largest inhibition zones, remarkably surpassing Fluconazole in antifungal activity against C. albicans. Two alcohol-free mouthwash formulations with varying extract concentrations were developed and tested for pH, foamability, appearance, stability, and sensory acceptability. Both maintained an optimal pH, clear physical appearance, and stability over time, while preserving antimicrobial potency. Taste and aroma evaluations confirmed strong user acceptability. PIPERPURE bridges traditional herbal wisdom and modern formulation science to deliver an effective, chemical-free oral care solution. With proven laboratory efficacy, stability, and consumer appeal, it addresses unmet needs in preventive dentistry while supporting sustainability and cultural heritage. The product holds strong commercialization potential in both domestic and international herbal oral care markets, offering health-conscious consumers a safe and innovative alternative to conventional mouthwashes.

Keywords – Piper betle L., herbal mouthwash, antimicrobial activity, oral pathogens, natural oral care, antifungal efficacy

INTRODUCTION

Oral diseases such as dental caries, gingivitis, and oral candidiasis remain among the most common health problems worldwide, affecting individuals across all age groups. These conditions are primarily caused by bacterial and fungal pathogens that colonize the

oral cavity, leading to pain, discomfort, and reduced quality of life. While conventional mouthwashes containing synthetic antiseptics like chlorhexidine are effective, their prolonged use is often associated with adverse effects, including tooth staining, altered taste, and mucosal irritation.

Driven by growing consumer demand for safer, plant-based, and eco-friendly alternatives, PIPERPURE was developed as a herbal antimicrobial mouthwash formulated from *Piper betle* L., a medicinal plant widely recognized in Southeast Asian traditional medicine for its potent antimicrobial, antioxidant, and anti-inflammatory properties. The motivation behind this innovation stems from the need to provide an effective, chemical-free oral hygiene product that not only addresses microbial control but also aligns with sustainability and cultural heritage.

By integrating traditional herbal knowledge with modern formulation science, PIPERPURE aims to deliver a safe, effective, and market-ready solution for maintaining oral health.

OBJECTIVE

The primary objective of this innovation is to develop and evaluate PIPERPURE, a herbal antimicrobial mouthwash derived from *Piper betle* L., as a safe and effective natural alternative to conventional chemical-based oral care products. Specifically, this project aims to:

i. **Formulate** an alcohol-free mouthwash incorporating *Piper betle* ethanolic extract with optimal pH, stability, and sensory acceptability.
ii. **Evaluate** the antimicrobial efficacy of the formulation against selected oral pathogens, including *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Candida albicans*.
iii. **Establish** the product's potential for commercialization as a sustainable, culturally rooted, and consumer-friendly oral hygiene solution.

DESCRIPTION OF THE PROJECT

PIPERPURE is an innovative herbal antimicrobial mouthwash developed from the ethanolic extract of Piper betle L. leaves, a medicinal plant well-known in Southeast Asian traditional medicine for its potent antimicrobial, antioxidant, and anti-inflammatory properties. Fresh leaves were extracted through maceration using 95% ethanol, and qualitative phytochemical screening confirmed the presence of bioactive compounds such as flavonoids, tannins, saponins, and steroids. The antimicrobial efficacy of the extract was evaluated using the disc-diffusion method against Staphylococcus aureus, Pseudomonas aeruginosa, and Candida albicans, revealing moderate to significant inhibitory effects, with the 250 mg/mL concentration demonstrating the largest inhibition zones and surpassing Fluconazole in antifungal activity. Two alcohol-free formulations with varying extract concentrations were then developed and assessed for pH, foamability, clarity, stability, and sensory acceptability. Both maintained optimal pH levels, stability over time, and pleasant taste and aroma while retaining strong antimicrobial activity. By integrating traditional herbal knowledge with modern formulation techniques, PIPERPURE offers an effective, chemical-free, and culturally relevant oral hygiene solution that meets growing consumer demand for safe, natural, and sustainable personal care products, with strong potential for commercialization in local and global markets.

NOVELTY

PIPERPURE introduces a unique integration of traditional herbal knowledge and modern formulation science to create an effective, chemical-free mouthwash that addresses current gaps in oral care. While *Piper betle* L. has been traditionally chewed for its medicinal benefits, its application as a scientifically validated, alcohol-free mouthwash is a novel approach in the oral hygiene market. The originality of this product lies in three main aspects:

- Innovative Use of *Piper betle* L. Extract - Unlike existing herbal mouthwashes that rely on common plant extracts such as tea tree or peppermint, PIPERPURE harnesses the potent antimicrobial and antifungal properties of *Piper betle*, with laboratory evidence showing superior activity against *Candida albicans* compared to Fluconazole.

- Optimized Alcohol-Free Formulation - Many conventional and herbal mouthwashes contain alcohol, which can cause oral dryness and irritation. PIPERPURE is formulated without alcohol while maintaining stability, clarity, palatability, and high antimicrobial efficacy, making it suitable for sensitive users and long-term use.

- Cultural and Sustainable Value - This product revives a culturally significant Southeast Asian medicinal plant and transforms it into a standardized, market-ready product that aligns with global trends toward sustainable, eco-friendly, and culturally inspired health solutions.

By combining a less-explored yet highly potent plant extract with a consumer-friendly, safe, and effective delivery system, PIPERPURE stands out as a distinctive and innovative oral care solution with strong potential for both niche and mainstream markets.

CONCLUSION

PIPERPURE demonstrates that *Piper betle* L. ethanolic extract possesses strong antimicrobial and antifungal properties, making it a viable natural alternative to conventional chemical-based mouthwashes. Laboratory testing confirmed significant inhibitory effects against key oral pathogens, with superior antifungal performance compared to Fluconazole, while formulation studies ensured stability, optimal pH, and consumer acceptability. By delivering effective oral microbial control without alcohol or synthetic antiseptics, PIPERPURE addresses growing consumer demand for safe, sustainable, and culturally rooted health products. Its integration of traditional herbal knowledge with modern formulation science offers a competitive advantage in the expanding herbal oral care market. With proven efficacy, pleasant sensory qualities, and scalability in production, PIPERPURE holds strong potential for commercialization as a chemical-free oral hygiene solution for both local and global markets.

YST029 - PYRRO-3: IN SILICO STUDY OF A MULTI-TARGET INHIBITOR

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ABSTRACT

Hypertension, diabetes, and bacterial infections are major global health problems, and patients with more than one of these conditions often require multiple medications. This increases cost, inconvenience, and the potential of side effects. A promising solution is a single compound hitting multiple diseases. This project conducted a virtual screening of pyrrolidine-based compounds to assess their potential as multi-target inhibitors for three key targets: angiotensin-converting enzyme (ACE) to reduce blood pressure, α-amylase to control blood sugar, and bacterial enzymes to combat infections. Pyrrolidine is well-known in medicinal chemistry for its wide range of biological activities. However, its possible role as a multi-target inhibitor is underexplored, especially through computational studies. Using molecular docking, several promising candidates were identified with strong predicted binding to all three targets. This study employs computational screening that provides a faster, more cost-effective, and greener path for the early stage of drug discovery. The findings provide valuable leads for the pharmaceutical industry, supporting the development of broad-spectrum therapeutics to improve treatment for patients with multiple health problems.

Keywords – docking, pyrrolidine, ACE, antidiabetic, antibacterial

INTRODUCTION

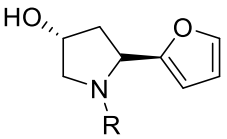
Pyrrolidine-based compounds are one of the important scaffolds in contemporary drug development due to their conformational adaptability and the potential to engage in hydrogen bonding. This versatile nitrogen heterocycle is known for its inhibition properties for the treatment of diabetes, hypertension, cancer, and bacterial infections (Seema et al., 2025). Patients who suffer from more than one of these conditions often require multiple medications, which can be costly, inconvenient, and may cause side effects from drug interactions. Thus, it is important to develop a single compound that can target multiple diseases. However, incorporating a computational approach with experimental design for the development of pyrrolidine-based compounds as drug candidates for the multi-target inhibitor is scarce. Furthermore, pyrrolidine rings are present in at least 37 FDA-approved drugs from different therapeutic classes, indicating their central role in medicinal chemistry (Li Petri et al., 2021).

OBJECTIVE

This project aims to perform virtual screening of a designed library of pyrrolidine derivatives against three different targets (ACE, α-amylase, and *E. coli*) through a molecular docking study using Autodock Vina (Troot & Olson, 2010).

DESCRIPTION OF THE PROJECT

This project investigates the potential of pyrrolidine-based compounds for multi-target inhibition of α-amylase, ACE, and bacterial enzymes (*E. Coli*). The core structure of the studied compound is given in Figure 1, and the binding energy from the docking study is tabulated in Table 1.



R = H, CH_3, $CH_2CH_2CH_3$, C_6H_5, CH_2CH_2OH

Figure 1: The core structure of the target pyrrolidine derivatives

Table 1: Binding energy of pyrrolidine derivatives against ACE (PDB ID: 1O86), α-amylase (PDB ID: 2QV4), and *E. Coli* (PDB ID: 1W3R).

Derivatives	Binding energy (kcal)		
	ACE	α-amylase	Antibacterial
H	-5.2	-5.6	-3.6
CH_3	-5.4	-5.4	-3.5
$CH_2CH_2CH_3$	-5.7	-5.7	-3.7
C_6H_5	-7.0	-6.8	-4.2
CH_2CH_2OH	-5.6	-5.8	-3.7
Standard	-5.3 (captopril)	-5.5 (miglitol)	-5.1 (norfloxacin)

NOVELTY

This project explores the multi-target potential of the design compounds, whereas other studies focus on a single target. The virtual screening approach employed in this work promotes early leads for pharmaceutical development and a green approach to drug discovery, thereby reducing cost, time, and use of harmful chemicals. If it could be commercialized in the later stage, it would reduce patient burden and risk of side effects.

CONCLUSION

The designed pyrrolidine derivatives exhibit a strong binding energy against ACE and α-amylase compared to their standard drugs, captopril and miglitol, respectively. Derivatives

with a phenyl group emerge as a promising multi-target inhibitor due to the highest binding energy among others.

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YST030 - OPTIMIZING SCHOOL EXAMINATION TIMETABLES WITH INTEGER LINEAR PROGRAMMING

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ABSTRACT

Scheduling school examinations is a complex and time-consuming process which often required school administrators to manually arrange numerous subjects across limited period or timeslots while avoiding student and resource conflicts. This study addresses the School Examination Timetabling Problem (SETP) by developing an optimization model using Integer Linear Programming (ILP) to create efficient and conflict free examination schedules. The study utilizes real data from a secondary school in Kelantan and applies the ILP model using Microsoft Excel's Solver. The data consist of the timetabling of 28 examinations, each with a duration ranging from 1 to 2.5 hours, for three students' classes over nine days. The study develops an ILP model with the objective function to maximize the effective allocation of examination hours while considering two hard constraints and one soft constraint. All examinations are scheduled exactly once and the limit number of examinations per day are considered as the hard constraints in this study. For a more convenient examination timetable, the soft constraint includes grouping certain examinations on the same day. Results demonstrate the applicability of ILP in examination timetabling problem especially in school and offers a practical solution that can be adapted by other academic institutions facing similar scheduling challenges.

Keywords – School Examination Timetabling Problem (SETP), Integer Linear Programming (ILP), Microsoft Excel's Solver

INTRODUCTION

According to Güler and Geçici (2020), examination timetabling is an inevitable problem of educational establishments. Integer Linear Programming (ILP) demonstrates strong capabilities to automate this process by emerging as a powerful optimization tool. Research demonstrates that ILP serves as a mathematical modelling method which transforms restrictions and business targets into linear formulas for optimizing decision outcomes (Jamaluddin & Aizam, 2017). The application of ILP in school examination timetabling helps administrators create linear mathematical models which lead to the identification of optimal examination arrangements throughout the timetable. Besides, ILP offers user-friendly features that expedite the resolution of timetabling problems.

OBJECTIVE

The objectives of this study are:

i. To optimize the school examination timetabling problem using integer linear programming model.
ii. To solve integer linear programming model using Microsoft Excel's Solver.

SCHOOL EXAMINATION TIMETABLING PROBLEM

Table 1 presents 28 examinations and their respective durations, which range from 1 to 2.50 hours. The allocation of examinations to three different classes (4SN, 4SK, and 4AK) are shown too. This table serves as a reference to schedule examinations according to the time available and the constraints relating to the examination timetable. This examinations data are taken from a secondary school in Kelantan.

Table 1: List of examinations and its duration

Examination	Subject	Duration (Hour)	4SN	4SK	4AK
E1	Bahasa Melayu 1	2	/	/	/
E2	Bahasa Melayu 2	2.5	/	/	/
E3	Bahasa Inggeris 1	1.5	/	/	/
E4	Bahasa Inggeris 2	1.5	/	/	/
E5	PJPK	1	/	/	/
E6	Pendidikan Islam	2.5	/	/	/
E7	Tasawwur Islam	2.5		/	
E8	Sejarah 1	1	/	/	/
E9	Sejarah 2	2.5	/	/	/
E10	Matematik 1	1.5	/	/	/
E11	Matematik 2	2.5	/	/	/
E12	Matematik Tambahan 1	2	/		
E13	Matematik Tambahan 2	2.5	/		
E14	Sains Komputer	2.5		/	
E15	Kesusasteraan Melayu	2.5			/
E16	Sains 1	1.25		/	/
E17	Sains 2	2.5		/	/
E18	Fizik 1	1.25	/		
E19	Fizik 2	2.5	/		
E20	Kimia 1	1.25	/		
E21	Kimia 2	2.5	/		
E22	Ekonomi 1	1.25			/
E23	Ekonomi 2	2.25			/
E24	Prinsip Perakaunan 1	1.25			/
E25	Prinsip Perakaunan 2	2.5			/
E26	Biologi 1	1.25	/		
E27	Biologi 2	2.5	/		
E28	Reka Cipta	2.5		/	

The examination schedule spans a total of nine days, with each examination allocated to specific days to optimize the examination flow. The common examination, which is the examination taken by all students, will be set over the first four days. The examination includes E1 to E6 and E8 to E11. The remaining five days will be used for the elective examinations. These examinations pertain to certain classes or groups of students, so they are scheduled after the common examinations to ensure there is no overlap. The

examining structure makes sure that all examinations, either common or elective, are placed well in the schedule, avoiding conflicts and ensuring smooth examinations for all students.

ILP FORMULATION

These models effectively incorporate three key constraints critical to solving the school examination timetabling problem, particularly in secondary schools. Before the model is discussed in detail, some notations used are introduced.

Set of examination (E) : $\{E1, E2, \dots, E28\}$
Set of common examination (E_c) : $\{E1, E2, E3, E4, E5, E6, E8, E9, E10, E11\}$
Set of elective examination (E_e) : $\{E7, E12, E13, E14, E15, E16, E17, E18, E19, E20, E21, E22, E23, E24, E25, E26, E27, E28\}$
Set of days : $\{D1, D2, \dots, D9\}$
Duration of each exam : $\{H_{E1} = 2, H_{E2} = 2.5, \dots, H_{E28} = 2.5\}$

Decision variable, $X_{Ei,Di} = \begin{cases} 1, \text{if an examination Ei is aasigned to a day, Di} \\ 0, \text{ otherwise} \end{cases}$

Objective function

$$\text{Max } Z = \sum H_{E1} X_{Ei,Di}$$

Subject to

Constraint 1: All examinations must be assigned once

$$\sum_{D1}^{D4} X_{Ei,Di} = 1 \qquad \forall Ei \in E_c$$

$$\sum_{D5}^{D5} X_{Ei,Di} = 1 \qquad \forall Ei \in E_e$$

Constraint 2: The maximum number of examinations per day

$$\sum_{\mathrm{E_c}} X_{Ei,Di} \leq 3 \qquad \text{for D1, D2, D3, D4}$$

$$\sum_{\mathrm{E_e}} X_{Ei,Di} \leq 5 \qquad \text{for D5, D6, D7, D8, D9}$$

Constraints 3: Some examinations should be scheduled on the same day

$$X_{Ei,Di} - X_{Ej,Di} = 0 \qquad Ei, Ej \in E$$

RESULTS AND CONCLUSION

This study optimized the school examination timetabling problems by using Microsoft Excel's Solver, hence satisfying defined constraints. Figure 1 shows the generated examination timetable. The ILP method succeeded in satisfying all three constraints, such that all examinations must be assigned (Constraint 1), which means that every examination was assigned to a valid timeslot, and no examination has been left unassigned.

Constraint 2 limits the number of examination sittings per day and is also adhered to. Specifically, during the first four days of common examinations, no more than three examinations were scheduled per day, while in the following five days of elective examinations, the schedule allowed up to five examinations per day. It is to ensure that students are not overburdened with too many examinations on a given day, thus keeping the schedule manageable.

Day	8.00	9.00	10.00	11.00	12.00	1.00	2.00
1	E8 1 Hour				E9 2.50 Hours		
2	E10 1.50 Hours				E11 2.50 Hours		
3	E1 2 Hour				E2 2.50 Hours		
4	E3 1.50 Hours		E5 1 Hour		E4 1.50 Hours		
5	E6 2.50 Hours				E7 2.50 Hours		
					E15 2.50 Hours		
6	E16 1.25 Hours				E17 2.50 Hours		
	E18 1.25 Hours				E19 2.50 Hours		
7	E20 1.25 Hours				E21 2.50 Hours		
	E22 1.25 Hours				E23 2.25 Hours		
8	E12 2 Hour				E13 2.50 Hours		
					E14 2.50 Hours		
9	E24 1.25 Hours				E25 2.50 Hours		
	E26 1.25 Hours				E27 2.50 Hours		
					E28 2.50 Hours		

Figure 1: Generated school examination timetable

Furthermore, the model adhered to Constraint 3, which is that some examinations should be scheduled on the same day, which was achieved by scheduling related examinations on the same day. For example, E1 and E2 were scheduled on the same day. This ensures consistency in the subject matter since both examinations are focused on the same language, allowing students to experience a continuous testing environment.

In conclusion, the optimization process successfully satisfied the three constraints, leading to the establishment of an ILP technique for examination timetabling in educational institutions.

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YST031 - BLOOMYBURST

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ABSTRACT

Most commercialized popping boba incorporates synthetic colorants to influence consumer purchasing decisions and elevate brand positioning. However, this usage of synthetic dye can lead to many global health risks such as allergies, cancer, and Attention-deficit/hyperactivity disorder (ADHD). BloomyBurst contains 26.95 mg GAE/g of Total Phenolic, 0.89 mg QE/g of Total Flavonoid Compound (TFC), and 0.59 mg/kg of Total Monomeric Anthocyanin (TMAC). This product also exhibited strong antioxidant activities based on DPPH and ABTS radical scavenging activities, which are 81.34% and 31.52%, respectively. BloomyBurst displayed as a vibrant pearl with L* (10.33±0.26) C* (9.46±0.06) and h^{o} (338.19±1.13) values, making it more appealing for the targeted customers, who are kids and the beverage industry. Offered at a reasonable and affordable price (RM 8.20 for 500g), BloomyBurst can penetrate the market and gain a strategic advantage over its competitors based on the benefits offered.

Keywords – Popping Boba, natural colorant, natural antioxidant, calamansi lime and butterfly pea flower

INTRODUCTION

The increasing popularity of popping boba as a flavorful and sensory-enhancing ingredient in drinks and desserts has coincided with rising concerns about the heavy reliance on synthetic colors, flavors, and stabilizers in commercially available bead products. Conventional popping boba formulations often depend on artificial colorants such as Tartrazine, Brilliant Blue and Erythrosine to create visual appeal (Amchova et al., 2024). However, extended consumption of synthetic dyes has been associated with negative health impacts, including attention deficit hyperactivity disorder (ADHD), allergic reactions, and potential cancer risks (de Oliveira et al., 2024). Approximately 8% of children diagnosed with ADHD demonstrate notable increases in behavioral symptoms when they are exposed to synthetic food colorants. Furthermore, about 33% of these children experience an improvement in their ADHD symptoms when these dyes are eliminated from their diet (Rambler et al., 2022).

Butterfly pea flower *(Clitoria ternatea)*, provides a vibrant blue pigment that is abundant in anthocyanins with impressive antioxidant properties (Thuy et al., 2021). Meanwhile, calamansi lime (*Citrus × microcarpa)* is rich in vitamin C and offers additional antioxidant benefits (Husni et al., 2020). This innovation not only enhances the visual appeal of

products but also supports the larger goal of encouraging healthier and cleaner eating choices, aligns with Sustainable Development Goals (SDG) by promoting element number 3 (Good Health and Well-being) and number 12 (Responsible Consumption and Production). The development of these natural, antioxidant-rich popping boba beads centers around an encapsulation process that utilizes sodium alginate through ionic gelation. This method enhances the stability of natural colorants and antioxidants by leveraging synergistic effects. BloomyBurst specifically targets health-conscious consumers and is designed for kids, offering a safer, clean-label treat alternative, thereby addressing rising concerns about the effects of synthetic additives on children's health.

OBJECTIVE

Our primary objective is to create popping boba that offers both enhanced health benefits and striking aesthetic appeal. This project directly contributes to two critical Sustainable Development Goals (SDGs), which are SDG 3, 'Good Health and Well-being,' by promoting health across all ages, and SDG 12, fostering sustainable production and consumption for future generations.

DESCRIPTION OF THE PROJECT

BloomyBurst is our innovative new product consisting of translucent, captivating blue beads, created by encapsulating butterfly pea flower with calamansi lime using sodium alginate. These popping bobas boast vibrant coloration from anthocyanins, offer notable antioxidant capacities, and contain beneficial phenolic acids, flavonoids, and vitamin C. Packaged in a 500 mL amber PET plastic bottle with inert and light-protective materials to prevent light degradation, BloomyBurst ensures a remarkable shelf life of two years, bringing you natural goodness that lasts. BloomyBurst provides a sustainable business proposition with the commercial price of RM 8.20 for 500g and projected return on investment (ROI) of 150%.

BloomyBurst serves as a healthier alternative to conventional boba in the current beverage industry offering naturally derived vitamins, antioxidants, and natural colourants. BloomyBurst has a strong market potential to be marketed with its ability to reduce health risks associated with artificial additives such as allergies, cancer, and Attention-deficit/hyperactivity disorder (ADHD). The target market includes health-conscious consumers and the penetration to premium beverage sector with established industry brands such as Tealive and Mixue. BloomyBurst is not only nutritious product, but it also offers as a natural functional and visually appealing product for beverage manufacturers seeking to enhance their product portfolio and sales.

NOVELTY

Our core novelty lies in the innovative encapsulation of butterfly pea flower (*Clitoria ternatea)* using calamansi lime (*Citrus x microcarpa*) via sodium alginate spherification. This pioneering method specifically enables the production of stable sodium alginate beads of *C. ternatea*, presenting a crucial, natural, and sustainable alternative to current synthetic food colorants. This unique combination and product stability define our significant contribution.

CONCLUSION

BloomyBurst represents a significant advancement in the development of natural, health-promoting popping boba by utilizing the synergistic benefits of butterfly pea flower (*Clitoria ternatea)* and calamansi lime (*Citrus x microcarpa*), encapsulated through sodium alginate ionic gelation. By replacing synthetic colorants with vibrant, antioxidant-rich plant extracts, this innovation addresses consumer and parental concerns about the harmful effects of artificial additives. The product's visually appealing characteristics, enhanced antioxidant properties, and prolonged shelf life offer a practical and scalable solution that aligns with Sustainable Development Goals related to health and responsible consumption. BloomyBurst offers a clean-label, safe, and functional alternative that meets the market's demand for natural, nutritious, and visually appealing treats, promoting better health outcomes and supporting a more sustainable food industry.

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YST032 - DEVELOPMENT OF AN AGROROVER FOR SMART AGRICULTURAL AUTOMATION TO ENHANCE PRODUCTIVITY USING WIRELESS COMMUNICATION

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ABSTRACT

Modern agriculture is confronted by challenges including labor shortages, high technology costs, and unreliable rural power infrastructure. This thesis presents the design and development of AgroRover, an autonomous ESP32-based robotic system engineered for automated seeding operations in agricultural fields. The AgroRover integrates a linear actuator for soil penetration, a precision seed dispensing motor, and an ultrasonic sensor for real-time obstacle detection and avoidance. System monitoring and control are implemented via the Blynk IoT platform, facilitating remote operation and live data tracking through a smartphone interface. Experimental results demonstrate the system's rapid response capability, achieving an average obstacle avoidance reaction time of 782 ms and a control response time that increases linearly with distance, reaching 197 ms at 15 meters. Path-following accuracy is validated by an average drift of only 2.7 mm over a 3-meter trajectory, indicating high-precision navigation. Furthermore, battery performance analysis shows stable operation, with battery depletion curves for both operating modes confirming over 6 hours of continuous field deployment per charge. The robust wireless connectivity, reliable actuation, and scalable modular design support cost-effective implementation and future integration with renewable energy solutions. These results underscore AgroRover's potential as a practical, efficient, and scalable platform for next-generation, technology-driven precision agriculture.

Keywords – Smart AgroRover, Precision Agriculture, Autonomous Field Robot, IoT-based Agricultural Automation, Obstacle Avoidance Robotics

INTRODUCTION

The AgroRover was developed to address the growing need for efficient and affordable farming solutions, especially in rural areas where modern agricultural tools are scarce. Rising food demand, shrinking farmland, and labor shortages have made traditional methods less viable for sustaining productivity. By integrating robotics, automation, and wireless control, the AgroRover offers a cost-effective and user-friendly approach to seed planting and crop monitoring. Designed to overcome challenges such as limited access to technology, inconsistent power supply, and high equipment costs, it provides a sustainable and practical tool for improving yield and reducing manual workload in small to medium-scale farming.

OBJECTIVE

The objective of this project is to:

i. To design and develop an ESP32-based autonomous AgroRover capable of automating key agricultural tasks, including seed planting, monitoring, and maintenance.
ii. To measure the reliability of autonomous navigation by measuring the robot's ability to detect and avoid obstacles using ultrasonic sensors.
iii. To investigate the implementation of a wireless communication framework using ESP32 technology for real-time remote monitoring and control of the AgroRover's operations with a fast response time.

DESCRIPTION OF THE PROJECT

The AgroRover is an autonomous agricultural robot designed to automate seed planting and field navigation while providing real-time monitoring through IoT connectivity. Powered by an ESP32 microcontroller and integrated with the Blynk IoT platform, it allows farmers to start, stop, and adjust operations remotely using a smartphone. A linear actuator-driven dibbling mechanism creates precise planting holes, while a peripheral jaw seed dispenser ensures accurate seed placement with minimal waste. Ultrasonic sensors detect obstacles and enable automatic route adjustments, allowing uninterrupted operation in dynamic field conditions. Built on a lightweight aluminum chassis with rubber-treaded wheels, the AgroRover is durable, mobile, and able to operate for over six hours on a single charge. Its modular design allows easy maintenance and future upgrades, making it a practical, cost-effective, and sustainable solution for small to medium-sized farms.

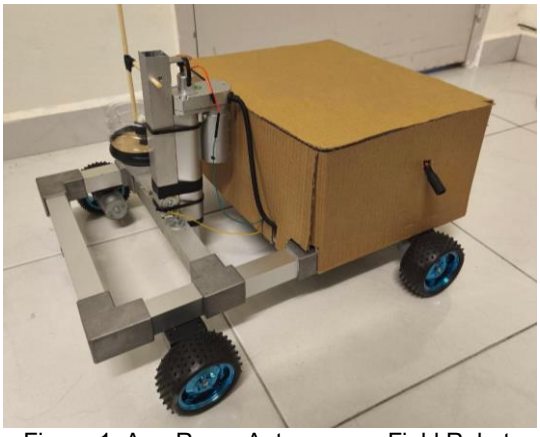

Figure 1: AgroRover Autonomous Field Robot.

Table 1: Key Features and Specifications of the AgroRover

Component	Description	Function	Specification	Benefit
Microcontroller	ESP32	Central control and IoT connectivity	Dual-core, Wi-Fi & Bluetooth	Low-cost, wireless monitoring & control
Planting Mechanism	Linear actuator with peripheral jaw dispenser	Creates holes and places seeds	Hole depth: 3–5 cm	Accurate, consistent planting
Navigation Sensor	Ultrasonic sensor	Detects obstacles & adjusts path	Range: ~20 cm detection	Prevents collisions

NOVELTY

The AgroRover is unique in combining low-cost automation, IoT connectivity, and precision planting into a single, accessible platform for small and medium-scale farming. Using an ESP32 microcontroller with the Blynk IoT platform, it enables real-time monitoring and control from anywhere via smartphone, overcoming the range limits of traditional systems. Its planting mechanism pairs a linear actuator-based dibbling system with a peripheral jaw seed dispenser for accurate hole depth and seed placement, while ultrasonic sensors provide real-time obstacle detection and automatic path adjustments. The modular design allows quick component replacement or upgrades, reducing downtime and costs. With over six hours of operation per charge, it is practical for areas with limited power supply. This blend of affordability, precision, and adaptability makes the AgroRover a novel solution for introducing precision agriculture to communities with limited access to advanced farming technology.

CONCLUSION

The AgroRover project demonstrates how affordable automation and IoT integration can effectively enhance agricultural productivity for small and medium-scale farms, particularly in rural areas with limited access to modern tools. Built on an ESP32 microcontroller and connected to the Blynk IoT platform, the system enables real-time monitoring and remote control through a smartphone, offering user-friendly operation regardless of location. Field testing confirmed its capability to navigate autonomously, detect and avoid obstacles, and maintain precise planting through a linear actuator-based dibbling mechanism paired with a precision seed dispenser. Its modular design simplifies maintenance and allows future upgrades, while its six-hour operating time per charge makes it practical for small to medium-sized plots. By automating repetitive planting tasks, the AgroRover addresses labor shortages, optimizes seed usage, and enables timely farming decisions through live data feedback. More than just a prototype, it provides a sustainable, cost-effective solution that can be adapted to various crops and farming conditions, offering an accessible entry point into precision agriculture. With further enhancements such as renewable energy integration and expanded automation features, the AgroRover holds strong potential to drive the adoption of smart farming technologies, reduce reliance on manual labor, and improve yields in diverse agricultural environments.

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YST033 - ORANGE PEELS AND BASIL LEAVES HERBAL TEA

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ABSTRACT

The increasing demand for natural and health-promoting beverages has led to this innovation of a herbal tea infusion with orange peel powder (OPP) and basil leaf powder (BLP). The project aims to create a functional herbal tea drink using these two materials with the delivery of health benefits as well as protecting the environment by the utilization of fruit peels. A 50:50 OPP-BLP blend was prepared and evaluated for physicochemical properties, antioxidant activity, and sensory acceptability, with green tea serving as the control. The OPP-BLP herbal tea exhibited a golden-brown hue. Total phenolic content (44.71 mg GAE/L) and antioxidant activity (1700 µmol TE/L) of OPP-BLP herbal tea, though slightly lower than green tea, remained within a range that suggests meaningful health benefits. Sensory evaluation confirmed that the OPP-BLP herbal tea was lower in color and odor that may likely due to panelist familiarity with green tea but the OPP-BLP herbal tea scored higher for flavor, aftertaste and overall acceptability, reflecting a pleasing and harmonious flavor experience from the citrusy and aromatic herbal infusion. The innovation lies in waste valorization and the novel combination of herbal ingredients, offering a sustainable alternative to traditional teas. This product addresses consumer demand for natural, functional, and eco-friendly beverages, positioning it as a promising prouct in the herbal tea market.

Keywords – herbal tea infusion, orange peels, basil leaves, sustainable product development

INTRODUCTION

In recent years, natural and health-promoting drinks have been in rising demand among consumers as people seek something better than artificially flavored beverages. Herbal tea is an attractive choice among consumers due to its medicinal and functional properties. The current project involves the development of OPP-BLP herbal tea, a unique infusion with orange peel powder (OPP) and basil leaf powder (BLP). Orange peel, a fruit waste by-product normally discarded as waste, is rich in phytochemicals with antioxidant activity. While leaves of the basil plant have been known traditionally to have medicinal properties such as anti-inflammatory and antioxidant effects. However, their applications in commercial herbal beverages are restricted. The motivation for this product innovation lies in the need to create a value-added, sustainable tea product which, beyond the improvement of health, supports minimizing food wastage. The combination should be

unique in experience and offer functional health benefits in order to cater to the increasing consumer demand for natural drinks.

OBJECTIVE

To develop an innovative herbal tea infusion made from dried orange peels and basil leaves.

DESCRIPTION OF THE PROJECT

The developed product is an herbal tea infusion made from the combination OPP and BLP, designed as a health-promoting and sensory appeal drink. This herbal tea drink utilizes orange peels, a fruit by-product that helps contribute to food waste reduction and environmental sustainability. Table 1 shows results of the analysis of OPP-BLP herbal tea and green tea as a control.

Table 1: Result of analysis on OPP-BLP herbal tea and control

Sample	Color	TPC (mg GAE/L)	FRAP (umol TE/L)	Sensory Acceptability				
				Color	Smell	Taste	After taste	Overall acceptability
OPP-BLP Herbal Tea	L*:41.55±1.28^{A} a*:0.08±0.04^{A} b*:0.26±0.35^{A}	44.71± 2.50^{B}	1700± 28.28^{B}	3.68± 1.96^{B}	5.74± 2.13^{A}	4.06± 0.42^{A}	4.26± 0.34^{A}	4.42± 0.26^{A}
Green Tea	L*:40.84±0.90^{A} a*:-0.25±0.14^{B} b*:1.20±0.45^{A}	257.94± 3.40^{A}	6056.25± 203.30^{A}	6.29± 2.48^{A}	5.87± 1.89^{A}	3.16± 0.54^{B}	3.10± 0.47^{B}	3.71± 1.44^{B}

Note: The different A-B capital letters indicate significant difference ($p < 0.05$) among sample and control.

The results showed a promising value of L*a*b* color analysis close to the color exhibited by control, in which the OPP-BLP herbal tea produced a golden-brown color of tea while control sample produced green color that is due to the chlorophyll pigments (Li et al., 2022). Golden-brown color of the OPP-BLP herbal tea may be attributed by the combinations of pigments present in both orange peels and basil leaves such as anthocyanin and carotenoid (Landi et al., 2012; Habibi et al., 2023). The major antioxidant compound in orange peels is hesperidin and due to its phytomediated character, orange peels are able to exhibit anticancer properties (Shrinath et al., 2023). Rosmarinic acid identified in basil leaves has proved to show high antioxidant activity compared to other compounds contained in basil (Nadeem et al., 2022). Rosmarinic acid acts as an antioxidant that guards against oxidative stress and aids in the prevention of cardiovascular and degenerative illnesses (Romano et al., 2022). This combination of both antioxidant compounds has the ability to work together synergistically in producing herbal tea infusion drink with great antioxidant capacity. Although the TPC and antioxidant activity of this formula are lower compared to the control sample, it nevertheless represents the most promising formulation, demonstrating substantial potential in approaching the efficacy of the control. In terms of sensory aspect, OPP-BLP herbal tea obtained low scores of color and smell compared to control, partly may be due to the familiarity of the panelists towards the green color and smell of green tea. However, regarding the aspect of taste and aftertaste, the developed OPP-BLP herbal tea obtained a higher score in comparison to the control sample. This may be because the citrusy flavor exhibited by the orange peels with the aromatic flavor of basil leaves produced a well-balanced taste that does not overtake or overshadow their respective tastes. In terms of the overall

acceptability, the OPP-BLP herbal tea also exhibited a higher scores compared to green tea indicating higher acceptance of herbal tea by the panelists.

NOVELTY

The novelty of this herbal tea lies in the utilization of underused agricultural waste products and medicinal plants in a new functional, health-promoting beverage. Herbal teas typically use well-known common ingredients like chamomile or mint, but this study incorporates orange peels that are normally regarded as waste products, as the primary ingredient together with basil leaves, an herbal plant that gives a synergistic mixture combination that elevate health benefits and flavor-wise. The tea drink is made entirely from plant-based materials; hence, it is caffeine-free. This may be suitable for individuals seeking non-stimulant drinks. This product has added value in offering specific health benefits along with current trend of herbal tea drinks. Hence, this study have been conducted in determining the best formulation of herbal tea drink and revealed that formulations incorporating 50% OPP and 50% BLP exhibit an overall great color, antioxidant activity and sensory acceptability. Apart from its functionality for being eco-friendly, it offers an aromatic profile from the synergy of the citrusy flavors of orange peels combined with the herbal scent from basil leaves.

CONCLUSION

In conclusion, the development of an herbal tea infusion from orange peel powder and basil leaf powder is an innovative, health-oriented, and sustainable approach to functional beverage formulation. The product is successful in utilizing agricultural waste and medicinal herbs to create a tea infusion that shows good antioxidant activity and sensory acceptability. Though it has lower total phenolic content and antioxidant activity than the green tea control, the herbal tea has excellent potential in its well-balanced taste, aftertaste and overall acceptability which were given higher sensory scores. Its golden-brown color and fragrance from natural pigments and bioactive compounds such as hesperidin and rosmarinic acid are additional values. Overall, this product not only aids consumer health but also environmental sustainability by upcycling fruit waste into a valuable, usable drink.

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YST034 - DAILEETOX (POMEGRANATE BOTANICAL DRINK)

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ABSTRACT

This report details the development of Daileetox, a novel pomegranate botanical beverage in an easy-to-use premix powder format. Infused with strawberry, red dates, ginger and moringa, this innovative product responds to the rising consumer demand for natural, health-conscious, and functional beverages that blend traditional herbal wisdom with modern convenience. The novelty of Daileetox lies in its distinctive, synergistic blend of natural ingredients, carefully selected for their complementary health benefits and unique flavor profile. This formula is specifically designed to support the body's natural detoxification processes, while also providing a rich array of antioxidants, essential vitamins like Vitamin C from strawberry, minerals, and anti-inflammatory compounds from superfoods like moringa. Pomegranate contributes valuable nutrients such as hydrolysable tannins and anthocyanins, further enhancing cellular health and protection against free radicals. Daileetox stands out as a clean-label beverage, devoid of artificial colors, flavors, and preservatives, offering a sweet, tangy, and mildly spicy taste. The usefulness of Daileetox is multifaceted. Its convenient premix powder form ensures portability and quick preparation, making it ideal for busy lifestyles, including working professionals, students, and the elderly. It serves as a versatile functional beverage, perfect for a morning health boost, mid-day refreshment, or post-meal digestive aid. Furthermore, Daileetox is intentionally priced to be accessible without compromising quality, making wellness more affordable.

Keywords – Botanical Beverage, Functional Drink, Detoxification, Natural Ingredients, Wellness

INTRODUCTION

In recent years, the demand for natural, functional beverages has surged as consumers seek healthier and more convenient lifestyle choices. However, many commercial drinks on the market contain artificial additives, excess sugars, and limited nutritional value, failing to meet the growing awareness of clean-label and wellness-focused products. This gap inspired the development of *Daileetox*, a pomegranate-based botanical drink infused with strawberry, red dates, ginger, and moringa. The motivation behind Daileetox is to create a holistic beverage that not only offers a pleasant flavor profile but also supports detoxification, improves digestion, and enhances immune health using ingredients known for their natural benefits. Combining traditional herbal knowledge with modern food innovation, this product is designed to cater to the health-conscious community, including

students, professionals, and the elderly who need a portable and effective nutritional drink for daily use.

OBJECTIVE

i. To provide consumers with a delicious and effective botanical drink, Daileetox is specifically formulated with natural ingredients like moringa, red dates, ginger, and strawberry to support the body's natural detoxification processes and promote overall well-being in Malaysia
ii. To empower customers through education, providing clear and accessible information about the health benefits and proper use of Daileetox, enabling informed choices about well-being.
iii. To uphold sustainability and foster innovation, protect the planet by implementing eco-friendly packaging solutions across the product line while continuously expanding offerings with new functional beverage formulas that blend traditional botanicals with modern science to address diverse health and wellness needs.

DESCRIPTION OF THE PROJECT

Infused with strawberry, red dates, ginger, and moringa, the Pomegranate Botanical Drink is a carefully designed health beverage that combines traditional herbal knowledge with contemporary practicality. Natural, nutrient-rich ingredients with a reputation for improving wellness are used to make this ready-to-drink product. Antioxidants, which are abundant in strawberries and pomegranates, help shield the body from free radicals and promote the health of all cells (Derakhshan et al., 2018). While moringa, also known as the "miracle tree," provides vital vitamins, minerals, and anti-inflammatory chemicals, red dates are long prized for their capacity to increase immunity and enhance blood circulation. Ginger helps with digestion, relieves bloating or nausea, and provides a subtle heat to the flavour profile. This beverage provides a clean-label substitute for numerous commercial beverages because it is devoid of artificial colours, flavours, and preservatives. It is appropriate for daily consumption due to its sweet, tangy, and mildly spicy flavour, which appeals to a variety of palates. Convenience was a key consideration in the product's design; it comes in a portable, ready-to-drink form that doesn't need to be prepared, making it ideal for anyone on the go, including working professionals, students and elderly. This beverage is a useful, functional, and health-conscious choice that can be consumed as a post-meal digestive assistant, mid-day refreshment, or morning health boost. It combines traditional botanical benefits with modern beverage innovation to offer both nutrition and convenience in a single bottle.

Figure 1: Daileetox (Pomegranate Botanical Drink)

NOVELTY

Daileetox stands out for its distinctive blend of natural ingredients carefully selected for their complementary health benefits. The combination of pomegranate, moringa, red dates, ginger and strawberry create a synergistic formula that is not only delicious but also designed to support the body's natural detoxification processes. This unique recipe sets Daileetox apart from ordinary beverages by offering a thoughtful mix of antioxidants, vitamins and plant compounds rarely found together in a single product. Furthermore, beyond detoxification, Daileetox provides a wide range of wellness benefits that support overall vitality. Its rich antioxidant profile helps to protect cells from oxidative stress, while natural botanicals contribute to better digestion, improved energy and enhanced immune function. Pomegranate is renowned for its rich concentration of valuable nutrients and bioactive compounds. It contains hydrolysable and condensed tannins, flavonols, anthocyanins, and a variety of phenolic and organic acids that have been linked to numerous health benefits. Strawberry is also one of the main ingredients of Daileetox and it contains a lot of health benefits. Strawberries are a powerhouse of nutrition and play an important role in enhancing the benefits of Daileetox. They are naturally rich in vitamin C, which supports immune health, collagen production and antioxidant protection against free radicals. Strawberries also provide essential nutrients like folate. Potassium and fiber that contribute to heart health and better digestion. By including real strawberry powder, Daileetox combines delicious natural flavour with a wide range of health benefits. This all-in-one approach makes it easier for customers to incorporate targeted nutritional support into their daily routines without needing multiple supplements or products. Other than that, Daileetox is packaged in an easy-to-use premix powder making it perfect for busy lifestyles. Each sachet contains a measured serving that dissolves quickly in water, eliminating the need for complicated preparation. Whether at home, at work, or on the go, consumers can enjoy a refreshing, functional beverage anytime, anywhere. The portable packaging also ensures freshness and consistent quality on every serving. While many functional beverages can be expensive or out of reach for everyday consumers, Daileetox is intentionally priced to remain accessible without compromising quality. By combining premium ingredients with efficient production and distribution, we can offer a product that delivers comparable benefits to higher-priced alternatives making wellness more affordable for everyone. In summary, Daileetox offers a unique combination of ingredients that can benefit our body and at the same time it comes with an affordable price in a convenience premix powder.

CONCLUSION

To conclude, Daileetox combines traditional herbal ingredients with new food innovation to satisfy the growing demand for natural and functional beverages. This 15g premix powder sachet, which is made from pomegranate, strawberry, red dates, ginger, and moringa, provides a convenient, cost-effective, and clean-label option for immune support, detoxification, digestion, and overall, well-being. Daileetox is a healthier option to typical commercial drinks because it is free of artificial ingredients and provides a special blend of antioxidants, vitamins, and minerals in a single serving. Its affordable price ensures that it can reach an extensive demographic of health-conscious consumers, while its practical design, which is a single-serve sachet that can be dissolved instantly in warm water, fits busy lifestyles. With its unique ingredient combination, functional purpose, and user-friendly packaging, Daileetox not only addresses current health trends but also holds strong potential in Malaysia's growing market for functional drinks. It is more than simply a drink; it is a wellness companion that is designed to fit into contemporary lifestyles.

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YST035 - TWO-STEP ANODIZATION APPROACH FOR FABRICATING NANOPOROUS ALUMINA ON ALUMINUM HOLLOW TUBES

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ABSTRACT

This study reports the fabrication of nanoporous anodic aluminum oxide (AAO) layers on both the inner and outer surfaces of aluminum (Al) hollow tubes using a modified two-step anodization process. Unlike conventional AAO synthesis performed on planar or single-surface cylindrical substrates, the present method enables simultaneous anodization of concave and convex surfaces within a single system. The novelty of this work lies in the dual-surface anodization approach for hollow tubular substrates, achieving hexagonal nanoporous morphology across geometrically distinct surfaces without requiring separate processing steps. This method expands the applicability of AAO beyond traditional planar templates, offering a scalable route for complex 3D architectures. The resulting dual-surface AAO tubes hold significant potential for advanced applications, including multifunctional membranes, high-surface-area catalytic supports, and fluidic devices where inside–outside accessibility is critical. Their large surface area, high pore uniformity, and robust structure make them suitable for separation processes, sensing platforms, and energy storage devices. By enabling efficient and uniform anodization of both internal and external surfaces, this research provides a pathway for integrating AAO into next-generation tubular devices, offering enhanced performance in chemical, environmental, and biomedical applications.

Keywords – two-step anodization, AAO nanoporous structure, hollow tube

INTRODUCTION

The fabrication of AAO has progressed markedly, moving from its origins on conventional flat aluminum foils to more intricate forms such as aluminum wires, and, more recently, to 3D architectures like hollow Al tubes [1, 2]. This evolution is driven by the growing demand for high-surface-area nanostructures in cutting-edge technological applications. AAO is widely valued for its highly ordered nanoporous structure, chemical inertness, adjustable pore dimensions, and excellent thermal and mechanical stability, making it a versatile platform for use in nanotechnology, electronics, biosensing, and energy storage [3, 4].

Despite these advantages, AAO synthesis on planar aluminum foils presents notable limitations. Achieving pore distribution over large surface areas remains challenging, and the active surface is restricted to a single exposed side, constraining the total available functional area. By contrast, transitioning to 3D substrates such as hollow aluminum tubes enables the simultaneous use of both inner and outer surfaces, significantly increasing the effective surface area. This expanded geometry not only enhances material utilization but also opens opportunities for innovative device designs and multifunctional applications.

OBJECTIVE

This study aims to develop and optimize a two-step anodization process for fabricating nanoporous anodic aluminum oxide (AAO) on both the inner and outer surfaces of hollow aluminum tubes. The specific objectives are to:

i. Establish a reliable two-step anodization procedure capable of producing uniform, self-ordered nanopores on concave (inner) and convex (outer) surfaces simultaneously.

ii. Investigate the influence of anodization parameters, particularly voltage and time on pore morphology, oxide thickness, and structural uniformity across both surfaces.

METHODOLOGY

The fabrication of nanoporous AAO was fabricated on hollow aluminum tubes using a two-step anodization process in a custom-built etching cell [5]. Prior to anodization, the aluminum substrate was sonicated in acetone to remove surface contaminants. In the first anodization step, the exposed surfaces of the tube were immersed in an acidic electrolyte maintained at a constant temperature and subjected to a fixed voltage for one hour. The resulting oxide layer was then dissolved by immersing the tube in an etching solution for two hours, revealing a textured aluminum surface that served as a template for the subsequent anodization. The second anodization was performed under identical voltage and temperature conditions but with an extended duration to produce the final ordered nanoporous AAO layer. The surface morphology and cross-sectional structure of the AAO layers were examined using field emission scanning electron microscopy (FESEM) operated at an accelerating voltage of 5.0 kV and a working distance of 4–8 mm to achieve optimal image resolution. Quantitative analysis of pore structure and dimensions was performed using ImageJ software on the acquired FESEM micrographs.

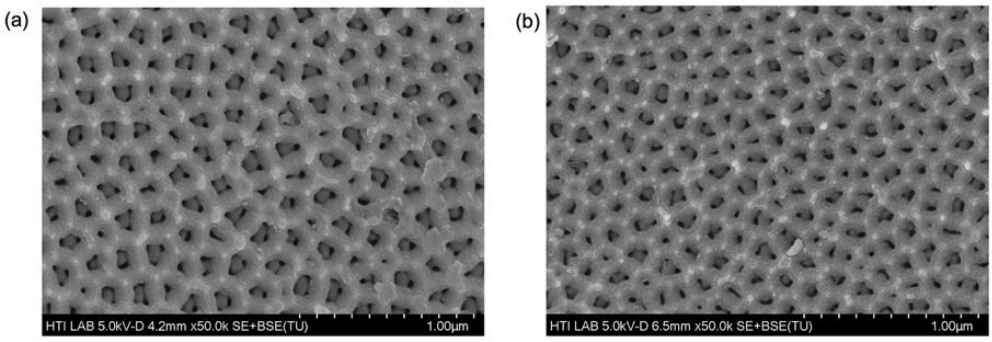

Figure 2 Top-view FESEM images of AAO on the (a) convex and (b) concave surfaces of the Al tube anodized at 80 V for 6 hours.

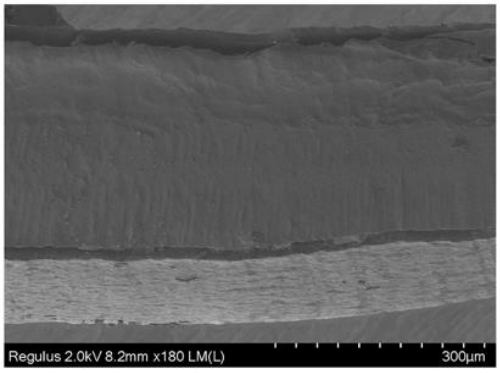

Figure 3 Cross-section of the Al hollow tube with two layers of AAO sandwiching the Al substrate.

RESULTS AND DISCUSSION

The top-view FESEM images of the AAO at 50,000× and cross-section at 180× magnification is shown in Figure 2(a) and (b), respectively. The convex surfaces exhibit an average pore sizes 80nm while the concave surfaces reported a slightly lower pore sizes, around 70nm. This variation arises from the different electrochemical conditions on the tube's inner and outer surfaces [6]. The outer surface, being more directly exposed to the electrolyte, is subjected to a stronger electric field during anodization. This intensified local field accelerates pore growth and leads to the development of larger pores. Conversely, the inner surface, which is partially enclosed and less exposed within the hollow structure, experiences a weaker electric field, producing smaller pores. A similar pattern is observed for the interpore distance, where the outer AAO layer consistently exhibits larger spacing than the inner AAO layer. Figure 3 shows the cross-section Al hollow tube with well attached layers of AAO between the Al substrate. The average thickness of outer and inner AAO layer were measured to be 17μm and 12μm, respectively. The anodization time shows a linear relationship with the AAO thickness [7], indicating a proportional increase in thickness with longer anodization times.

CONCLUSION

A dual-surface AAO layer was successfully formed on the hollow aluminum tube, confirming the feasibility of this fabrication approach. The results highlight its potential for a wide range of applications, including gas separation, sensing, energy storage, and serving as a template for the synthesis of various nanostructures.

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THEME 3

PROFESSIONAL (SOCIAL SCIENCE) COMMUNITY AND CULTURAL SUPPORT

PSS001 - S-ILTIZAM: ISLAMIC MICRO SAVING AND LEARNING TOOL FOR UNIVERSITY STUDENTS

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ABSTRACT

University students in Malaysia, particularly those from low- to middle-income backgrounds, face mounting financial pressures without access to structured financial literacy or culturally aligned saving mechanisms. In response to this gap, *S-Iltizam* is introduced as a mobile-based Islamic micro-saving and learning tool tailored for Muslim university students. Grounded in Maqasid al-Shariah and Islamic financial ethics, the app integrates practical digital saving features with spiritual development components to foster holistic student well-being. Key modules within *S-Iltizam* include a goal-based savings tracker such as for tuition, umrah, sadaqah, a daily Quran reading and zikir reminder system, a visual dashboard summarizing financial growth, and personalized encouragements embedded with Islamic values. The design reflects a user-centred approach, catering to the Gen Z digital lifestyle while reinforcing Islamic behavioural discipline. Unlike conventional financial apps, *S-Iltizam* offers a dual developmental track—financial and spiritual—thus positioning itself uniquely within the Shariah-compliant fintech landscape. The novelty lies in how it gamifies saving behaviour with Islamic teachings, providing not only functional support for money management but also enhancing users' spiritual connection through daily engagement. Preliminary pilot tests with university students demonstrated increased saving frequency, improved religious consistency, and positive feedback on app usability and motivation features. The project contributes to the national agenda of financial inclusion and supports United Nations SDGs, particularly SDG 4 (Quality Education) and SDG 8 (Decent Work and Economic Growth). *S-Iltizam* is envisioned as a scalable, ethical fintech solution with potential to be adopted by higher education institutions, zakat bodies, and Islamic schools. It represents a meaningful innovation that bridges modern technology with Islamic pedagogy to empower the next generation of financially responsible, spiritually conscious youth.

Keywords – Islamic Financial Literacy, Micro-Saving App, Shariah-Compliant Fintech, University Students, Digital Islamic Learning

INTRODUCTION

University students in Malaysia face increasing pressure to manage personal finances, often without formal financial education. This can lead to poor budgeting, overspending, and long-term debt. For Muslim students, the lack of digital tools that combine financial

management with Islamic values further limits their engagement with structured saving behaviour. *S-Iltizam* addresses this gap by offering a mobile platform that not only promotes micro-saving but also integrates Islamic learning tools, guided by Maqasid al-Shariah.

OBJECTIVE

i. To promote responsible and consistent financial behaviour among Muslim university students using a Shariah-compliant digital tool.
ii. To integrate Islamic teachings into daily financial habits through reminders, Quran tracking, and goal-based savings.
iii. To create an engaging and user-friendly mobile platform that blends financial technology with spiritual development.

DESCRIPTION OF THE PROJECT

Figure 1: Login and Sign-Up Page for the S-Iltizam Application

Figure 2: User Interface of the S-Iltizam Application and Record Saving Process

Figure 3: Calendar Tracking Based on the S-Iltizam Application

Figure 4: Learning Features on the S-Iltizam Application

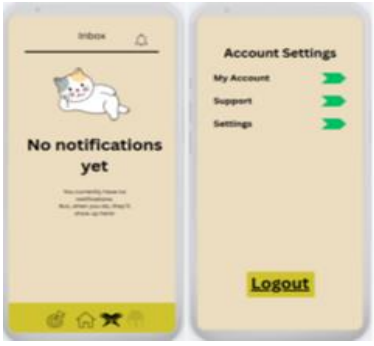

Figure 5: Other Features of the S-Iltizam Application

S-Iltizam is a mobile application designed to empower Muslim university students with the tools for disciplined financial saving and spiritual growth. Key features include:

i. Saving Goal Tool: Users can set financial goals such as tuition, sadaqah, or umrah savings with progress tracking and motivational alerts.
ii. Quran Reading Tracker: Helps users track daily reading, review statistics, and connect spiritual growth with financial discipline.
iii. Daily Doa and Zikir: Sends authenticated Islamic supplications and dhikr reminders.
iv. Total Saving Summary Dashboard: Provides an overall view of savings, expenditure, and personal milestones.

S-Iltizam is built with a user-friendly interface and is optimized for Gen Z digital preferences, using Islamic content as behavioural nudges.

NOVELTY

S-Iltizam stands out for its integrated approach to financial literacy and Islamic education. It is the first app of its kind in Malaysia to:

i. Combine micro-finance tools with gamified spiritual content.
ii. Embed Islamic behavioural nudges (e.g., Quranic reminders tied to savings goals).
iii. Support Maqasid al-Shariah dimensions including hifz al-mal (wealth protection), hifz al-din (faith), and hifz al-aql (intellect).
iv. Provide a dual-track development model that nurtures both material and spiritual well-being.

CONCLUSION

S-Iltizam presents a practical and innovative solution for promoting financial responsibility and spiritual growth among Muslim university students. It has the potential to expand to other demographics such as madrasah students, young professionals, and Islamic schools. With its Shariah-compliant framework and engaging design, the tool addresses a critical societal need and contributes to the broader goals of financial inclusion and ethical fintech development.

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PSS002 - FSPPP EXAM KIT 2.0: DEVELOPMENT OF A MOBILE/WEB-BASED EXAM INFORMATION SYSTEM

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ABSTRACT

The FSPPP Exam Kit is an innovative initiative introduced by the Faculty of Administrative Science and Policy Studies (FSPPP), Universiti Teknologi MARA (UiTM), to enhance students' access to final examination information. Following the successful implementation of Phase by featuring QR code-enabled access to essential exam documents and phase 2 proposes the development of a comprehensive mobile and web-based application. This next phase aims to provide a centralized, interactive, and real-time platform tailored to the academic needs of FSPPP students and administrators. The proposed application will feature personalized dashboards, downloadable exam documents, real-time updates, examination schedules, and venue locators. This transformation addresses current limitations such as lack of personalization, fragmented communication, and dependency on static QR-based systems. With a focus on user friendliness and accessibility, the platform will leverage technologies such as React Native for cross-platform compatibility and Firebase for secure data management. The target users include FSPPP students, academic staff and admin staff. Phase 2 of the FSPPP Exam Kit not only supports UiTM's digital transformation agenda but also responds to the growing need for sustainable, paperless, and responsive academic solutions. The expected outcomes include enhanced student satisfaction, reduced administrative workload, and streamlined exam operations. This project sets a precedent for future innovations within the faculty and beyond, reinforcing FSPPP's commitment to academic excellence and student success.

Keywords – FSPPP, Exam Kit, Students, Education, Examination

INTRODUCTION

The FSPPP Exam Kit was developed as a digital innovation initiative under the Faculty of Administrative Science and Policy Studies (FSPPP), Universiti Teknologi MARA, to enhance the management and dissemination of final examination information. The first phase of this project was presented at the Convensyen Kumpulan Inovatif dan Kreatif (KIK) UiTM Zon Selatan 2024, where it was honoured with a Silver Medal for its innovative contribution. Initially this project introduced in Phase 1 through a QR code-based system, the kit successfully provided students with quick and easy access to essential documents such as exam timetables, seating arrangements, and examination codes.

Since its implementation in 2024, the FSPPP Exam Kit has received overwhelmingly positive responses from the faculty community. A recent feedback survey involving 254 respondents, including both students and academic staff, revealed that 95% of students expressed satisfaction with the existence of the Exam Kit. Furthermore, a significant majority of the respondents agreed that a more updated and interactive system should be developed to further enhance accessibility and functionality.

Despite its effectiveness, the current system has notable limitations. It lacks real-time updates, personalized user experiences, and relies heavily on static QR-based document access. These shortcomings have posed challenges, particularly during critical examination periods, where timely and centralized information delivery is essential. Additionally, the absence of a fully integrated platform has contributed to inefficiencies and increased administrative workload for faculty staff. According to Moulton et al. (2024), the FSPPP Exam Kit significantly improved communication between faculty and students, reduced confusion during examination periods, and facilitated better compliance with exam protocols. Their study emphasized the importance of structured information dissemination in academic settings. These findings are supported by Yang et al. (2023), who noted that user satisfaction and communication success in academic platforms are closely tied to the quality, accessibility, and timeliness of the information provided.

Motivated by these findings, Phase 2 proposes the development of a mobile and web-based application that will serve as a centralized platform for all examination-related information. The aim is to significantly improve user experience, streamline communication, and support FSPPP's commitment to digital transformation and academic excellence.

OBJECTIVE

The main objective of developing Phase 2 of the FSPPP Exam Kit is to enhance the accessibility, efficiency, and user experience of exam-related information delivery through the creation of a centralized mobile and web-based application. This platform aims to support both students and faculty members by providing a more interactive, responsive, and personalized system for managing final examination resources. Specifically, the objectives of this project are:

i. To develop a centralized digital platform that integrates essential final examination information such as timetables, venues, examination codes, and downloadable documents.
ii. To implement real-time notification features that allow timely updates and communication between the examination committee and students.
iii. To improve user experience through personalized dashboards and student-specific exam data access.
iv. To align the faculty's examination operations with UiTM's digitalization and paperless initiatives by promoting sustainable practices.

This project is intended to serve as a model for future digital innovations within FSPPP and UiTM at large, offering long-term benefits in terms of accessibility, communication, and operational efficiency.

DESCRIPTION OF THE PROJECT

The FSPPP Exam Kit (Phase 2) is a mobile and web-based application designed to streamline and digitalize the management and delivery of final examination information to students and faculty staff. Building upon the success of the QR-based system introduced in Phase 1, this upgraded platform offers a more comprehensive and interactive solution that supports real-time access, personalized content, and centralized control. The application includes the following core features:

A. User Dashboard - A personalized dashboard where students can view their specific examination schedule, exam venue, seat number, and downloadable documents. Admin staff will also have a management interface.
B. Timetable and Venue Locator - Provides students with real-time access to their program's exam timetable and an interactive venue map for easy navigation.
C. Document Repository - Stores important exam-related documents such as examination slips, seating lists, and examination codes in downloadable formats.\
D. FAQ and Guidelines Section - A centralized section containing frequently asked questions, dress code requirements, exam regulations, and emergency protocols.\
E. QR Code Integration - Quick login access or scanning feature for students to retrieve personalized data instantly.
F. Admin Panel for Exam Committee - A backend system for the exam committee to manage content uploads, scheduling, and notifications with minimal effort.

The usefulness and practicality of FSPPP EXAM Kit are:

i. For Students: Reduces confusion and stress during the exam season by providing timely, accurate, and centralized information. Encourages self-reliance and preparedness.
ii. For Administrative Staff:Reduces workload related to manual document distribution and repetitive queries. Enhances efficiency and accuracy in managing exam logistics.
iii. For the Faculty: Aligns with UiTM's digitalization goals and promotes a paperless, sustainable approach to exam operations. It also sets a benchmark for other faculties to adopt similar digital practices.

The Sample Diagrams of FSPPP EXAM Kit are as follow:

Figure 1: Application Interface Mock up
Link for website: https://sites.google.com/view/fspppexamkit

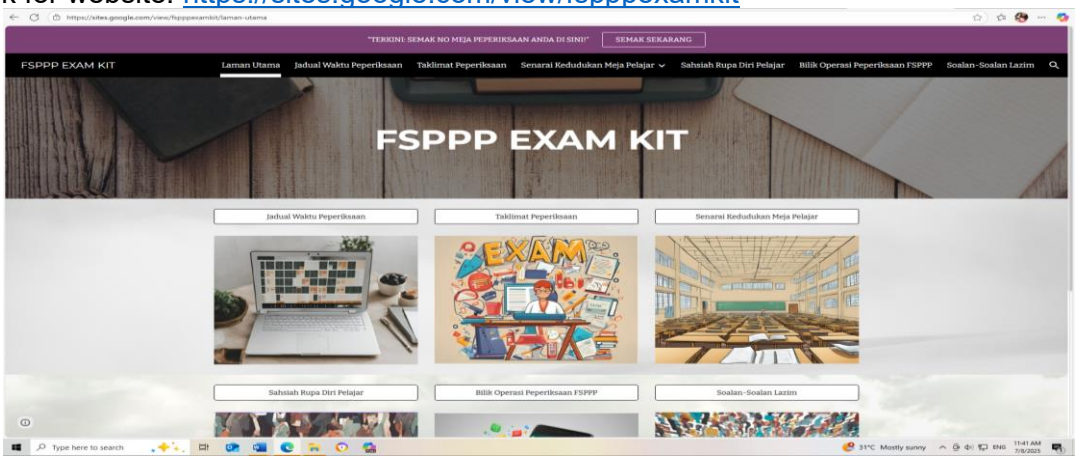

Figure 1: Front page FSPPP Exam Kit

Figure 2: Content of FSPPP EXAM Kit

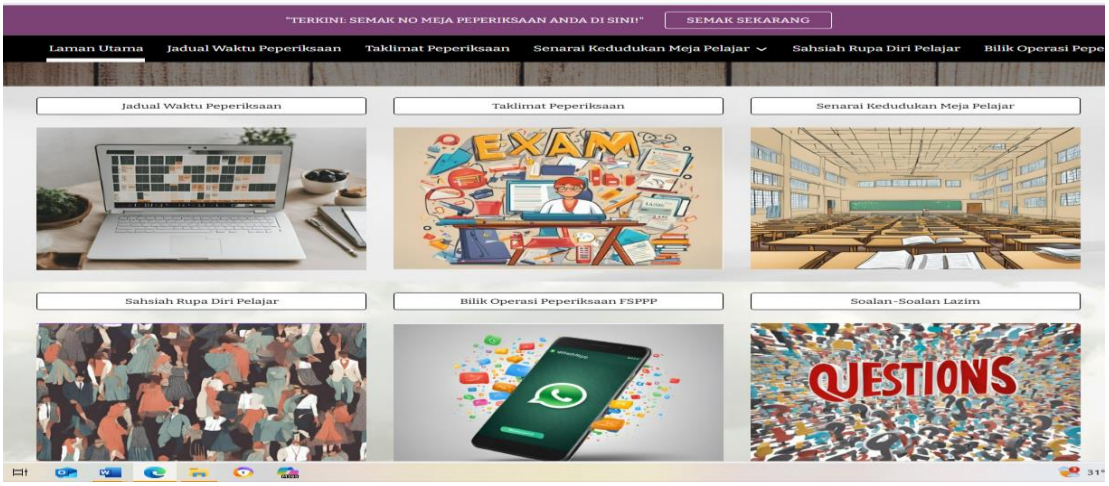

Figure 2: Content of FSPPP EXAM Kit

NOVELTY

The FSPPP Exam Kit (Phase 2) introduces a novel approach to the management and dissemination of examination information by transforming a previously static and document-based process into a dynamic, centralized, and fully digital platform. Unlike conventional systems that rely on manual uploads or general announcements via email or notice boards, this project integrates real-time data delivery, personalized access, and interactive user interfaces into a single application.

The uniqueness of this product lies in its custom-built design for faculty-level examination management, which specifically addresses the operational workflow and user needs within the context of the Faculty of Administrative Science and Policy Studies (FSPPP). It is one of the first faculty-led innovations in UiTM to shift from a QR-based access system to a fully functional mobile/web application dedicated to exam preparedness. In addition, the system's ability to integrate QR code scanning, real-time notifications, and personalized data into one cohesive platform offers a fresh and practical innovation in academic digital services. The solution reflects a scalable model that can potentially be replicated across other faculties or academic institutions, making it not only a unique product but also a pioneer in modernizing examination operations within Malaysian higher education.

CONCLUSION

The FSPPP Exam Kit (Phase 2) represents a significant step forward in digitalizing and enhancing the management of final examination information within the Faculty of Administrative Science and Policy Studies (FSPPP), Universiti Teknologi MARA. Building on the success of the initial QR-based system, this proposed mobile and web-based application offers a centralized, efficient, and user-friendly platform that addresses the current limitations faced by both students and academic staff.

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PSS003 - i-INTEGRATED AUDIT MANAGEMENT SYSTEM

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ABSTRACT

This study evaluates the content validity and implementation potential of the IAB Integrated Audit Management System (IIAMS), a digital platform developed by the Aminuddin Baki Institute (IAB) to enhance internal audit management through the integration of Lean principles and ISO 9001:2015 standards. Using a quantitative approach, seven experts assessed IIAMS via the Content Validity Index (CVI) and SPSS analysis, with all items scoring above the 0.78 threshold, indicating high validity. Mean scores for usability, interface, and content suitability ranged from 4.2 to 4.6, reflecting strong user acceptance despite minor concerns over smartphone access. IIAMS improves audit transparency, efficiency, and accountability by enabling real-time document upload, retrieval, and monitoring. Beyond compliance, it supports continuous improvement and data-driven decision-making. The system demonstrates strong potential for replication across other Ministry of Education training institutes, positioning it as a benchmark for digital innovation in educational governance and national education management transformation.

Keywords **– audit management, digital systems, Lean, ISO 9001, IIAMS, content validity**

INTRODUCTION

ISO 9001 is a globally recognized quality management system standard with over one million certified organizations worldwide (Bravi et al., 2019; Başaran, 2021; Wilson & Campbell, 2020). However, its implementation in the public sector and educational institutions often faces challenges where Quality Management Systems (QMS) are applied bureaucratically, prioritizing documentation compliance over continuous improvement and operational effectiveness (Gebregergs, 2019; Brooks et al., 2021). This can lead to inefficiencies, resource wastage, and audits with minimal organizational impact. Lean Management principles focusing on waste reduction, process efficiency, and value creation offer potential to strengthen QMS (Bacoup et al., 2018), yet integration between Lean and ISO frameworks remains limited in training institutions.

In Malaysia, the Institut Aminuddin Baki (IAB), as the Ministry of Education's primary training center for educational leadership, has faced audit challenges including fragmented document management, inconsistent processes, and weak links between audit findings and institutional improvements. IIAMS was developed to address these issues, providing a centralized digital platform accessible via http://iiams.iab.edu.my that

embeds LPMS principles into ISO-based audits, reduces duplication, standardizes workflows, and generates data-driven insights to drive continuous improvement.

OBJECTIVE

To evaluate the effectiveness of IIAMS in integrating Lean Quality Management System (LPMS) principles with ISO-based audit processes to improve efficiency, transparency, and continuous improvement in internal audit management.

DESCRIPTION OF THE PROJECT

IIAMS was designed to facilitate the systematic collection, storage, and management of internal audit documents in accordance with ISO 9001:2015 standards. It provides auditors with a secure, centralized platform to upload audit reports, observations, corrective actions, and improvement proposals. The system also allows quick access to historical audit data, enabling better tracking of progress and corrective actions while ensuring compliance with ISO requirements.
By digitizing the audit process, IIAMS eliminates reliance on physical documents and face-to-face meetings, enabling flexible and collaborative work regardless of location. It also supports long-term quality improvements by allowing users to reference past audit findings, plan improvement measures, and perform basic audit data analysis to inform strategic decisions.

NOVELTY

IIAMS introduces a unique integration of ISO 9001 compliance requirements with Lean Quality Management System (LPMS) principles in a fully digital platform tailored for educational training institutions. Unlike conventional audits that rely on manual documentation and fragmented workflows, IIAMS centralizes all processes in a real-time, cloud-based environment, eliminating duplication, enhancing transparency, and ensuring consistency across audit stages.
Its dual role as both a compliance tool and a strategic improvement mechanism further distinguishes IIAMS. Beyond fulfilling ISO audit requirements, it incorporates data analytics to identify recurring issues, track corrective actions, and generate actionable insights. With smartphone accessibility, remote collaboration, and continuous reference to past audits, IIAMS reduces time, cost, and resource consumption while fostering a culture of continuous improvement.

CONCLUSION

The development of IIAMS demonstrates that a digital, integrated approach can transform internal audit management in educational training institutions, enhancing efficiency, transparency, and accountability. Expert evaluations confirm high usability and content validity, indicating readiness for broader adoption. Future development will explore commercialization, replication across other Ministry of Education training institutes, and advanced features such as AI-driven analysis, automated reporting, and integration with existing training management systems. With its proven potential, IIAMS stands as a high-

impact innovation aligned with Malaysia's MADANI aspirations and the transformation of national education governance.

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PSS004 - GAME-INTEGRATED COMMUNICATIVE FRAMEWORK: TRANSFORMING ESL SPEAKING THROUGH MAINSTREAM DIGITAL GAMING

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ABSTRACT

This paper introduces the *Game-Integrated Communicative Framework* (GICF), an innovative solution to persistent challenges in Malaysian tertiary ESL education: low speaking confidence, lack of authentic practice, and difficulty with strategic communication tasks like giving instructions and leading discussions. Moving beyond traditional teacher-centered methods, GICF systematically integrates the popular cooperative game *Overcooked* (on the Nintendo Switch) into a structured Task-Based Language Teaching (TBLT) cycle. This creates a high-engagement, low-anxiety environment where learners practise imperative use, sequencing, and negotiation in time-sensitive collaborative scenarios. A mixed-methods pilot study with 40 A2-B1 CEFR learners at UiTM Sarawak demonstrated significant outcomes: increased classroom engagement, reduced speaking anxiety, and improved accuracy in functional language use. By merging theory-driven pedagogy with the motivational power of gaming, GICF addresses both linguistic and affective barriers to fluency. Furthermore, it presents substantial commercial potential for scalable educational products, aligning with national educational goals and advancing Sustainable Development Goal 4: Quality Education.

Keywords – ESL Speaking, Gamification, Digital Game-Based Learning, Leadership Language, Instruction-Giving

INTRODUCTION

Despite decades of English instruction under national policies (KSSR, KSSM, CEFR), Malaysian tertiary students often graduate with low confidence in spoken English. Traditional, teacher-centered classrooms fail to provide authentic, real-time communication practice, leaving learners anxious and ill-prepared for strategic tasks like instruction-giving and discussion leadership. The *Game-Integrated Communicative Framework* (GICF) addresses this critical gap. It recontextualizes a mainstream entertainment platform into a rigorous pedagogical tool, transforming the popular cooperative game *Overcooked* into a catalyst for language acquisition. GICF is significant for its dual focus: it measurably enhances oral proficiency through structured practice while simultaneously fostering indispensable 21st-century skills like collaboration, leadership,

and problem-solving. Its demonstrated scalability and commercial viability position GICF as a transformative model for modern language education.

OBJECTIVE

The objectives of this project are threefold. Firstly, it aims to design and implement the GICF using mainstream cooperative gaming to enhance ESL learners' instruction-giving, leadership language, and collaboration skills in speaking classrooms. Secondly, it seeks to evaluate GICF's impact on reducing speaking anxiety while promoting authentic, real-time communication in tertiary ESL settings. Lastly, it explores the potential scalability of GICF for broader applications, including teacher training programmes and the development of digital ESL learning resources.

DESCRIPTION OF THE PROJECT

GICF employs the *Task-Based Language Teaching* (TBLT) cycle to integrate *Overcooked*, a cooperative multiplayer game by Ghost Town Games on the Nintendo Switch into ESL speaking lessons, ensuring gameplay meets defined linguistic objectives rather than serving as entertainment. In *Overcooked*, players collaborate to prepare and deliver food orders under strict time limits, undertaking tasks such as chopping, while managing obstacles such as moving platforms or restricted workspace. Success depends on real-time communication, strategic role allocation, and efficient task delegation within rounds lasting two to four minutes.

GICF is delivered in three stages. In the pre-task phase, the instructor introduces the game, explains the rules, and teaches functional language for instruction-giving, sequencing, and negotiation, such as "*First, boil the rice; then serve the dish*". Roles are assigned as one *Leader*, one *Coordinator*, and one or two *Implementers*, with each responsible for specific communicative and operational functions.

Figure 1: Learners played *Overcooked* on Nintendo Switch within the GICF using a TBLT approach.

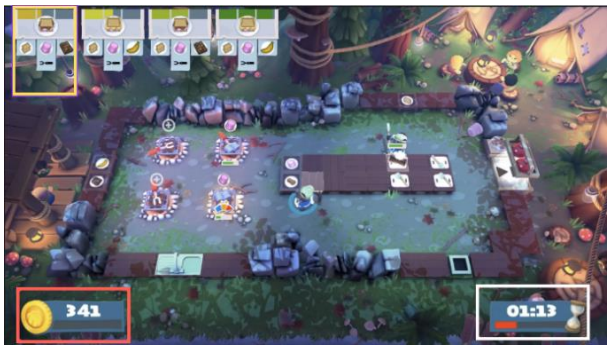

Figure 2: *Overcooked* gameplay interface

During the task phase, learners engage in gameplay using the target language, applying pre-taught structures to articulate strategies, negotiate responsibilities, and respond to challenges. A structured *Gameplay Language Bank* supports this process, categorising expressions by communicative function and role: *Leaders* issue clear imperatives, *Coordinators* manage sequencing, and *Implementers* execute tasks while participating in negotiations.

Table 1: Example of Gameplay Language Bank by Function and Role.

Language Function	Example Sentence	Role Likely to Use It	Purpose in Gameplan
Imperative (Giving direct instructions)	"Chop the onions!"	Leader	Commanding
	"Wash the plates now!"	Coordinator	Urging and instructing
	"Serve the salad quickly!"	Implementer	Prompting teammates

The post-task phase involves reflective discussion, where learners analyse strategies, identify effective expressions, and consider improvements. This structured cycle transforms *Overcooked* from a leisure game into a pedagogical tool that enhances linguistic proficiency while fostering 21st-century skills such as teamwork, leadership, and problem-solving.

NOVELTY

This project's novelty lies in integrating a mainstream entertainment game into formal ESL pedagogy through a structured, theory-based framework. Unlike most Digital Game-Based Language Learning research focused on educational games, it employs the popular Nintendo Switch game *Overcooked* within a *Task-Based Language Teaching* (TBLT) cycle. The GICF addresses strategic language use and affective factors by embedding tasks in an engaging, low-anxiety context. It recontextualises *Overcooked* into a tool combining linguistic targets, reflective practice, and gamified motivation, retaining its entertainment value while aligning with communicative objectives such as instruction-giving, negotiation, and leadership language.

CONCLUSION

The *Game-Integrated Communicative Framework* (GICF) effectively enhances ESL learners' oral communication, particularly in instruction-giving and collaborative problem-solving, while reducing speaking anxiety and boosting engagement. It fosters leadership, teamwork, and digital literacy through structured integration of the mainstream game *Overcooked*. Rule modifications and scaffolding improved participation and confidence, highlighting the value of pedagogical flexibility and technology alignment with learning goals. Aligned with Malaysia's CEFR reforms and *Sustainable Development Goal 4: Quality Education*, GICF is both a transformative teaching innovation and a market-ready product.

PSS005 - GLOBAL VOICES: AI PERSONA LAB (CONSUMER PERSONA CHATBOT)

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ABSTRACT

Global Voices: AI Persona Lab is an educational innovation that transforms theoretical learning into dynamic, experiential simulations using AI-powered personas. Initially applied in a consumer behavior module in Malaysian higher education, the Lab enables students to interact with hyper-realistic AI chatbots representing diverse cultural, generational, and consumer profiles. These personas exhibit nuanced decision-making, emotional depth, and cultural authenticity, allowing students to practice inquiry-driven engagement in a low-stakes yet realistic environment. The platform integrates GPT-4o for natural language processing, ElevenLabs for voice synthesis, and Deepgram for speech-to-text, supporting unscripted, adaptive conversations. Grounded in Kolb's Experiential Learning Theory, the Lab guides students through insight gathering, analysis, strategy design, and virtual marketplace testing, fostering empathy, cross-cultural competency, and applied problem-solving. Its tool-agnostic, web-based design ensures accessibility and scalability across disciplines such as healthcare, tourism, and design. The innovation has yielded measurable improvements in student engagement and performance, positioning it as a adaptable, human-centered model for AI-enhanced education.

Keywords – generative AI, experiential learning, cross-cultural simulation, gamified pedagogy

INTRODUCTION

Global Voices: AI Persona Lab addresses the gap between theoretical instruction and real-world application in higher education. By using AI-driven persona simulations, it replaces passive learning with active, conversational engagement. Designed initially for consumer behavior courses, the Lab immerses students in interactions with diverse consumer archetypes, enhancing empathy, cultural understanding, and strategic thinking through dynamic AI responses.

OBJECTIVE

The primary objectives of Global Voices: AI Persona Lab are to:

i. Transform passive knowledge consumption into active learning through authentic, AI-mediated inquiry.
ii. Foster empathy, cross-cultural understanding, and advanced application of marketing and consumer behaviour theories.

iii. Provide a low-barrier, scalable educational tool that requires no programming, hardware, or platform installation.
iv. Enhance student engagement, learning outcomes, and reflective practice through a structured yet flexible experiential journey.
v. Develop a model adaptable across disciplines where user, client, or stakeholder empathy is essential.

DESCRIPTION OF THE PROJECT

Grounded in Kolb's Experiential Learning Theory, the Lab follows a structured multi-phase learning journey powered by custom-engineered AI chatbots. Each persona is hosted on a web-based interface that integrates GPT-4o for natural language processing, ElevenLabs for lifelike voice synthesis, and Deepgram for accurate speech-to-text recognition.

These chatbots act as hyper-realistic consumer personas capable of engaging in unscripted, context-aware conversations that adapt to the student's line of questioning. Their responses incorporate individualised cultural values, behaviours, and emotional tones, simulating authentic consumer interviews in a safe yet unpredictable environment.

Students begin by interacting with the personas to elicit behavioural insights, then analyse the data using structured frameworks to build comprehensive consumer profiles. Based on these insights, they design products, campaigns, or strategies aligned with persona needs.

The journey also includes an immersive virtual marketplace simulation, where students present offerings to their persona and receive dynamic, persona-specific feedback, allowing them to test and refine their approach. Later phases focus on self-reflection and cross-cultural adaptation, encouraging students to adapt strategies for different markets.

The Lab is entirely web-based, requiring no coding skills or specialised hardware, ensuring ease of adoption across institutions.

NOVELTY

The distinctiveness of Global Voices: AI Persona Lab lies in its fusion of unscripted AI persona interaction, gamified decision-making, and cross-cultural simulations within a unified and adaptable platform. Unlike scripted roleplays, the chatbots provide unpredictable, nuanced responses that replicate the complexity of real-world interactions.

Its modular design ensures scalability across disciplines such as pharmacy, tourism, law, and design, while its adaptability allows it to evolve alongside advances in AI technology.

CONCLUSION

The Lab has demonstrated measurable success, with higher teaching engagement ratings and improved student performance. Students reported stronger theory application, greater cultural awareness, and increased confidence in managing real-world challenges.

With planned expansion through educator toolkits and adaptable persona modules, Global Voices: AI Persona Lab represents a future-ready, human-centred model for AI-enhanced education, bridging the gap between knowledge and practice in the digital age.

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PSS006 - VISUALIZING CONTRADICTIONS: AN INTERACTIVE COMIC FOR LEARNING PHYSICAL CONTRADICTION

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ABSTRACT

This study developed an Interactive Learning Comic to teach Physical Contradiction in Form 2 Design and Technology. Using the ADDIE instructional design model and constructivist learning principles, the comic was designed to enhance student engagement and conceptual understanding. Three phases guided the project: identifying instructional requirements, designing and developing the comic, and evaluating its usability through expert interviews. Three subject experts affirmed the comic's effectiveness in simplifying complex concepts via visual storytelling, interactivity, and relatable content. The module offers a practical alternative to traditional textbooks and supports both student learning and teacher instruction. Future work will extend this approach to develop a comic module on time separation inventive principles.

Keywords – Interactive Learning Comic, Design and Technology, Physical Contradiction, Inventive Principles

INTRODUCTION

Teachers face significant challenges in adapting to the transformation of the subject of Integrated Living Skills into the subject of Design and Technology in 2017, which emphasizes problem-solving through TRIZ principles as part of Malaysia's IR4.0 education strategy. This is supported by Sharberi et al. (2020), who noted that learning modules are essential as reference materials, especially those focused on TRIZ principles. The study highlights the importance of interactive teaching aids, such as digital comics, in assisting the teaching of complex topics like Inventive Problem Solving. Previous research found that students retain information better when teaching aids incorporate images and visuals (Abdullah et al., 2015). Mohd Razali and Ayob (2018) also argued that using cartoon illustrations as an interactive module stimulates students' minds to be more active in the classroom. The development of interactive comics in this study aims to enhance students' understanding of the Physical Contradiction subtopic through TRIZ principles, which include the methods of Spatial and Temporal Separation. This comic is expected to improve students' understanding, motivation, and interest in learning complex subject of Design and Technology topics in a more visual and interactive way, while also aiding teachers in delivering more effective instruction.

Interactive comics also play a crucial role in supporting constructivist theory-based learning, where students build knowledge through experiences and simulations in relevant

contexts. This is further supported by Kho et al. (2020), who argued that the use of comics in teaching and learning theoretically strengthens the constructivist approach. With this approach, the study hopes to provide improvements in delivering the content of the subject of Design and Technology and meet the demands of 21st-century learning, which is more interactive and student-centered.

OBJECTIVE

The objectives of this study are to identify the instructional material (IM) requirements for the subtopic of Physical Contradiction in the Form 2 subject of Design and Technology, to develop an Interactive Learning Comic as an instructional material for this subtopic, and to evaluate the usability of the Interactive Learning Comic in supporting the teaching and learning of the Physical Contradiction subtopic in Form 2 subject of Design and Technology.

DESCRIPTION OF THE PROJECT

This qualitative study examines the usability of an Interactive Learning Comic for the Physical Contradiction subtopic in the subject of Design and Technology. Three experienced teachers in the subject of Design and Technology, each with over five years of teaching experience, evaluated the module through semi-structured interviews after reviewing it in advance. Guided by the ADDIE model, the module's development involved:
(1) Analysing the needs of teachers and students for accessible, visually engaging, and example-rich resources;
(2) Designing interactive materials with QR codes, real-life examples, and storyboard illustrations to simplify TRIZ inventive principles;
(3) Developing the comic narrative, practice spaces, and gamified quizzes;
(4) Implementing and refining the module based on expert feedback; and
(5) Evaluating its effectiveness over a one-week trial. Thematic analysis of interview data provided insights into the module's suitability and effectiveness in enhancing teaching and learning.

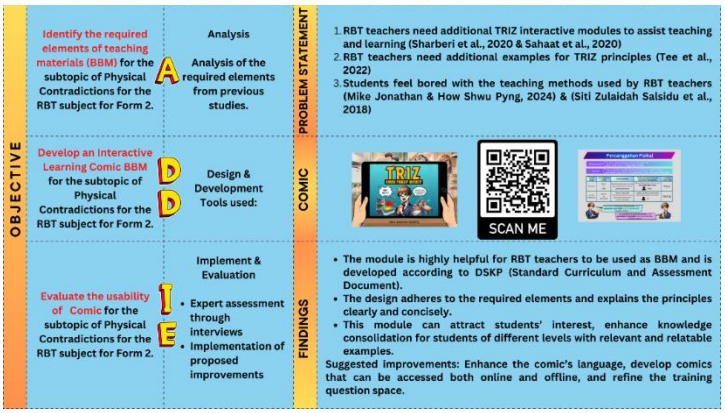

Figure 1: Development and Evaluation of an Interactive Learning Module Using the ADDIE Model.

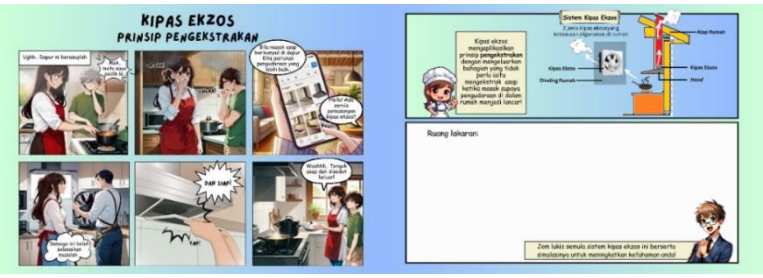

Figure 2: A section of the comic that visually depicts a problem and its solution using the TRIZ principle, accompanied by illustrated explanations.

NOVELTY

The novelty of this product lies in its integration of the TRIZ inventive principles into a visually engaging comic-based learning module, specifically tailored for the Physical Contradiction subtopic in subject of Design and Technology. Unlike conventional teaching resources that rely heavily on text and static diagrams, this module presents problem scenarios and solutions through illustrated storytelling, supported by interactive elements such as QR codes linking to gamified quizzes. This unique combination of visual narratives, real-life examples, and digital interactivity not only simplifies complex concepts but also enhances student engagement, making it an innovative tool for fostering creativity, problem-solving skills, and deeper conceptual understanding in the classroom.

CONCLUSION

All experts agreed that the developed comic module is useful for both teachers and students, though its usability could be improved for greater effectiveness. The interactive format offers flexible learning, simplifies teachers' preparation by providing reusable materials, and supports online sessions or projection via smartTVs. Interactive learning captures students' interest, actively engages them, and enhances understanding, reducing boredom and drowsiness in class. Overall, the interactive learning comic on physical contradictions helps teachers overcome instructional challenges and fosters a more engaging classroom environment.

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PSS007 - i-FIQH EASY

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ABSTRAK

Pengajaran kursus Ekonomi dan Kewangan Islam melibatkan penggunaan pelbagai istilah teknikal dalam bahasa Arab seperti *Murabahah, Musyarakah, Mudarabah, Wakalah* dan sebagainya. Istilah-istilah ini menjadi cabaran kepada pelajar yang tidak mempunyai asas bahasa Arab, termasuk pelajar bukan Islam, sehingga menjejaskan penguasaan konsep asas perbankan Islam dan keberkesanan pembelajaran. Bagi mengatasi isu ini, projek inovasi i-FIQH EASY dibangunkan sebagai bahan bantu mengajar berasaskan kecerdasan buatan (AI) khusus untuk topik *Islamic Banking Product*. Inovasi berbentuk komik bergambar ini menyampaikan kandungan melalui jalan cerita yang menarik, dilengkapi sebutan istilah, maksud ringkas dalam Bahasa Melayu/Inggeris, serta contoh penggunaannya dalam situasi harian dan contoh aplikasi di bank. Pembangunan i-FIQH EASY menggunakan gabungan aplikasi Gemini, Canva AI dan Comica, dengan pengesahan kandungan oleh dua orang pakar bidang. Ujian kebolehgunaan menunjukkan respon positif daripada pelajar, termasuk pelajar bukan Islam, yang mendapati i-FIQH EASY membantu mereka memahami istilah teknikal dan meningkatkan minat terhadap subjek. Inovasi ini membolehkan pelajar mengakses pembelajaran di mana-mana sahaja, serta berpotensi diperluas kepada kursus seperti CTU241 dan CTU351 di UiTM, subjek berkaitan di IPTA lain, serta dikembangkan kepada modul video bersiri atau aplikasi pembelajaran pintar untuk pengalaman yang lebih interaktif.

Kata kunci – Kewangan Islam, istilah Arab, Fiqh, inovasi pengajaran

PENGENALAN

Ramai pelajar UiTM menghadapi cabaran memahami istilah dan konsep perbankan Islam kerana penggunaan istilah Arab yang kompleks, penerangan yang terlalu teknikal, serta kekurangan bahan pembelajaran interaktif yang dekat dengan dunia mereka. iFiqhEasy menyampaikan konsep perbankan Islam melalui cerita ringkas yang dekat dengan kehidupan pelajar UiTM. Setiap istilah seperti *Wakalah*, *Murabahah*, *Mudharabah* dan *Musharakah* diterjemah dalam ilustrasi komik dan animasi yang memudahkan pemahaman. Kisahnya berpaksikan situasi harian pelajar, contohnya melantik rakan membeli buku bagi menggambarkan *Wakalah* atau berkongsi modal untuk projek perniagaan bagi *Musharakah*. Bahasa yang digunakan mudah, esra, dan inklusif, membolehkan pelajar tanpa asas Bahasa Arab termasuk pelajar bukan Islam dapat memahami konsep dengan cepat. Kandungannya juga disesuaikan dengan silibus CTU241 dan CTU351, menjadikan pembelajaran lebih relevan, fleksibel dan menarik.

OBJEKTIF

Antara objektif Projek i-FIQH EASY ialah dapat memudahkan pemahaman konsep perbankan Islam melalui penceritaan ringkas, ilustrasi komik dan animasi yang relevan dengan kehidupan seharian pelajar. Kedua, dapat mengurangkan halangan bahasa dan istilah teknikal dalam pembelajaran subjek *Islamic Banking* khususnya bagi pelajar tanpa asas Bahasa Arab. Ketiga, ia dapat meningkatkan minat dan penglibatan pelajar dalam mempelajari fiqh muamalat melalui pendekatan interaktif dan mesra pengguna.

Selain itu, projek ini juga dapat menyokong pencapaian hasil pembelajaran kursus (CLO) dan mengintegrasikan teknologi kreatif dalam pengajaran dan pembelajaran Islam kontemporari.

PENERANGAN TENTANG PROJEK

Butiran Produk

Nama : i-FIQH EASY
Fungsi : i-FIQH EASY memperkenalkan pendekatan inovatif dalam pengajaran asas perbankan Islam dengan menggabungkan pemahaman istilah Arab, visual interaktif, dan platform media sosial untuk menghasilkan pengalaman pembelajaran yang pantas, mudah, dan menarik.

Kegunaan : Menggunakan ilustrasi gaya komik dan video pendek (YouTube) untuk menjelaskan konsep seperti *Wakalah*, *Murabahah*, *Mudharabah*, dan *Musharakah*, menjadikan pembelajaran lebih mesra generasi muda. Berbeza dengan kaedah tradisional, i-FIQH EASY bukan sahaja menerangkan istilah Arab dalam perbankan Islam, tetapi juga memaparkannya melalui animasi dan contoh kehidupan sebenar, memudahkan pelajar memahami konsep dengan lebih cepat. Direka khas untuk pelajar kursus CTU241 & CTU351 di UiTM termasuk pelajar bukan Islam, dengan penekanan pada kefahaman istilah tanpa mengira latar belakang bahasa Arab. Ia dapat mengurangkan masa pembelajaran dengan membina hubungan terus antara istilah Arab, maksud, dan aplikasi dunia sebenar dalam perbankan Islam.

Rajah 1: Logo i-FIQH EASY

Rajah 2: Contoh Animasi dan QR untuk audio dalam bentuk YouTube

PEMBAHARUAN

i-FIQH EASY adalah bahan bantu mengajar yang memudahkan kefahaman istilah Arab dalam Perbankan Islam, terutamanya untuk pelajar yang tidak mempunyai asas bahasa Arab. Ia menggabungkan ilustrasi komik, video pendek YouTube, serta contoh ang dekat dengan jiwa pelajar. Kandungan direka agar inklusif, sesuai untuk pelajar Muslim dan bukan Muslim, serta selari dengan sukatan kursus CTU241 dan CTU351 di UiTM.

Produk ini menyokong matlamat **United Nations Sustainable Development Goals (SDGs)**, khususnya:

- **SDG 4: Quality Education** – memastikan akses kepada pendidikan berkualiti dan inklusif.
- **SDG 8: Decent Work and Economic Growth** – membangunkan kemahiran kewangan Islam untuk kegunaan industri.
- **SDG 10: Reduced Inequalities** – mengurangkan jurang pemahaman antara pelajar dengan latar belakang bahasa yang berbeza.

i-FIQH EASY membantu membentuk generasi celik kewangan Islam yang bersedia untuk pasaran kerja global, sambil memupuk kefahaman konsep Syariah secara mudah, interaktif dan relevan dengan keperluan semasa.

KESIMPULAN

Kesimpulannya ialah i-FIQH EASY berjaya menjadi satu pendekatan inovatif dalam pengajaran konsep perbankan Islam yang mesra pengguna, interaktif, dan inklusif. Melalui penggunaan cerita ringkas, ilustrasi komik, dan animasi, ia bukan sahaja memudahkan pemahaman pelajar terhadap istilah teknikal dan konsep Syariah, malah mengurangkan halangan bahasa bagi pelajar tanpa asas Arab. Pendekatan yang relevan dengan situasi harian ini meningkatkan minat serta penglibatan pelajar, di samping memastikan kandungan dapat diakses oleh semua, termasuk bukan Muslim. Integrasi teknologi multimedia turut menyokong pencapaian CLO dan meningkatkan kualiti PdP agar lebih kreatif, berkesan, dan selari dengan keperluan pembelajaran abad ke-21.

PSS008 - DARI PENTAS KE PODCAST: THEATRE THAT ECHOES

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ABSTRACT

This project is an innovation by Kelab ABSTRAK, a theatre, dance, and music club in UiTM Kuala Pilah and its podcast initiative titled *Dari Pentas ke Podcast*, which transforms its stage productions into audio dramas. Theatre has long depended on the physical presence of both performers and audience, relying heavily on visual storytelling like sets, costumes and lighting. However, with the rise of digital platforms and changing audience behaviours, new formats are emerging to complement or even replace traditional performances. Audio drama, once associated with early radio, is now experiencing a resurgence through podcasts. This extended abstract introduces *Dari Pentas ke Podcast*, a student-driven innovation that reinterprets staged plays as audio productions to make theatre more accessible, sustainable, and creatively fluid.

Keywords – ABSTRAK, audio drama, podcast, Spotify, commercialisation

INTRODUCTION

The theatre wing of Kelab ABSTRAK has been actively staging plays since 2018. During the Covid-19 pandemic, when the dance and music performances had to stop due to physical and geographical distance, members of the theatre unit soldiered on performing online using the Zoom platform, never stopping at the various constraints that social distancing have imposed on the field of performance arts. When physical performances were once again allowed, the theatre unit continued to grow from strength to strength, staging works from notable local playwrights like Khairunazwan Rodzy, Yusof Bakar, Hatta Azad Khan and Wiramanja just to name a few, in UiTM Kuala Pilah.

The process of staging a performance is an invaluable experience where members of the production learn skills of sorts relating to the stage and develop the soft skills which enriches human interaction. Documenting the process of staging a play is very important to archive and preserve Kelab ABSTRAK's staged performances for various reference purposes. Video recordings and photographs were taken to be uploaded on youtube and social media from the start of the process until the days of performance.

The idea of uploading the audio version of the previously staged plays on a podcast titled *Dari Pentas ke Podcast* is the latest theatre unit initiative to document work done by its talented and hardworking members. Listening to plays is definitely a different experience

and will put the different senses to work in order for enjoyment and appreciation to happen. There are people who are more auditory than others and with the surge of interest in podcasting as an avenue of audio discussion and storytelling, we believe that the decision to preserve the staged plays in audio form is practical and beneficial.

The demand for skills in science, technology, engineering, and mathematics (STEM) continues to grow with the integration of arts into education today. The arts represent disciplines such as visual arts, music, theatre, and design that allow the students to participate in audio-based activities for literary appreciation (Abidin et al., 2024). The advent of technology has marked a pivotal shift from traditional print formats to digital platforms. This transition has reshaped how readers interact with texts and printed materials, paving new ways of accessing and consuming any written content (Palanisamy & Rajasekaran, 2025). This has not only changed how individuals read but also how they engage with texts. The emergence of e-books in the late 20th century marked a change that allows users to access printed materials with ease due to their portability and quick-access nature.

Drawing upon this digital revolution, the 21st-century era has witnessed the rise of audio-based literary formats. Podcasting is an audio-based approach that can promote narrative learning and provide better engagement with the audio. Podcasts are digital audio files that are readily available to be downloaded or streamed from the Internet (Ying et al., 2024). The use of podcasts in teaching and learning has been rapidly increasing, but not many studies have been done to incorporate the use of podcasts for stage performance in audio format. The digital era has opened up the opportunity for listeners to access music anywhere and anytime through streaming services such as Spotify, YouTube or Apple Music. Spotify offers instant access to more than 70 million tracks that represent massive data sources for listeners (Terroso-Saenz et al., 2023). There is a need for an audio platform that can be effortlessly consumed while multitasking, where the listeners can listen to the audio while doing other activities (Palanisamy & Rajasekaran, 2025). Ying et al. (2025) stated that podcasting not only promotes memorable learning but also allows the listeners to translate their listening experience into actual practice.

OBJECTIVE

The main objectives of *Dari Pentas ke Podcast* are:

i. To archive and preserve Kelab ABSTRAK's staged performances in audio form.
ii. To expand access to Kelab ABSTRAK's creative output beyond the stage at UiTM Kuala Pilah community.
iii. To encourage appreciation of theatre scripts as literary texts among UiTM Kuala Pilah student community and the general public as a whole

DESCRIPTION OF THE PROJECT

Dari Pentas ke Podcast transforms previously staged plays into audio dramas. The project involves recording audio versions of the plays that have been staged and adapting them into podcast episodes. Each production is adapted for sound, involving
script adjustments, voice re-recordings, and the addition of ambient soundscapes and music. These are edited and published on podcast platforms accessible to the public. The process includes selecting a staged production from ABSTRAK's archive, rehearsing and

re-recording the play with a focus on vocal performance, adding sound effects and transitions to enhance immersion and finally publishing and promoting the episodes on digital platforms. The project is a further collaboration between performers, directors, and audio editors within the club after the stage play has ended.

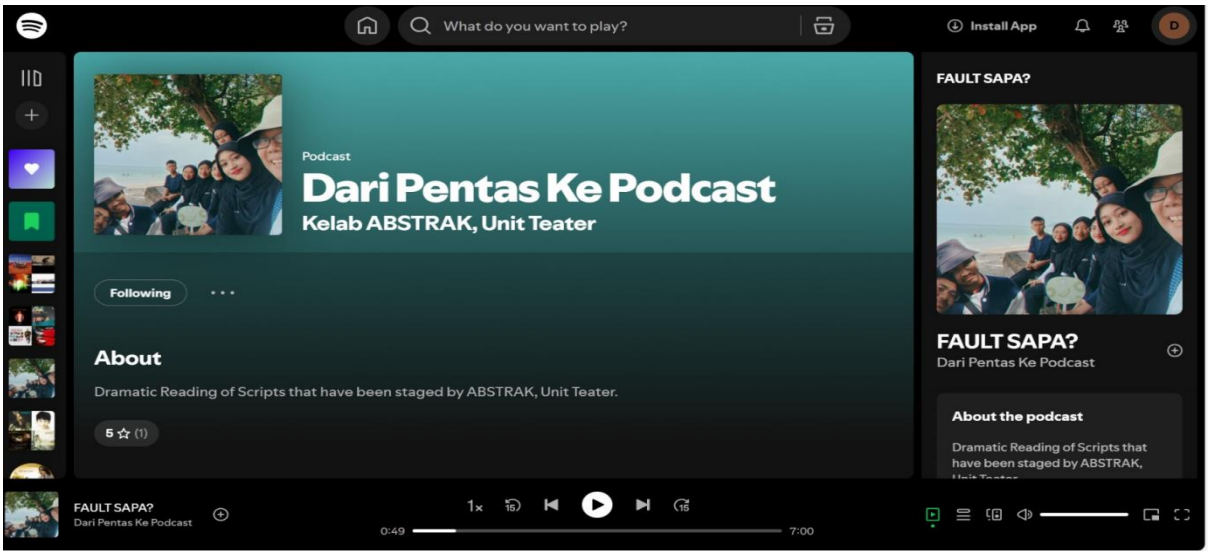

Figure 1: *Dari Pentas Ke Podcast*, a podcast created via Spotify

NOVELTY

While radio dramas have existed for decades, this project differentiates itself by these three novelties. Firstly, unlike livestreamed theatre or recorded stage videos, *Dari Pentas ke Podcast* reinvents theatre as a sound-first experience. Its novelty lies in taking traditionally visual content and converting it to a purely auditory form removing barriers for the visually impaired or geographically distant. Also, those who may have missed the real-time stage performance can access the audio tracks later.

The second novelty is that audio plays are lightweight and portable. Only minimal resources are needed, making it cost-effective for student theatre groups like Kelab ABSTRAK. The selected music streaming service, Spotify, allows users to get instant access to an unprecedented amount of audio of any type. The podcasts are distributed on popular streaming platforms, enabling easy access for listeners which brings us to the final novelty of the product which is the commercial potential.

There is definitely a commercial potential for Kelab ABSTRAK's podcast *Dari Kertas Ke Pentas* once it becomes well known to the global literary community. This can be done through advertising, sponsorships and paid subscriptions. Also those who care for the arts may want to donate money to the club to see it flourish in the long run by becoming patrons of the club.

CONCLUSION

Kelab ABSTRAK's *Dari Pentas ke Podcast* highlights how audio drama can serve as an effective, accessible, and a valuable form of theatre. *Dari Pentas ke Podcast* is not just a preservation project for Kelab ABSTRAK but also an expansion of what theatre can be more. By embracing podcasting as a medium, Kelab ABSTRAK has created a bridge between stage performance and digital storytelling. This innovation not only sustains

Kelab ABSTRAK's artistic legacy but also provides a meaningful training ground for students while reaching audiences far beyond the theatre walls of UiTM Kuala Pilah.

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NSIEX+RS 2025
NEGERI SEMBILAN INTERNATIONAL EXPOSITION

THEME 4

PROFESSIONAL (SCIENCE AND TECHNOLOGY) RESILIENCE IN SCIENTIFIC PURSUE

PST001 - GAMMAGLOW DUCK: READY-TO-COOK SMOKED DUCK MEAT PRESERVED VIA GAMMA TECHNOLOGY

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ABSTRACT

This innovation presents a ready-to-cook, vacuum-packed, gamma-irradiated smoked duck developed specifically for traditional Negeri Sembilan cuisine. It addresses key challenges faced by Malaysia's food processing micro, small, and medium enterprises (MSMEs), including short shelf life, microbial contamination, and quality degradation during storage. The objective is to produce a smoked duck product that retains its flavour and quality at ambient room temperature (27°C), eliminating the need for cold storage. This is achieved through the integration of three techniques: warm smoking, double-layer vacuum packaging, and gamma irradiation. Warm smoking reduces carcinogenic compounds typically associated with traditional smoking methods. The double-layer vacuum packaging enhances packaging durability and inhibits microbial growth. Gamma irradiation effectively eliminates microbial contaminants, extending shelf life while preserving the product's authentic taste and texture. This innovation offers a practical, scalable solution tailored for MSMEs in the poultry processing sector.

Keywords – Gamma Irradiation, Smoked Duck, Vacuum Packaging, Shelf Life Extension

INTRODUCTION

Smoked duck is a traditional delicacy in Malaysia, especially in Negeri Sembilan. However, the industry faces several challenges including short shelf life, microbial contamination, reliance on cold storage, and rising production costs. These issues are particularly burdensome for MSMEs. The motivation behind this product's development is to address these pain points by enhancing product safety, extending shelf life, and ensuring quality without cold storage.

OBJECTIVE

The objective of this project is to develop a ready-to-cook smoked duck product that retains its flavour, texture, and safety at room temperature (27°C), thereby enabling safer distribution, prolonged shelf life, and reduced dependency on cold chain logistics.

DESCRIPTION OF THE PROJECT

GammaGlow Duck is a ready-to-cook, vacuum-packed, gamma-irradiated smoked duck that combines warm smoking to impart a distinctive flavour while reducing carcinogenic compounds typically associated with traditional smoking, double-layer vacuum packaging to enhance barrier protection and inhibit microbial growth, and gamma irradiation to eliminate pathogens and extend shelf life without the need for chemical preservatives or cold storage. This product is specifically optimised for MSMEs and supports food sustainability by eliminating the need for cold storage during both storage and transport, while preserving the authentic taste, texture, and safety essential to traditional dishes.

(a) (b)

Figure 1: Image of (a) vacuum packed and (b) final product of GammaGlow Duck.

NOVELTY

GammaGlow Duck is the first Malaysian smoked duck product that combines traditional warm smoking with modern gamma irradiation and double-layer vacuum packaging. This innovative tri-technology integration enables room-temperature storage while ensuring food safety and quality, without the need for cold storage or added chemical preservatives. The approach is both scientifically validated and commercially scalable for MSMEs.

CONCLUSION

Gamma irradiation, when combined with warm smoking and advanced vacuum packaging, effectively enhances the shelf life and microbiological safety of smoked duck without compromising its sensory qualities. This innovation offers a sustainable, cost-effective solution for local food processors and has strong commercialization potential.

PST002 - THE FIREFIGHTER ROBOT WITH CAMERA-BASED DETECTION AND GPS NAVIGATION

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ABSTRACT

Firefighting is a high-risk job where firefighters are often exposed to dangerous conditions such as fire, smoke, toxic gases and unstable structures. This project introduces a Firefighter Robot equipped with a night vision camera, designed to reduce or eliminate the need for human presence in hazardous situations. The robot can be remotely controlled or operate autonomously to navigate through rough terrain, detect fire in low visibility environments and extinguish flames using a built in fire suppression system. It also includes GPS tracking for real-time location monitoring and live video streaming to support decision making from a safe distance. The integration of these technologies into one system allows the robot to perform critical firefighting tasks efficiently and safely. This innovation not only protects human lives but also enhances the speed and effectiveness of emergency responses in dangerous or hard to reach areas.

Keywords – firefighter, robot, camera, gps tracking, arduino

INTRODUCTION

Firefighting is inherently a high risk profession, where firefighters are frequently exposed to life threatening situations while rescuing individuals in danger. As a result, they often operate in unpredictable and rapidly changing environments. The job is physically demanding and firefighters routinely encounter numerous hazards as part of their everyday duties (Heydari et al., 2022). According to (Cuenca-Lozano & Ramírez-García, 2023), firefighters are exposed to harmful substances in the environment, such as carbon monoxide, hydrogen cyanide, aerosols and tiny particles in the air. These can negatively affect their health. Thus, this project presents a Firefighter Robot that can be controlled from a distance to put out fires and handle dangerous situations. It helps reduce injuries and damage while providing a quick and effective response even in dark or difficult to reach places.

OBJECTIVE

There are three (3) primary objectives of the Firefighter Robot project: First, to develop a remotely controlled robot capable of navigating and performing firefighting tasks in hazardous environments without human intervention by integrating a night vision camera system that allows accurate detection and response to fire outbreaks in dark or smoke filled areas. Second, to equipped the robot with a fire suppression system such as a water or chemical spray mechanism to effectively extinguish various types of fires. Lastly, to integrate GPS technology in allowing for real-time location tracking.

DESCRIPTION OF THE PROJECT

The Firefighter Robot is designed with two main components: a transmitter and a receiver. The transmitter uses joystick modules to control the robot's movement, while push buttons are used to activate the DC water pump and request GPS location data. These inputs are sent wirelessly to the receiver using the nRF24L01 module, which then carries out the corresponding actions; water spraying as in Figure 1 and location sharing as in Figure 2. To support remote operation in dark or smoke filled environments, the robot is equipped with a night vision camera that streams live video directly to a mobile device as in Figure 3. This robot is constructed with durable materials such as aluminum composite panels and custom couplers to withstand extreme conditions. Its tank-style wheels further enhance mobility, enabling the robot to navigate across rough and uneven terrain with stability and ease.

Figure 1: The Firefighter Robot with a Fire Suppression System

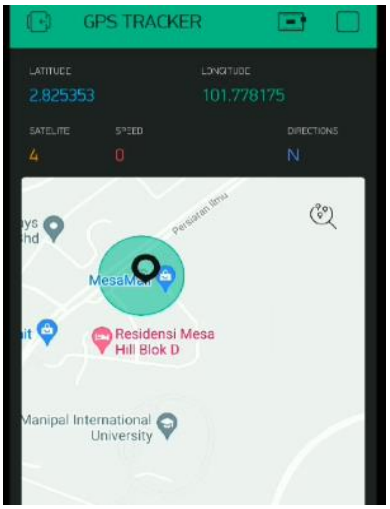

Figure 2: The Firefighter Robot GPS Location

Figure 3: The Prototype of Firefighter Robot and Camera View from Smartphone

NOVELTY

The novelty of this project is in creating a robot that can take over dangerous firefighting tasks without needing a person to be there. It combines night vision, remote or automatic control, live video and a fire suppression system in one machine. Unlike other robots that only help firefighters, this one is built to work on its own in dark, smoky or risky places. It can move through rough areas to find fires and send its location which make it a new and safer way to fight fires without putting people in danger.

CONCLUSION

In conclusion, the Firefighter Robot with camera detection and GPS navigation offers a safer and smarter way to handle fire emergencies without risking human lives. With its ability to navigate dangerous environments, it can detect fires in low visibility and operate

firefighting tools remotely. It serves as a strong alternative to human firefighters in high risk situations. This project shows how technology can improve safety, reduce injuries and response more effective toward emergency.

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PST003 - XactMath: AN INNOVATIVE TEACHING TOOL TO SUPPORT FORMULA AND TOPIC SELECTION IN BUSINESS MATHEMATICS

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ABSTRACT

This study investigates the use of the XactMath application as a digital learning tool to support students in mastering the topics of Simple Interest and Promissory Notes in Business Mathematics. The application guides students through three steps: identifying keywords, matching them to formulas and selecting the appropriate formula for problem-solving. A descriptive analysis was conducted to measure student acceptance and interest in the app after usage. Findings from a sample of 50 students, consisting of 36 females (72%) and 14 males (28%) revealed a high level of acceptance (M = 4.46, SD = 0.54) and strong interest (M = 4.44, SD = 0.52) in using the app for learning. Students agreed that the app improved their understanding, memorization and application of concepts, even without lecturer guidance. These results suggest that XactMath is a promising instrument for improving mathematical learning engagement and self-directed learning in business-related topics.

Keywords – engagement, technology, self-directed learning, mathematical learning

INTRODUCTION

In the digital era, technology-enhanced learning has become an essential strategy in higher education. The rapid pace of technological advancement presents ongoing challenges, requiring continuous adaptation of teaching methods and learning resources. In response, universities are increasingly embracing digital transformation as a sustainable approach, integrating information and communication technologies, computing and connectivity tools into the learning environment (Mondragon-Estrada et al., 2023). Thus, the integration of digital tools in teaching and learning has become a key strategy to enhance flexibility, engagement and educational access. In addition, understanding how students make connections across mathematical situations, particularly in problem-solving contexts like calculation is crucial to enhancing their learning experience.

Lockwood (2011) emphasizes the importance of analysing student-generated connections through the lens of actor-oriented transfer, which provides valuable insights into how students perceive similarities and differences among problems. Many students struggle not only with understanding mathematical concepts but also with applying the correct formulas when solving calculus problems. Alias et al. (2023) found that students often commit conceptual, procedural and technical errors, particularly when differentiating or integrating functions such as misapplying the quotient or product rule. This suggests that formula selection and application remain critical barriers to mastering foundational calculus. Many students struggle not only with understanding formulas but also with identifying the correct formula to apply. Recognizing this issue, the XactMath application was developed to provide a structured and interactive approach.

The effectiveness of the XactMath application was evaluated by having students use the tool and complete a survey measuring their acceptance and interest. The results in Table 1 show a high level of acceptance, with an average mean score of 4.46 and a standard deviation of 0.54. Table 2 indicates a similarly high level of interest, with an average mean score of 4.44 and a standard deviation of 0.52. These findings suggest that students were highly engaged, motivated and able to learn independently. Overall, the results support the integration of XactMath into business mathematics instruction to improve learning outcomes and boost student confidence.

Table 1: Descriptive statistics for students' acceptance of XactMath application

A: Students' Acceptance on XactMath apps	**Mean Score**	**SD**	**Interpretation**
XactMath apps help me to memorize the formula of Simple Interest & Promissory Notes.	4.50	0.514	High
XactMath apps is suitable to be used in learning Simple Interest & Promissory Notes.	4.44	0.511	High
XactMath apps help me to differentiate the concept of Simple Interest & Promissory Notes.	4.44	0.616	High
I can master the topic of Simple Interest & Promissory Notes using the XactMath apps.	4.39	0.502	High
I can remember the rules Simple Interest & Promissory Notes easily by learning using XactMath apps.	4.50	0.514	High
I can apply the rules of Simple Interest & Promissory Notes using XactMath apps.	4.44	0.511	High
I know how to play the apps without lecturer's guidance.	4.50	0.618	High
Total	**4.46**	**0.54**	**High**

Table 2: Descriptive statistics for students' interest in using XactMath application

B: Students' Interest on the Application of XactMath	Mean Score	SD	Interpretation
I have fun in learning Simple Interest & Promissory Notes via XactMath apps	4.61	0.502	High
I am interested to learn about Simple Interest & Promissory Notes	4.44	0.511	High
I am excited because I understand the concepts of Simple Interest & Promissory Notes	4.44	0.511	High
I am more motivated to learn this topic	4.50	0.514	High
I am thrilled when XactMath apps is used in learning Simple Interest & Promissory Notes	4.28	0.575	High
I am not easily bored when XactMath apps are used in learning.	4.39	0.502	High
I like to learn about Simple Interest & Promissory Notes because this topic can enhance my thinking skills.	4.44	0.511	High
Total	**4.44**	**0.52**	**High**

OBJECTIVE

The objectives of this study and the development of the XactMath application are:

i. To assist students in identifying keywords related to Business Mathematics problems, specifically on Simple Interest and Promissory Notes.
ii. To support students in selecting and applying the correct formulas through a guided, interactive process.
iii. To evaluate students' acceptance and interest levels after using the application in a learning environment.

DESCRIPTION OF THE PROJECT

XactMath is a mobile-based educational application developed to support students in mastering Business Mathematics formulas. It employs a three-step framework: **(1)** identifying keywords in problem statements, **(2)** matching keywords to relevant formulas and **(3)** selecting and applying the appropriate formula. The application features a user-friendly interface and an organized formula database by topic, keyword and symbol to enhance independent and accurate problem-solving.

NOVELTY

The novelty of XactMath application lies in its keyword-driven formula-matching system. Unlike traditional formula sheets or static learning platforms, XactMath application allows students to interactively discover the correct formula based on problem keywords. This

mimics real examination conditions where students must interpret questions independently.

Furthermore:

i. It bridges the gap between textbook theory and practical application.
ii. Encourages self-directed learning without heavy reliance on instructors.
iii. Offers customized learning pathways depending on the topic and keyword selected.

This pedagogical design not only supports memorization but also strengthens conceptual understanding, making it particularly significant in topics students often find abstract or confusing.

CONCLUSION

The findings from the descriptive analysis indicate that XactMath is highly accepted and well-received by students, with high average scores for both acceptance (M = 4.46) and interest (M = 4.44). Students reported improvements in memory retention, understanding of mathematical rules and confidence in solving Business Math problems independently. The application's structured three-step method enhances both engagement and effectiveness in learning. XactMath demonstrates strong potential as an innovative digital solution to support teaching and learning in Business Mathematics, particularly in improving formula recognition, problem-solving accuracy, and motivation among learners.

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PST004 - MAMMOAI: AUTOMATED MAMMOGRAPHIC BREAST CANCER CLASSIFIER POWERED BY AUTOML

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ABSTRACT

MammoAI is a breakthrough AI-powered system designed to revolutionize breast cancer screening through fully automated mammographic image analysis. Developed using the state-of-the-art Auto-Sklearn AutoML framework, MammoAI integrates advanced image enhancement, tumor segmentation, and optimized machine learning pipelines to classify breast tumors with high precision. This product addresses the critical need for consistent, scalable, and accurate diagnostic tools, particularly in regions with limited radiological expertise. The innovation combines Contrast Limited Adaptive Histogram Equalization (CLAHE) and Active Contour Method (ACM) for robust tumor delineation, followed by extraction of 37 key radiomic features. These are then processed through MammoAI's smart ensemble learning engine, achieving 76.16% test accuracy and 0.86 AUC after optimization. Designed with scalability, speed, and minimal user input in mind, MammoAI holds strong commercialization potential as a clinical decision support system that augments radiologist workflow, reduces diagnostic delays, and enhances early detection outcomes.

Keywords – Mammography, Breast Cancer, Radiomics, AutoML, Auto-Sklearn

INTRODUCTION

Breast cancer is the most common cancer affecting women globally, accounting for 2.3 million new cases annually (Sung et al., 2021). Despite mammography being the gold standard for early detection, interpretation inconsistencies and limited access to skilled radiologists remain major bottlenecks. With increasing demand for faster and more accurate diagnostics, AI-driven solutions are essential to modern healthcare delivery. MammoAI was conceived to automate and enhance mammographic cancer detection through an end-to-end AutoML-driven platform that minimizes human bias and maximizes diagnostic performance.

OBJECTIVE

To develop MammoAI, an AI-based mammography analysis system that automates image enhancement, tumor segmentation, feature extraction, and cancer classification, offering a scalable solution to enhance diagnostic accuracy and accessibility.

DESCRIPTION OF THE PROJECT

MammoAI introduces an end-to-end diagnostic pipeline that integrates AI technologies with radiological image analysis to assist clinicians in breast cancer detection. The process begins with image enhancement using Contrast Limited Adaptive Histogram Equalization (CLAHE), which improves contrast across localized regions of mammographic images, making subtle lesions more detectable. This is followed by semi-automated tumor segmentation utilizing the Active Contour Method (ACM), which iteratively refines tumor boundaries to accurately capture the shape and size of suspicious regions. Once segmented, the system extracts 37 radiomic features from each image, encompassing first-order statistics, GLCM-based texture features, and shape descriptors to quantitatively represent the tumor's morphology and heterogeneity. These features are input into the Auto-Sklearn framework, an AutoML platform that automatically selects and optimizes machine learning models through ensemble learning and Bayesian optimization. Using this method, MammoAI effectively classifies tumors as benign or malignant. The system was validated using 244 DICOM mammographic images sourced from the CBIS-DDSM and DDSM public databases. Results show a significant improvement in diagnostic performance, with classification accuracy rising from 55.10% to 76.16%, and AUC increasing from 0.64 to 0.86 after model tuning and data resampling. MammoAI not only offers a rapid and reproducible solution but is also scalable for integration into hospital PACS systems or as a cloud-based diagnostic service.

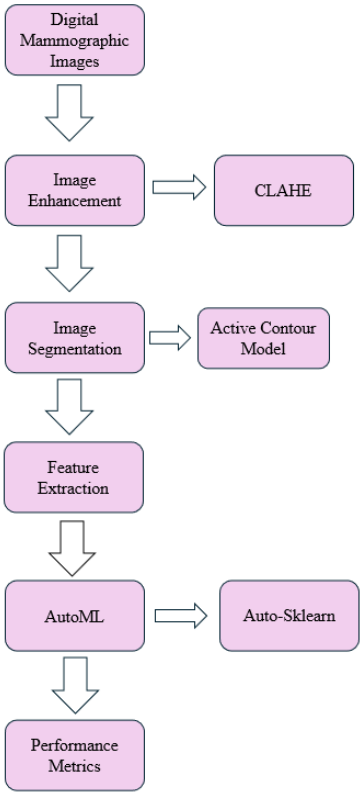

Figure 1: MammoAI processing pipeline from image input to classification output

Table 1: MammoAI classification performance before and after optimization

Metric	Standard	MammoAI Optimized
Accuracy	55.10%	76.16%
Precision	60.90%	70.40%
Recall	53.80%	76.00%
AUC-ROC	0.64	0.86

NOVELTY

MammoAI stands out by embedding a full AutoML pipeline into the radiology workflow, offering zero-code automation for radiomic analysis. The use of CLAHE-ACM pre-processing and Tuning-Ensemble N-Best strategy in Auto-Sklearn for mammography is a novel approach not widely commercialized. Unlike static rule-based systems, MammoAI evolves with more data, making it adaptable to different datasets, breast densities, and clinical environments. It's scalable for cloud deployment, making it an ideal candidate for telemedicine, AI-as-a-service, and diagnostic centers.

CONCLUSION

MammoAI is an innovative AI-based solution poised to transform mammographic cancer diagnostics. With its fully automated workflow, validated performance, and high scalability, MammoAI has strong commercialization potential for hospitals, diagnostic labs, and mobile screening units. By augmenting radiologist capabilities and accelerating early detection, MammoAI has the potential to significantly improve breast cancer outcomes nationwide.

PST005 - EMPOWERING SUSTAINABLE INFRASTRUCTURE WITH SCDesignPro: AN INNOVATIVE EVALUATION OF STONE COLUMN PERFORMANCE

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ABSTRACT

Stone columns are widely used as a ground improvement technique to enhance bearing capacity and reduce settlement in soft soils. However, most conventional design approaches assume only vertical and concentric loadings, which may not reflect actual field conditions where complex load combinations often occur. SCDesignPro is an innovative solution developed to evaluate the bearing capacity of stone columns under inclined and eccentric loading conditions, addressing a critical gap in current geotechnical engineering practices. The tool integrates advanced numerical modelling using PLAXIS 3D with comprehensive parametric studies to develop practical and reliable design formulas. The novelty of SCDesignPro lies in its ability to account for combined inclined and eccentric loading effects, significantly enhancing design reliability for structures constructed on soft and challenging ground conditions. This contributes to safer and more efficient foundation performance, reducing the risk of failure. With its user-friendly interface and smart computational features, SCDesignPro offers an efficient and accessible design tool for engineers, consultants, and researchers. Its wide applicability and strong commercial potential position it as a valuable contribution to digital geotechnical engineering solutions. SCDesignPro aligns with SDG 9: Industry, Innovation and Infrastructure, by promoting resilient infrastructure through smart, data-driven design tools, and SDG 11: Sustainable Cities and Communities, by enhancing the safety and durability of urban development through improved ground improvement strategies.

Keywords – Stone Column, Bearing Capacity, Inclined Load, Eccentric Load, Sustainable

INTRODUCTION

Stone columns have become a preferred solution for ground improvement due to their proven effectiveness in reinforcing weak soils, offering both enhanced bearing capacity and reduced settlement (Ghazavi, Rouhani, & Khoshghalb, 2024). Conventionally, design approaches assume only vertical and concentric loads; however, real-world conditions often involve inclined and eccentric loadings due to factors such as sloping terrain, asymmetrical superstructures, or seismic events (Ng, Idrus, & Chew, 2021). These

complex loading scenarios challenge traditional design assumptions and can potentially compromise foundation performance under actual field conditions.

Recent studies have confirmed that bearing capacity diminishes significantly as load eccentricity increases, and that failure mechanisms shift from uniform shear to modes such as bulging and bending in stone columns (Ng, Idrus, & Chew, 2022). Additionally, investigations into inclined loading have shown that neglecting these load conditions can lead to non-conservative design outcomes.

SCDesignPro was developed to address this critical gap. It integrates PLAXIS 3D numerical modelling with extensive parametric analysis to accurately assess stone column performance under realistic, combined loading conditions. By generating design formulas that reflect actual field complexities, the tool aims to enhance design accuracy, improve foundation resilience, and support geotechnical engineers in developing sustainable infrastructure solutions.

OBJECTIVE

The primary objectives of developing SCDesignPro are as follows:

i. To develop a smart and user-friendly tool that accurately evaluates the bearing capacity of stone columns under inclined and eccentric loading conditions, reflecting realistic field scenarios often overlooked in conventional design methods.
ii. To enhance the safety, efficiency, and reliability of stone column designs in soft soils by addressing the limitations of existing design approaches.
iii. To support sustainable infrastructure development by providing a solution that aligns with the principles of resilient foundation engineering and contributes to the relevant Sustainable Development Goals (SDGs).

DESCRIPTION OF THE PROJECT

SCDesignPro is a user-friendly tool developed to evaluate the bearing capacity of stone columns under inclined and eccentric loading conditions. Its development involved four primary stages: numerical modelling, parametric analysis, formulation of predictive equations, and software design. The tool features an easy-to-navigate interface, allowing users to input key parameters such as soil properties, footing and stone column size, inclination angle and eccentricity value. The tool uses formulas derived from advanced PLAXIS 3D modelling and parametric studies to deliver fast and accurate results. These formulas are developed for two soil conditions of drained and undrained, reflecting different soil behaviour under loading.

The bearing capacity of stone columns under drained soil conditions can be determined using Equation 1 and Equation 2, which represent the modified inclination factor, i_γ and eccentricity factor, e_γ, respectively, for inclined and eccentric loading.

$$i_\gamma = \frac{1.07}{1+ e^{(0.17\beta-16)}} \quad (1)$$

$$e_\gamma = 1 - 2.78e_x \quad (2)$$

For undrained soil conditions, Equation 3 and Equation 4 present the modified bearing capacity factor under inclined loading, $N_{c,i}$, while Equation 5 provides the eccentricity factor, e_γ, used to account for load eccentricity.

$$N_{ci} = kN_c \tag{3}$$

$$k = 0.2 + \frac{1}{1.15 + e^{(0.1b\beta - 2.3)}} \tag{4}$$

$$e_\gamma = 1 - 1.55e_x \tag{5}$$

SCDesignPro was developed using Microsoft Excel and is designed to streamline the design process by integrating the equations of this study. SCDesignPro is practical for engineers, researchers, and students, as it simplifies complex analysis, reduces design time, and improves the reliability of foundation design on soft soils. Its ability to address real-world loading conditions makes it a valuable and efficient tool for both professional practice and academic use.

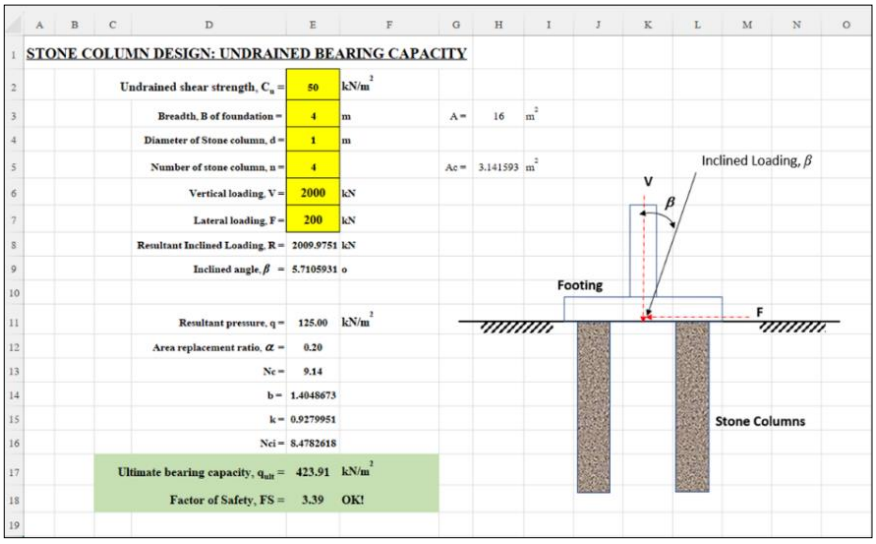

Figure 1: The interface of SCDesignPro software

NOVELTY

The novelty of SCDesignPro lies in its ability to evaluate the bearing capacity of stone columns under combined inclined and eccentric loading conditions, which are commonly neglected in conventional design methods. Using a groundbreaking approach that integrates PLAXIS 3D modelling with a detailed parametric study, the tool generates design formulas for both drained and undrained soil conditions. This dual-condition formulation, along with the ability to simulate complex load effects, provides new insights into the performance of stone columns in real-world applications. Therefore, SCDesignPro offers a unique, data-driven solution that not only fills a critical gap in geotechnical design practice but also contributes to the advancement of knowledge in foundation engineering.

SCDesignPro offers significant advantages to engineers, including the automated handling of complex design calculations, the flexibility to quickly adjust design parameters and a reduction in design-related errors. SCDesignPro demonstrates strong potential for commercialization, making it a valuable asset for engineering firms aiming to streamline their design workflows and improve project outcomes.

CONCLUSION

SCDesignPro is a practical and innovative tool that helps engineers evaluate the bearing capacity of stone columns under inclined and eccentric loading conditions, which are often overlooked in conventional design methods. It provides reliable design formulas for both drained and undrained soil conditions, improving the safety and accuracy of foundation

designs, especially in soft soil. In addition to its technical value, SCDesignPro supports the Sustainable Development Goals (SDGs), particularly SDG 9, by promoting innovation in infrastructure, and SDG 11, by contributing to safer and more sustainable cities and communities.

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NEGERI SEMBILAN INTERNATIONAL EXPOSITION

PST006 - Z-FERT: NATURAL FERTILITY FOR BETTER PLANT GROWTH

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ABSTRACT

Global agriculture faces critical challenges as soil fertility declines due to intensive farming practices and excessive chemical fertilizer use, with approximately 33% of soils worldwide being moderately to highly degraded. This study introduces Z-FERT, an innovative biological approach that utilizes *Zophobas atratus* larvae to transform horse dung into an effective organic fertilizer for enhanced plant growth. The research employed a Randomized Complete Block Design with seven replicates per treatment, conducted over six weeks using *Spinacia oleracea* (spinach) as the model plant species. The experimental framework incorporated *Z. atratus* larvae (1.5-2.5 inches) to accelerate the decomposition of sterilized horse dung (100g per sample), creating a nutrient-rich organic fertilizer. Soil organic matter content, plant height, dry biomass, and relative growth rate were measured using Loss on Ignition method and statistical analysis through two-way ANOVA and paired t-tests. Results demonstrated that horse dung-treated soil showed significantly higher organic matter content (2.588 ± 0.13%) compared to control groups. Plants grown in horse dung-treated soil exhibited significantly greater height increases ($p = 0.001$), with growth rates of 19.05% versus 14.29% in control conditions. The relative growth rate was also significantly higher (0.025±0.004 g/day) compared to control soil (0.012±0.0026 g/day). This innovative approach represents a breakthrough in sustainable agriculture by providing a scientifically rigorous, economically viable solution to soil degradation. Z-FERT harnesses natural decomposition processes to create a scalable alternative to chemical fertilizers while reducing organic waste pollution and CO_2 emissions, ultimately supporting next-generation farming practices that balance high productivity with environmental stewardship.

Keywords – organic fertilizer, plant growth, soil fertility, sustainable agriculture, Zophobas atratus

INTRODUCTION

Global agriculture is facing a major challenge as soil fertility declines due to intensive farming and excessive chemical fertilizer use. Around 33% of soils worldwide are moderately to highly degraded (FAO & IPTS, 2020), reducing productivity and ecosystem services. In tropical regions like Southeast Asia, continuous chemical use causes erosion,

nutrient imbalance, and loss of organic matter (Montanarella et al., 2016). This harms soil health, pollutes the environment, and raises farming costs.

Natural fertilizers are gaining increasing attention as sustainable alternatives to chemical inputs in agriculture. Among these, compost derived from animal manure provides essential nutrients while improving soil health and structure. Horse dung, in particular, is rich in organic matter and beneficial microorganisms and has the ability to heat up the compost pile, making it a valuable resource for composting. It provides essential macro and micronutrients for plant growth. Composted horse manure can improve soil fertility, structure, and water retention.

Recent research has explored the use of insect larvae, such as *Z. atratus* (commonly known as superworm), to accelerate the composting process and enhance the nutrient profile of the resulting fertilizer. These larvae efficiently break down organic waste and some plastics, contributing to a more rapid and eco-friendly composting method, converting various waste materials into biomass and frass.

This study investigates the potential of composted horse dung processed by *Z. atratus* larvae as a natural fertilizer for spinach (*S. oleracea*) cultivation. Spinach was chosen as a fast-growing leafy vegetable that is highly responsive to soil fertility and nutrient availability. Utilizing insect-assisted composting offers a sustainable method for organic waste management, a low-cost alternative to restore soil fertility, reduce reliance on chemical fertilizers, and enhance crop productivity. The findings could provide valuable insights into integrated organic farming systems and circular agriculture practices.

OBJECTIVE

To assess the effectiveness of horse dung as an organic fertilizer for *Spinacia oleracea*, facilitated by the decomposition capabilities of *Zophobas atratus* larvae.

DESCRIPTION OF THE PROJECT

The research employs a comprehensive experimental design using a Randomized Complete Block Design (RCBD) with seven replicates per treatment, conducted at UiTM Negeri Sembilan Kampus Kuala Pilah under controlled conditions. The key experimental components include *Z. atratus* larvae (1.5-2.5 inches), sterilized horse dung (100g per sample) as substrate types, *S. oleracea* (spinach) as the model plant for growth assessment, and a 6-week monitoring period. The measurement parameters encompass soil organic matter content using the Loss on Ignition (LOI) method, plant growth metrics including height, dry biomass, and relative growth rate, with statistical analysis using two-way ANOVA and paired t-tests.

Soil organic matter (SOM) content in horse dung-treated soil vs. Control

Horse dung-treated soil ($2.588 \pm 0.13\%$) showed higher organic matter content than the control, indicating its potential to enhance soil fertility and support plant growth. The presence of *Z. atratus* larvae further accelerated dung decomposition, improving soil quality through increased organic matter and nutrient content (Khalil et al., 2020).

Mean weekly plant height increase based on dung treatment

The effect of horse dung, as a source of organic matter, on the increase in *S. oleracea* height was identified, and indirectly, the planting duration was also compared to determine its impact on the growth of the species (Figure 1).

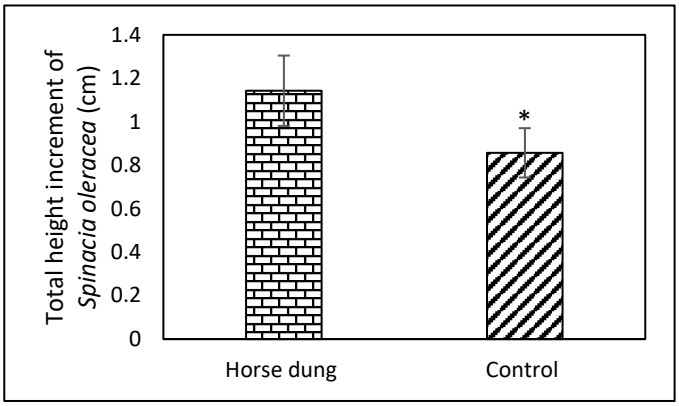

Figure 1: Total height increase of Spinacia oleracea in horse dung-treated soil and control soil.

Based on the analysis, there was no significant interaction between dung and week, $F_{(4, 60)} = 0.63$, $p = 0.642$, suggesting that the influence of dung type on plant height was consistent across the planting weeks. A significant main effect of dung was found, $F_{(1, 60)} = 12.63$, $p = 0.001$, indicating that *S. oleracea* fertilized with horse dung had significantly higher plant height than the control. These findings are also supported by Table 1. Similarly, the planting period (week) had a significant main effect, $F_{(4, 60)} = 6.63$, $p = 0.001$, where longer planting durations resulted in significantly greater plant height compared to shorter periods.

Table 1: Growth rate (%) and relative growth rate (g/day) of treated and untreated Spinacia oleracea

Parameter	Horse Dung Treatment	Control	p-value	Significance ($p < 0.05$)
Growth Rate (GR) (%)	19.05%	14.29%	0.003	Significant
Relative Growth Rate (RGR) (g/day)	0.025±0.004	0.012±0.0026	0.001	Significant

Biomass, the total dry matter produced, reflects plant growth and vitality. Its increase is linked to higher organic matter and key nutrients (N, P, K) in horse manure, which improve soil structure, boost microbial activity, and enhance nutrient uptake. Plants that grow in soil with high organic matter content tend to show improved growth, such as height. The improvement is believed to be associated with the enhancement of fertility by *Z. atratus* larvae, especially regarding nutrient cycling in the soil (Bottinelli et al., 2021). This result indicates a highly significant positive effect of horse dung on plant growth performance under experimental conditions. These findings are supported by Kovács et al. (2016), who demonstrated that horse manure boosts spinach shoot and root biomass by enhancing soil N and P levels.

NOVELTY

This study introduces an innovative biological approach using *Z. atratus* larvae to enhance soil fertility through organic waste processing. While previous research has explored various decomposer organisms (Zhang et al., 2023), limited studies have specifically investigated the synergistic effects of *Z. atratus* larvae on horse dung on soil fertility and plant growth. This innovation lies in the use of *Z. atratus* larvae as living bioreactors for the decomposition of organic waste, specifically horse dung. When the waste is processed by the larvae, a controlled experimental framework is established to measure improvements in soil fertility and plant growth responses, ultimately providing a scalable and sustainable alternative to chemical fertilizers. Economically, it enhances plant growth, increases agricultural yields and productivity, while transforming waste into valuable resources. From a sustainability perspective, this reduces organic waste and odour pollution and lowers CO_2 emissions from manure, helping to mitigate climate change.

CONCLUSION

The proposed study transforming horse dung into an organic fertilizer using *Z. atratus* larvae represents a breakthrough in sustainable agriculture. It confirms the suitability of traditional cow and goat manure and expands the toolkit to include horse dung. This research delivers a scientifically rigorous, economically viable solution to soil degradation by harnessing the larvae's natural decomposition abilities. It paves the way for next-generation farming practices that balance high productivity with environmental stewardship.

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PST007 - *LUBRIGREEN*: ECO-FRIENDLY BIOLUBRICANT BASE STOCK FROM SOYBEAN OIL

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ABSTRACT

The rising demand for lubricants in automotive and industrial sectors highlights the need for efficient, high-performance products with minimal environmental impact. Conventional lubricants, primarily derived from petroleum-based mineral oils, are non-renewable, environmentally hazardous, and contribute significantly to pollution and greenhouse gas emissions. These issues underscore the urgent need for sustainable alternatives. This innovation introduces *LubriGreen*, a novel biolubricant base stock synthesized from soybean oil, an abundant and eco-friendly raw material. *LubriGreen* is produced through a two-step process: hydrolysis of soybean oil to obtain soybean oil fatty acids, followed by esterification with neopentyl glycol, resulting in soybean oil neopentyl glycol (SBONPG) ester. This chemical modification improves the lubricant's thermal and oxidative stability, extending its service life and efficiency under demanding conditions. *LubriGreen* is biodegradable, non-toxic, and significantly reduces environmental risks by minimizing soil and water contamination. Its adoption supports green chemistry principles and contributes to the circular economy by adding value to agricultural products. Furthermore, it delivers excellent lubrication properties, reducing friction and wear in machinery and engines, thereby improving operational reliability and energy efficiency. By replacing petroleum-based lubricants with this renewable alternative, industries can achieve high performance while promoting environmental sustainability and economic resilience.

Keywords – biolubricant, environmental sustainability, renewable sources, soybean oil

INTRODUCTION

In today's industrial landscape, conventional petroleum-based lubricants pose significant environmental and health risks. These lubricants are non-renewable, contribute to pollution, and accelerate greenhouse gas emissions. The global shift towards sustainability has intensified the demand for eco-friendly alternatives, positioning biolubricants, which are derived from renewable, biodegradable resources, as a viable solution. This innovation introduces LubriGreen, a green biolubricant base stock synthesized from soybean oil, a widely available and environmentally sustainable

resource. While soybean oil offers many advantages, its direct use is limited due to low oxidative stability, largely attributed to the presence of β-hydrogen in the glycerol backbone in triacylglycerol structure (Nor et al., 2019; Nor et al., 2022; Khairuddin et al., 2024). To overcome this, the soybean oil undergoes a two-step chemical modification: hydrolysis to extract fatty acids, followed by esterification with neopentyl glycol. The product is a soybean oil neopentyl glycol (SBONPG) ester, also known as *LubriGreen*. This modification significantly enhances the lubricant's oxidative and thermal stability, making it suitable for demanding industrial and automotive applications. *LubriGreen* is biodegradable, non-toxic, and helps reduce soil and water contamination, supporting SDG 12: Responsible Consumption and Production. By replacing petroleum-based lubricants with a plant-based alternative, this innovation contributes to SDG 13: Climate Action by lowering carbon emissions and promoting a cleaner environment. Additionally, *LubriGreen* aligns with SDG 7: Affordable and Clean Energy by improving energy efficiency through better lubrication performance, and with SDG 9: Industry, Innovation and Infrastructure by fostering sustainable industrial practices and adding value to agricultural resources through green technology. Through this project, we aim to drive innovation in lubricant technology while advancing global sustainability goals and contributing to a greener, more resilient future.

OBJECTIVE

The objectives of this product are:

i. To develop *LubriGreen*, a biodegradable, non-toxic, and environmentally friendly biolubricant base stock as a sustainable substitute for conventional mineral oil-based lubricants**.**
ii. To contribute to the advancement of green technology by formulating a high-performance biolubricant that complies with environmental regulations and promotes sustainable practices in industrial and automotive sectors**.**

DESCRIPTION OF THE PROJECT

LubriGreen is a high-performance, sustainable biolubricant base stock engineered from chemically modified soybean oil. It stands out with its excellent physicochemical properties, including a low pour point of -11°C and a high flash point of 238°C, enabling reliable performance across a broad temperature range. These characteristics enhance cold-start capabilities and thermal stability, making *LubriGreen* ideal for demanding industrial and automotive applications. Its unique molecular structure, which features branched carbon chains and bent configurations, offers superior lubrication, effectively reducing friction, wear, and corrosion. These properties extend the lifespan of machinery and improve energy efficiency. Beyond performance, *LubriGreen* prioritizes environmental responsibility. It is biodegradable, non-toxic, and poses minimal risk to ecosystems by reducing pollution and carbon footprint. Its long service life, low maintenance requirements, and compatibility with existing systems make it a practical and scalable solution for industries seeking to transition from petroleum-based lubricants to greener alternatives. By integrating renewable resources with advanced chemical engineering, *LubriGreen* offers a forward-thinking solution that promotes sustainable industrial practices while maintaining operational excellence.

NOVELTY

This project introduces a structurally enhanced biolubricant through the strategic esterification of soybean oil with neopentyl glycol, resulting in a branched molecular architecture that offers superior oxidative stability, thermal resistance, and lubrication efficiency compared to conventional vegetable oil-based lubricants. This innovative molecular design directly addresses the limitations of standard biolubricants, such as rapid degradation and poor high-temperature performance, making it viable for high-demand industrial and automotive applications. What distinguishes this innovation is not only its advanced chemical formulation, but also its commitment to local resource valorization, transforming agricultural by-products into high-value green technology. This directly supports the circular bioeconomy and promotes rural economic development, reducing environmental impact and dependency on fossil resources. Furthermore, LubriGreen's drop-in compatibility with existing machinery allows for immediate, low-cost adoption without requiring system modifications, accelerating the transition toward sustainable lubrication solutions in line with SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action). Its performance also contributes to improved energy efficiency, aligning with SDG 7 (Affordable and Clean Energy), while reinforcing SDG 9 (Industry, Innovation and Infrastructure) through the promotion of eco-innovation in lubricant technology.

CONCLUSION

This innovation successfully demonstrates the synthesis of a high-performance biolubricant base stock from soybean oil through chemical modification with neopentyl glycol**.** The resulting product exhibits a higher flash point and excellent low-temperature flow properties, making it suitable for a wide range of industrial and automotive applications. As a biodegradable, renewable, and non-toxic lubricant, it presents a safer and more sustainable alternative to conventional petroleum-based lubricants. The success of this process confirms that plant-based oils can be effectively engineered to meet modern performance standards, supporting environmentally responsible innovation. Overall, this biolubricant offers a viable, eco-friendly solution that bridges the gap between performance and sustainability in lubricant technology.

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PST008 - MORILIEF: SUGAR-FREE *MORINGA OLEIFERA* HERBAL LOZENGES FOR NATURAL THROAT CARE

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ABSTRACT

Sore throat, a common clinical complaint affects millions globally and often requires only symptomatic relief. In response to the increasing demand for natural and sugar-free solutions, we present 'Morilief' as an innovative, sugar-free hard candy lozenge formulated with *Moringa oleifera* extract. Known for its anti-inflammatory and antimicrobial properties, *Moringa oleifera* was selected as the main bioactive component for its ability to relieve throat discomfort while promoting oral health. The formulation utilizes both hot and cold maceration techniques to extract bioactive compounds, combined with heat-controlled cooking and congealing processes to preserve their efficacy. To ensure suitability for diabetics and oral health-conscious users, the product incorporates natural sweeteners including xylitol, isomalt, and stevia. Acacia gum enhances the lozenge's structure and texture, while green tea emulco and natural colorants provide flavor and aesthetic appeal. Accelerated stability testing confirmed a projected 12-month shelf life with stable physical and microbial properties. Morilief represents a safe, effective, and consumer-friendly alternative to conventional throat lozenges, integrating herbal wisdom with modern sugar-free formulation technology. It addresses current health needs with promising commercialization potential.

Keywords – Moringa oleifera, sugar-free, lozenges, sore throat, herbal innovation

INTRODUCTION

Sore throat or pharyngitis is among the most common upper respiratory symptoms encountered in healthcare settings (Palm et al., 2018). Although usually self-limiting, symptoms such as pain, inflammation, and discomfort can significantly affect the patient's quality of life (Ware et al., 2023). Existing lozenge solutions are often sugar-based and synthetic, making them unsuitable for diabetics and raising concerns over long-term oral health effects. There is an increasing consumer trend toward natural, sugar-free, and plant-based products, creating a gap in the throat care market for an effective, herbal-based lozenge (Ebiuwa & Matthew , 2023). *Moringa oleifera*, a plant known for its anti-inflammatory and antimicrobial properties, offers a promising solution that is yet to be fully explored in mainstream throat relief products.

OBJECTIVE

The objectives of this product are:

i. To provide natural relief for sore throat symptoms with added protection against dental caries using *Moringa oleifera* extract.
ii. To deliver plant-derived herbal ingredients that align with the growing demand for natural health solutions.
iii. To provide an inclusive product that is suitable for diabetic consumers by utilizing sugar-free formulation.

DESCRIPTION OF THE PROJECT

Morilief is a hard candy lozenge composed of aqueous extract from *Moringa oleifera* leaves, obtained via cold and hot maceration. The extracts are freeze-dried and integrated into a candy matrix using xylitol, isomalt, stevia, acacia gum, green tea emulco, and colorants. The controlled cooking process avoids degradation of thermolabile compounds. This product offers a range of appealing features, making it both health-conscious and practical for everyday use. It is 100% sugar-free, making it diabetic-friendly and safe for teeth, thanks to its incorporation of anti- and non-cariogenic ingredients. Naturally flavored with green tea and Moringa, it provides a pleasant taste without artificial additives. The product is easy to consume and requires no prescription, with a projected shelf life of one year based on accelerated testing. In terms of functionality, it soothes throat inflammation and irritation while delivering anti-inflammatory and antimicrobial compounds directly to the affected area. Suitable for all age groups, it caters to a wide consumer base. From a business standpoint, it is cost-effective to manufacture and easily scalable for commercial production. Its design and benefits make it an ideal product for placement in pharmacies, wellness stores, and over-the-counter markets.

NOVELTY

Morilief is a first-of-its-kind sugar free herbal lozenge formulated with *Moringa oleifera* extract, developed to meet the increasing demand for natural, safe and accessible throat care solutions. Morilief uses natural sweeteners such as xylitol, isomalt, and stevia. This makes the formulation diabetic friendly, tooth safe and suitable for individuals seeking healthier alternatives Schweitzer et al., 2024; Nicky et al. 2024). This is topped with protective effects of *Moringa* extract against dental caries while actively easing throat discomfort (Ignatov & Papova, 2021; Shafiq & Mahdee, 2023). The product is enhanced with natural green tea and *Moringa* flavor offering a pleasant taste without synthetic additives. Its easy-to-consume format requires no prescription, making it widely accessible for daily relief of sore throat symptoms. Morilief is scientifically validated through accelerated stability testing, ensuring a projected shelf life of one year with stable physical and microbial properties. The dual extraction method, combining cold and hot maceration, maximizes the retention of bioactive compounds. Its broad suitability across all age groups combined with cost effective production and scalability makes Morilief ideal for pharmacies, wellness retailers and commercial markets. This product merges traditional herbal knowledge with modern formulation science offering a truly novel solution in the field of natural throat therapeutics.

CONCLUSION

Morilief successfully combines traditional herbal knowledge with modern formulation science to produce a safe, sugar-free, and effective throat lozenge. It offers significant potential for commercial innovation in the functional oral care and natural health product sectors. Continued clinical testing and market validation are underway to further establish its efficacy and consumer reach.

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PST009 - ECOFUSION: SUSTAINABLE COMPOSITES FROM RECYCLED PLASTICS AND WATER HYACINTH FIBRES

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ABSTRACT

Ecofusion introduces an innovative, scalable solution to two pressing environmental challenges: plastic pollution and invasive water hyacinth (WH) overgrowth. Sustainable and good performance composites was fabricated by reinforcing recycled low-density polyethylene and recycled linear low density polyethylene (rLDPE/rLLDPE) with treated water hyacinth fibres (WHF). This project's core innovation is its pioneering dual-waste valorization approach, directly addressing ecological concerns while simultaneously creating a new class of functional composite materials; turning waste into wealth. WHF was chemically treated using 5 wt% NaOH to optimize interfacial bonding, and was further blended with rLDPE/rLLDPE at 5%, 10%, and 15% loadings. Rigorous testing revealed an increased in tensile strength peaking at 18.02 MPa with 10% WHF and a maximum Young's modulus of 352 MPa at 15% WHF, signifying enhanced stiffness. The increased in WHF loadings had also increased the impact strength, density and hardness of the composites. Fourier Transform Infrared (FTIR) analysis confirmed robust chemical interactions, ensuring material integrity despite WHF's inherent hydrophilicity. These cost-effective and scalable biocomposites demonstrate versatile applicability in areas such as eco-friendly packaging, lightweight automotive panels, and durable construction materials. Ecofusion represents a significant leap towards circular economy practices, offering a pragmatic and profitable pathway to mitigate plastic waste and manage aquatic biomass, delivering both ecological restoration and industrial advancement. This is a game-changer for sustainable materials.

Keywords – Sustainable composites, water hyacinth fiber, recycled polyethylene, green materials

INTRODUCTION

The proliferation of non-biodegradable plastic waste, particularly polyethylene (PE), and the uncontrolled growth of invasive WH pose significant, dual environmental challenges. PE waste contributes to long-term pollution, while WH clogs waterways, disrupts ecosystems, and creates waste management problems. Addressing the drawbacks of recycling PE, such as reduced mechanical quality compared to virgin polymers, is a primary motivation for this project. Therefore, this study aims to address both problems simultaneously by developing a novel composite material. By integrating treated WHF, a low-cost and renewable resource rich in cellulose, with rLDPE/rLLDPE, this project seeks

to enhance the mechanical properties of the recycled plastic and valorize two waste streams into a sustainable and valuable material.

This dual-waste valorization approach not only mitigates environmental pollution but also promotes the principles of a circular economy.

OBJECTIVE

The objective of this product is to develop and characterize the physicomechanical properties of sustainable composite materials from recycled polyethylene PE waste and invasive WHFs thereby offering an eco-friendly and economically viable solution to two critical environmental challenges.

DESCRIPTION OF THE PROJECT

Ecofusion composites are novel, eco-friendly materials produced from two abundant waste streams which are blends of post-consumer/industrial rLDPE/rLLDPE and treated lignocellulosic WHF. WHF loadings were optimized between 5% and 15%. The ecofusion composites exhibit improved tensile strength and significantly increased stiffness/Young's modulus compared to virgin PE or unreinforced recycled PE. Enhanced adhesion between the hydrophilic WHF and the hydrophobic PE matrix were achieved through a proprietary 5 wt% NaOH treatment, ensuring efficient stress transfer between fibers and the polymer matrix.

Therefore, it can be inferred that the mechanical properties can be tailored by adjusting WHF content, allowing for optimization based on specific application requirements. This project also retains the ease of processing characteristic of thermoplastics, allowing for fabrication using standard methods like melt blending, extrusion, and injection molding. The composites produced is capable of withstanding significant tensile and impact loading, making them suitable for semi-structural applications. The incorporation of WHF imparts increased rigidity, crucial for applications requiring dimensional stability and resistance to deformation under load. While natural fibers are generally hydrophilic, the improved interfacial bonding also helps to mitigate excessive water absorption, enhancing durability in various environments.

The advantage of this project also helps to reduce the demand for virgin petroleum-based plastics and offers a sustainable alternative to traditional fillers, conserving non-renewable resources. Besides, the utilization of inexpensive and abundant waste materials, leading to potentially lower production costs compared to composites made with synthetic fibers or virgin polymers. The commercialization of WH plant into useful products could provides potential opportunities for local communities involved in harvesting and pre-processing water hyacinth, fostering local economies.

Figure 1: The ecofusion composites production process

NOVELTY

The primary novelty of "ecofusion" lies in its pioneering dual-waste valorization approach, which uniquely addresses two pervasive environmental pollutants; non-biodegradable PE plastic waste and invasive WH biomass, by transforming them into high-performance, sustainable composite materials. Unlike approaches that tackle these problems in isolation, this project presents an integrated, closed-loop solution that simultaneously reduces landfill burden and manages aquatic overgrowth. The project demonstrates a cost-effective and industrially scalable method for producing these biocomposites. Utilizing abundant and often problematic waste materials as raw inputs significantly reduces material costs, making the end product economically attractive for various industries.

CONCLUSION

Ecofusion had successfully turns two waste problems which are plastic pollution and invasive WH into a single solution. By combining recycled plastic with treated WHFs, the project created a strong and stiff new composite material. This approach not only cleans up the environment but also provides a cost-effective way to make new products for industries like packaging and construction, proving that waste can be a valuable resource in a circular economy.

PST010 - KIK SmartJury: AN AUTOMATED REAL-TIME SCORING SYSTEM FOR KIK CONVENTION JUDGING

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ABSTRACT

The evaluation process in innovation competitions, such as the Konvensyen Kumpulan Inovatif & Kreatif (KIK), traditionally involves manual score tabulation, ranking, and reporting. These manual processes can be time-consuming, prone to human error, and inefficient, especially in large-scale events. KIK SmartJury is a web-based automated scoring system developed to address these challenges for the UiTM Zon Selatan KIK Convention 2024. The system enables judges to input scores online, with dynamic, real-time calculation of results and automatic assignment of winners in each category and for the overall competition. Developed using Python (Flask) as the backend framework, HTML, CSS, and JavaScripted for the frontend and utilizing MySQL for database management, KIK SmartJury streamlines the judging process, generates comprehensive scoring reports, and enables direct export to PDF or Excel. By implementing the System Development Life Cycle (SDLC) methodology, the system was designed with iterative feedback and refinement, ensuring reliability and usability. KIK SmartJury represents a novel solution within UiTM, as no other branch has implemented a similar automated judging system for KIK events. This innovation has the potential for adoption across other UiTM branches and commercialisation for broader applications.

Keywords – automated scoring system, real-time calculation, system development, innovation competition

INTRODUCTION

Automated scoring systems for competitions and educational assessments have gained prominence due to their efficiency and objectivity compared to manual grading (Sijuan Xue et al., 2024). The adoption of automated scoring in high-stakes assessments has enabled the implementation of more complex performance tasks without increasing the need for human raters (Foltz et al., 2020).The Konvensyen Kumpulan Inovatif & Kreatif (KIK) is a platform for showcasing innovation and creativity, where accurate, efficient, and transparent judging is critical. Conventional judging methods rely on manual score sheets, separate calculations, and physical reporting, often leading to delays, inconsistencies, and administrative burden. The increasing demand for efficiency, accuracy, and real-time

results in such competitions calls for a technological solution that can modernise the scoring process. In addition, KIK judging is conducted in a fast-paced manner, where scoring and winner announcements must be completed immediately after all participants present their projects. Therefore, a highly efficient system is required to ensure seamless operations. In response, the KIK SmartJury system was developed for UiTM Zon Selatan 2024 to digitise and automate judging tasks, ensuring smooth operations for both judges and the organising committee.

OBJECTIVE

The main objective of KIK SmartJury is to provide judges with an online platform for entering scores in real time. Other objectives are to perform dynamic, automated calculation of scores without manual intervention, to automatically determine winners for each category and overall ranking, to generate comprehensive scoring reports in PDF and Excel formats, eliminating the need for manual report preparation and to reduce administrative workload and enhance transparency in the judging process.

DESCRIPTION OF THE PROJECT

KIK SmartJury is a web application designed with a responsive and user-friendly interface to ensure accessibility across devices. The system architecture integrates the backend (Python Flask for application logic and MySQL for secure database management), and frontend (HTML, CSS, and JavaScript for an intuitive and responsive interface). KIK SmartJury was developed using the System Development Life Cycle (SDLC), including planning, analysis, design, development, testing, and evaluation stages. During operation, judges log in and enter scores per criterion for each project. The system performs dynamic real-time calculations, instantly updating total scores. Once judging is completed, KIK SmartJury automatically determines winners for each category and the overall champion. Additionally, it generates and prints complete scoring documents, including the individual judge scoring sheets, consolidated scores, and ranking summaries.

An integrated export feature allows all reports to be downloaded in PDF format, and a built-in filter function enables users to quickly filter and view specific documents based on project category. This automation eliminates the need for manual compilation, saving significant time and effort for the judging and organising committees. Figure 1 depicts the main interfaces of KIK SmartJury.

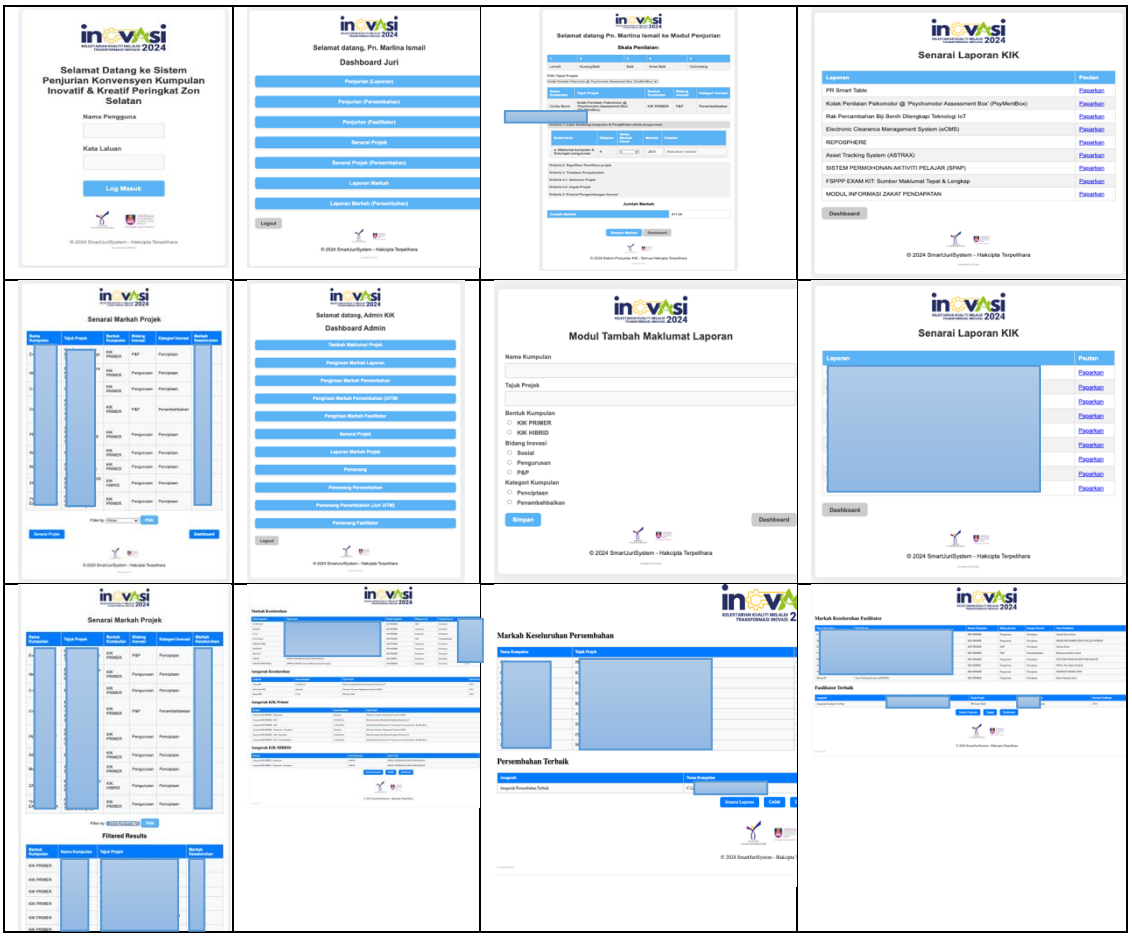

Figure 1: The main interfaces of KIK SmartJury

NOVELTY

KIK SmartJury introduces several unique elements that distinguish it from existing judging systems within UiTM:

1. Real-time score computation: Scores are calculated dynamically as judges input them, eliminating manual tabulation.
2. Automatic winner assignment: The system determines category winners and the overall champion without manual processing.
3. Integrated reporting: Instant generation of complete scoring reports with PDF and Excel export capabilities.
4. Scalability: Designed for potential adaptation to other UiTM branches or commercial use in different competition settings.

CONCLUSION

KIK SmartJury transforms the judging process for innovation competitions by replacing manual calculations with a fully automated, real-time scoring and reporting system. Its deployment for the UiTM Zon Selatan KIK Convention 2024 demonstrates its potential to enhance efficiency, transparency, and accuracy in event evaluation. As the first system of its kind within UiTM, it sets a precedent for modernising judging processes across

branches. The system's scalability, combined with its unique real-time calculation and reporting features, positions KIK SmartJury as a valuable innovation with both institutional and commercial potential. Future enhancements may include integration with live event displays, AI-assisted scoring analytics, and mobile app functionality for even greater accessibility.

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PST011 - ALGALEAN MEAT (LOW-FAT MEAT ANALOGUE WITH BORNEO SEA GRAPES)

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ABSTRACT

AlgaLean Meat is a plant-based meat analogue developed to meet the increasing global demand for healthy and sustainable protein alternatives. Conventional meat production is associated with high greenhouse gas emissions and intensive resource use, while many existing meat analogues rely heavily on synthetic additives, offering limited functional benefits. To address these gaps, AlgaLean Meat incorporates *Caulerpa lentillifera* (sea grapes), a nutrient-rich green seaweed native to Sabah, into textured vegetable protein-based formulations. The novelty of AlgaLean Meat lies in its integration of *C. lentillifera* into a meat analogue matrix, a combination rarely explored in commercial or research settings. The sea grapes are naturally rich in dietary fibre, bioactive compounds, as well as hydrocolloids that enhance water retention and cooking yield. By leveraging these properties, the product achieves functional improvements without artificial binders or preservatives. At an optimal inclusion level, seaweed enhances nutritional value and oxidative stability while maintaining desirable sensory qualities such as flavour, juiciness, and texture. The usefulness of AlgaLean Meat extends beyond its nutritional and sensory benefits. It offers consumers a healthier, lower-fat protein source with added dietary fibre, while its natural antioxidant capacity may extend shelf life. The product also showcases the potential of underutilized marine resources in the creation of value-added foods, aligning with sustainable development goals and market trends toward functional, eco-conscious eating. By combining Borneo's premium sea grapes with plant-based technology, AlgaLean Meat delivers an innovative, functional, and sustainable solution for the next generation of meat alternatives.

Keywords – plant-based meat, sustainable protein, functional food, seaweed

INTRODUCTION

In recent years, the market for plant-based meat analogues has expanded rapidly, driven by increased product availability and strong media promotion (Xie et al., 2024). Meat analogues, also referred to as plant-based meat, are designed to replicate the structure and texture of conventional meat, although they differ significantly in composition (Ahmad et al., 2022). According to a survey, the market share of plant-based meat analogues accounted for just 0.1% of fresh meat sales in January 2017; however, it increased fourfold to 0.4% within 18 months, highlighting the growing interest in sustainable meat alternatives

(Zhao et al., 2023). Meat analogues are typically made from textured vegetable protein (TVP), a dry, protein-rich material derived from soy protein concentrates.

However, TVP lacks the ability to form a cohesive structure on its own and therefore requires the addition of binders (Kim et al., 2024). Polysaccharide-based binders, particularly dietary fibers, are commonly added to improve water-holding capacity and modify texture of plant-based meat. Seaweed has garnered significant attention in recent years as a promising alternative source of food ingredients, owing to its abundance, low production cost, and environmental sustainability. Among the various edible seaweeds, *C. lentillifera* stands out as a species with considerable nutritional and functional promise. Traditionally, *C. lentillifera* is consumed fresh in salads and side dishes, appreciated for its succulent texture and slightly salty, ocean-like flavor. These sensory attributes, along with their nutritional richness, suggest that *C. lentillifera* could be further utilized in a wide array of processed food products.

Developed in collaboration between SCU Southeast Asia and Universiti Malaysia Sabah, AlgaLean Meat is crafted to attract vegans, vegetarians, and health-conscious consumers, delivering a distinctive ocean-fresh flavor with a strong Bornean identity. By harnessing an underutilized marine crop, this innovation not only meets the rising demand for nutritious, eco-friendly meat alternatives but also supports sustainable aquaculture and the local coastal economy in Borneo.

OBJECTIVE

i. To enhance the nutritional profile of plant-based meat by increasing dietary fiber and incorporating natural antioxidants without added fat.
ii. To evaluate the functional properties contributed by *C. lentillifera*, including texture, cooking yield, and oxidative stability.
iii. To promote the use of underutilized local marine resources in sustainable, value-added food products.

DESCRIPTION OF THE PROJECT

AlgaLean Meat (Figure 1) is a locally inspired plant-based meat that pairs textured vegetable protein with *C. lentillifera* to deliver a distinctive flavor and functional benefits. The inclusion of seaweed enhances cooking yield, reduces cooking loss, and slows lipid oxidation, extending shelf life without synthetic preservatives, while natural hydrocolloids improve water-binding and texture. This distinctive product delivers a subtle ocean-fresh flavor and meat-like bite, providing a healthier, lower-calorie alternative to conventional meat and many existing plant-based products. Practical to prepare and versatile in use, it can be pan-fried, grilled, or served in burgers, catering to vegans, vegetarians, flexitarians, and health-conscious consumers. By utilizing a locally sourced, underused marine crop, AlgaLean Meat supports the blue economy and reduces reliance on imported ingredients, making it a functional and commercially viable meat alternative for both local and international markets.

Figure 1: AlgaLean Meat.

NOVELTY

AlgaLean Meat introduces a unique formulation that combines textured vegetable protein with *C. lentillifera* to produce a no-added-fat plant-based meat with enhanced nutritional and functional qualities. Unlike conventional meat analogues that rely on synthetic binders and added fats, this product harnesses the seaweed's natural antioxidants, dietary fiber, and hydrocolloids to improve texture, cooking yield, moisture retention, and oxidative stability. The seaweed is processed into powder form (Figure 2), which helps reduce the intensity of its ocean-like flavor, increasing consumer acceptability while still delivering its health benefits. The integration of this locally sourced, underutilized marine crop imparts a subtle ocean-fresh note and a natural green hue, creating a product that is nutritionally superior, sensorially distinctive, and strongly tied to Borneo's identity. This innovative approach elevates the value of sea grapes beyond their traditional fresh consumption and aligns with clean-label, eco-friendly food trends.

Figure 2: Seaweed powder.

CONCLUSION

AlgaLean Meat demonstrates how local marine resources can be transformed into a sustainable, value-added plant-based meat alternative that meets the rising demand for healthier, functional foods. By incorporating *C. lentillifera*, the product delivers improved texture, extended shelf life, and higher dietary fiber without added fat or synthetic additives. Its distinctive flavor, appealing appearance, and versatility in preparation make it attractive to a wide range of consumers, from vegans to health-conscious flexitarians. Beyond its consumer appeal, AlgaLean Meat supports the blue economy, reduces reliance on imported ingredients, and showcases the potential of integrating traditional coastal resources into modern food innovation.

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PST012 - A PRACTICAL EXCEL SOLUTION FOR MULTI-CRITERIA ANALYSIS USING THE ENTROPY-ARAS APPROACH

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ABSTRACT

In this project, the Entropy-Additive Ratio Assessment (Entropy-ARAS) method is integrated with a user-friendly Microsoft Excel template. Traditionally, the decision maker chooses the best option or the best alternative independently of mathematical analysis. The project used the Entropy-ARAS to resolve the complex multi-criteria decision-making (MCDM) problems. The ARAS method is used to select the best alternative, and the Entropy method is used to establish the weights of the criteria. On the other hand, the Microsoft Excel template is designed to facilitate the complex MCDM problems by offering an organized and transparent framework for assessing the alternatives according to the multiple conflicting criteria. The novelty of this innovation lies in the incorporation of the Entropy-ARAS method into a Microsoft Excel template. Users can make an efficient and transparent decision without programming knowledge. The implementation of this template will guarantee the consistency of the final decisions and minimize the computation errors. In addition, the Excel-based Entropy-ARAS tool helps users comprehend and apply MCDM techniques to real-world problems as well as improve the quality and speed of decision-making.

Keywords – Entropy, ARAS, decision making

INTRODUCTION

Multi-criteria decision making (MCDM) is a branch of operations research (OR) that deals with evaluating and choosing between alternatives that are characterized by multiple conflicting criteria. Choosing the best alternatives is a complex process that requires careful consideration of various criteria. Numerous MCDM methods can be employed to address MCDM problems. Traditionally, decision-makers make decisions based on their subjective preferences without the involvement of mathematical analysis. The application of the MCDM method is expected to reduce bias and guarantee a structured and efficient decision-making process. This project proposes integrating the Entropy method with the Additive Ratio Assessment (ARAS) method. The ARAS method was introduced by Zavadskas and Turskis (2010). This method is based on comparing the ratios of utility function values for the alternatives to the optimal value, which allows for the determination of the proportional similarity of each alternative to the ideal alternative (Yücenur & Maden, 2024). It ranks a finite number of alternatives in relation to an ideal alternative by evaluating the proportionate utility ratio, which significantly improves the decision-making process

(Goswami et al., 2022). This approach not only evaluates the performance of the alternatives but also offers advantageous information concerning the proportional similarity of each alternative to the optimal choice (Yücenur & Maden, 2024).

The determination of the weight values is one of the important steps in the ARAS framework. The weight values are usually determined by the expert evaluation (Zavadskas & Turskis, 2010). Still, in this project, the Entropy method is employed to calculate the weight of the criteria. Entropy is an objective weighting method introduced by Shannon in 1948. This method is used to calculate the criteria weights without taking the decision-maker's opinion into consideration (Goswami et al., 2022). This method is fully independent of the decision maker's involvement and does not require any pairwise comparison matrix. Therefore, this method is free from inconsistency and does not require consistency checking for human judgments (Goswami et al., 2022). This project presents a user-friendly Microsoft Excel template that employs the Entropy-ARAS method to solve an MCDM problem. This tool will not only boost the decision-making process but is also expected to enhance its quality and speed.

OBJECTIVE

The objectives of the project are:

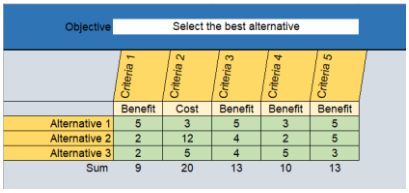
i. To design a user-friendly tool that integrates the Microsoft Excel template with the Entropy-ARAS method.
ii. To facilitate the decision-making process by providing a tool that automates the Entropy-ARAS calculation process.

DESCRIPTION OF THE PROJECT

This decision-making process involves three main phases. The first phase is data collection. The information about the criteria and alternatives is gathered. Then, the data are entered in a Microsoft Excel template. Figure 1 shows the decision matrix, which presents the evaluation of each alternative with respect to each criterion.

The second phase involved the application of the Entropy method to obtain the criteria weight. Once the decision matrix is constructed, it is first normalized. Then, the Entropy values and the degree of divergence for each criterion are calculated. Based on these, the weights of the criteria are determined. Figure 2 illustrates both the normalized decision matrix and the calculated weights.

The final phase involved applying the ARAS method to select the best alternatives. The process begins with the construction of the decision matrix. Next, the minimum and maximum criteria are identified, and any minimum criteria are converted into maximum criteria. Following this, the decision matrix is normalized, and the weighted normalized matrix is calculated. Next, the optimal values for each alternative and their respective degrees of utility are determined. Finally, the best alternative is identified based on the utility degree values. Figure 3 shows the ranking of the alternatives.



Objective	Select the best alternative				
	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5
	Benefit	Cost	Benefit	Benefit	Benefit
Alternative 1	5	3	5	3	5
Alternative 2	2	12	4	2	5
Alternative 3	2	5	4	5	3
Sum	9	20	13	10	13

Figure 1: Decision matrix

Objective	Select the best alternative					
	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	
	Benefit	Cost	Benefit	Benefit	Benefit	
Alternative 1	0.55556	0.15	0.38462	0.3	0.38462	
Alternative 2	0.22222	0.6	0.30769	0.2	0.38462	
Alternative 3	0.22222	0.25	0.30769	0.5	0.23077	
Sum	1	1	1	1	1	
Entropy	0.90571	0.85347	0.99474	0.93723	0.97705	
Degree of divergence	0.09429	0.14653	0.00526	0.06277	0.02295	0.3318
Criteria weight	0.28417	0.44161	0.01586	0.18918	0.06918	1
Ranking	2	1	5	3	4	

Figure 2: Normalized decision matrix and the weights of the criteria

Objective	Select the best alternative								
Criteria weight	0.28417	0.44161	0.01586	0.18918	0.06918				
	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5				
	Benefit	Cost	Benefit	Benefit	Benefit	Sum	U	%	Ranking
A0	0.10149	0.15495	0.00441	0.06306	0.01922	0.34312	1	100	
Alternative 1	0.10149	0.15495	0.00441	0.03784	0.01922	0.3179	0.92649	92.6487	1
Alternative 2	0.0406	0.03874	0.00352	0.02522	0.01922	0.1273	0.371	37.1002	3
Alternative 3	0.0406	0.09297	0.00352	0.06306	0.01153	0.21168	0.61692	61.6924	2

Figure 3: The ranking of the alternatives

NOVELTY

This project introduces a customizable and automated Microsoft Excel template that integrates the Entropy and ARAS methods, enabling users to perform MCDM analysis without the need for advanced programming or third-party software.

CONCLUSION

The Excel-based Entropy-ARAS tool is expected to guarantee consistency of the decision-making process and reduce calculation errors. The tool not only enhances the quality and speed of decision-making but also helps users to implement the MCDM techniques in real-world problems with their choices of alternatives and criteria.

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NEGERI SEMBILAN INTERNATIONAL EXPOSITION

PST013 - A USER-FRIENDLY EXCEL TEMPLATE FOR MULTI-CRITERIA DECISION MAKING (MCDM) PROBLEMS USING THE ENTROPY-COPRAS METHOD

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ABSTRACT

Multi-criteria decision-making (MCDM) problems are about choosing the best alternative while considering multiple conflicting criteria. Various MCDM techniques can be implemented to solve the MCDM problems. In this project, Entropy-COPRAS is implemented to solve the problem. The Entropy method is used to compute the weights of the criteria, while the COPRAS method is used to choose the best alternative. Traditionally, the decisions are made based on the decision-makers' subjective preferences and past experiences, which will lead to bias in the process. However, with the help of a mathematical analysis, the bias may be reduced significantly, since the Entropy calculates the weights of the criteria objectively. The Entropy-COPRAS integrates into a Microsoft Excel-based template to help decision-makers make transparent and organized decisions. The template will also allow decision-makers without programming knowledge to apply the Entropy-COPRAS method effectively. As a result, decision-makers can make decisions more quickly and with guaranteed calculation transparency.

Keywords – Entropy, COPRAS, selection problem

INTRODUCTION

In the context of multi-criteria decision making (MCDM), the decision-making process normally involved choosing the best alternatives in the presence of multiple conflicting criteria. Traditionally, decision-makers may make decisions solely based on their subjective preferences and past experiences, which will lead to bias. Thus, a mathematical analysis is needed for the decision-makers choosing the best alternatives while reducing the subjectivity in the decision-making process. Numerous MCDM methods can be used to evaluate the alternatives based on the predetermined selection criteria. By incorporating objective data and systematic approaches, decision-makers can enhance the reliability and validity of their choices, ultimately leading to more informed and accurate outcomes.

In this project, an MCDM method, which is Entropy-COPRAS, is proposed to choose the best alternative. The COPRAS method was developed by Zavadskas and Kaklauskas, the Vilnius Gediminas Technical University scientists, in 1996 (Thakkar, 2021). The COPRAS method has the capability to consider maximum and minimum criteria individually, which

aids in forecasting the effect of ideal and anti-ideal solutions on alternative selection (Goswami et al., 2022). Moreover, the relative importance in COPRAS allows the prioritization of the ideal solution that maximizes the benefit while minimizing the cost criteria, whereas the negative ideal solution maximizes the cost while minimizing the benefit criteria (Goswami et al., 2022). The advantages of COPRAS include its simplicity, lower computational time, and transparent computation process (Thakkar, 2021). The COPRAS method is also free from rank reversals and can generate more accurate results than methods like Simple Additive Weighting (SAW), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Vlse Kriterijumska Optimizacija Kompromisno Resenje (VIKOR), Analytic Hierarchy Process (AHP), etc. (Goswami et al., 2022). In addition, decisions produced by the COPRAS method are more efficient and less biased than those provided by TOPSIS and SAW (Thakkar, 2021). The COPRAS method is one of the common MCDM methods that is implemented to rank the alternatives based on various criteria with the help of criteria weights and the utility degree of alternatives (Thakkar, 2021). The issue that arises with the implementation of this method lies in the weight determination. Many weighting methods can be used to compute the criteria weight and in this project, the Entropy method is employed to calculate the weights. The Entropy method is an objective weighting method introduced by Shannon in 1948. This method is free from the decision-makers' involvement and inconsistencies and thus does not need the consistency-checking procedure (Goswami et al., 2022).

To enhance the accessibility of the Entropy-COPRAS method, it is integrated with Microsoft Excel. An Excel-based template is designed to help the decision-makers assess and choose the best alternatives even without programming knowledge. This user-friendly tool offers a structured and transparent decision-making process. The template allows users to perform the Entropy-COPRAS method effectively by easily inputting and analyzing the collected data and thus reducing the calculation errors.

OBJECTIVE

The objectives of the research are:

i. To apply the Entropy–COPRAS method in solving the MCDM problems.
ii. To integrate the Entropy–COPRAS method into a Microsoft Excel-based template to facilitate the decision-making process.

DESCRIPTION OF THE PROJECT

The Entropy-COPRAS framework starts with the data collection. The initial data about the assessment of the alternatives based on predetermined selection criteria are collected. The data is then transformed into a decision matrix and keyed into an Excel-based template, as shown in Figure 1.

Objective	Select the best alternative				
	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5
	Benefit	Cost	Benefit	Benefit	Benefit
Alternative 1	5	3	5	3	5
Alternative 2	2	12	4	2	5
Alternative 3	2	5	4	5	3
Sum	9	20	13	10	13

Figure 1: The decision matrix

The criteria weights are calculated by using the Entropy method. The values are then used as input in the COPRAS framework. Entropy-COPRAS is employed to rank and choose the best alternatives. Figure 2 shows the values of the weights. Meanwhile, Figure 3 shows the degree of the utility of each alternative and its ranking.

Objective	Select the best alternative					
	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	
	Benefit	Cost	Benefit	Benefit	Benefit	
Alternative 1	0.55556	0.15	0.38462	0.3	0.38462	
Alternative 2	0.22222	0.6	0.30769	0.2	0.38462	
Alternative 3	0.22222	0.25	0.30769	0.5	0.23077	
Sum	1	1	1	1	1	
Entropy	0.90571	0.85347	0.99474	0.93723	0.97705	
Degree of divergence	0.09429	0.14653	0.00526	0.06277	0.02295	0.3318
Criteria weight	0.28417	0.44161	0.01586	0.18918	0.06918	1
Ranking	2	1	5	3	4	

Figure 2: The weights of the criteria

Objective	Select the best alternative										
Criteria weight	0.28417	0.44161	0.01586	0.18918	0.06918						
	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5						
	Benefit	Cost	Benefit	Benefit	Benefit	Smax	Smin	Qi	U	%	Ranking
Alternative 1	0.15787	0.06624	0.0061	0.05675	0.02661	0.24733	0.06624	0.48604	1	100	1
Alternative 2	0.06315	0.26497	0.00488	0.03784	0.02661	0.13247	0.26497	0.19215	0.39534	39.5336	3
Alternative 3	0.06315	0.1104	0.00488	0.09459	0.01596	0.17858	0.1104	0.32181	0.6621	66.2099	2
						0.55839	0.44161	1			

Figure 3: The ranking of the alternatives

NOVELTY

The novelty of the project lies in the integration of Entropy-COPRAS with a Microsoft Excel-based template to ease the decision-making process.

CONCLUSION

The Entropy-COPRAS integrates into a Microsoft Excel-based template to help decision-makers make transparent and organized decisions. The template will also allow decision-makers without programming knowledge to apply the Entropy-COPRAS method effectively. As a result, decision-makers can make decisions more quickly and with guaranteed accuracy.

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PST014 - A FRAMEWORK OF NATIONAL MONITORING AND REPORTING SYSTEM TO PREVENT UNAUTHORIZED RON95 PURCHASES

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ABSTRACT

The Malaysian government allocates significant subsidies to maintain the affordability of RON95 fuel for its citizens. However, increasing incidents of foreign-registered vehicles purchasing RON95 have raised concerns regarding subsidy leakage and policy inefficiency. The absence of real-time monitoring and public reporting mechanisms further hampers efforts to control these violations. This innovation outlines the framework of the development and implementation of a community-based digital monitoring system, *RON95 Watch*, which empowers citizens to report violations in real-time. The framework is used to propose a mobile platform for monitoring and reporting unauthorized purchases of RON95 by foreigners. This system is hoped to enhance transparency and accountability in the distribution of fuel subsidies. The system will utilize a mobile application, artificial intelligence (AI)-powered license plate recognition, and direct integration with enforcement agencies to ensure timely intervention. The implementation will be divided into three phases: the development and pilot testing, the nationwide rollout, and the integration and policy support. The novelty of the *RON95 Watch* lies in its integrated, citizen-centric approach to subsidy enforcement. The initiative aims to protect national interests, promote fairness, and enhance the effectiveness of fuel subsidy enforcement. Even though this is a framework of the real system, the idea of the monitoring system for the prevention of unauthorized RON95 purchases is a small step to a bigger implementation.

Keywords – RON95, artificial intelligent, RON95 Watch

INTRODUCTION

In 2024, the Ministry of Finance of Malaysia reported almost MYR 20 billion in subsidies for RON95 petrol, which is exclusively available to citizens, as regulations prohibit sales to foreign nationals and foreign-registered vehicles (BERNAMA, 2025). However, weak enforcement at petrol stations, especially in border towns like Johor Bahru and Bukit Kayu Hitam, has allowed foreign-registered vehicles to disregard government regulations by purchasing subsidized petrol. Some citizens also exploit the fuel subsidy scheme by reselling the subsidized petrol to non-citizens for personal gain (Ismail et al., 2024). Such activities deplete public funds, distort market prices, and undermine the effectiveness of national fuel policies. The lack of real-time monitoring and public reporting mechanisms

hinders efforts to control these real-time monitoring and public reporting mechanisms hinders efforts to control these violations, highlighting the need for a technology-driven enforcement solution.

The government's initiatives, such as MyKad and e-wallet verification, establish a connection between purchases and citizens' identities; however, they encounter several operational challenges. These include ambiguous procedures, financial strain on station operators, and potential risks related to data misuse (Thomas, 2004). The proposed *RON95 Watch* system incorporates a mobile application, AI-powered license plate recognition, and real-time citizen reporting directly linked to enforcement agencies. This integrated approach aims to close enforcement gaps, curb cross-border smuggling, safeguard public funds, and ensure subsidies reach their intended recipients.

OBJECTIVE

This is a proposal and the objectives are:

i. To develop a mobile platform for monitoring and reporting unauthorized purchases of RON95 by foreigners.
ii. To involve Malaysian citizens in enforcing compliance through photographic reporting and geolocation tagging.
iii. To assist enforcement agencies in identifying and acting against violators efficiently.
iv. To enhance transparency and accountability in the distribution of fuel subsidies.

THE FRAMEWORK OF THE PROPOSED SOLUTION BY *RON95 WATCH*

This innovation proposes a framework for a system called *RON95 Watch*. The *RON95 Watch* is a digital solution that will integrate the web and AI throughout Malaysia. Below are the details of the framework.

RON95 Watch comprises:

- Mobile and web applications for public reporting.
- AI-based license plate recognition and database cross-referencing.
- Administrative dashboard for government use to track, verify, and respond to reports.

Key Features:

- User Reporting Interface: Users can snap and upload a photo of the suspected violation (e.g., a vehicle with foreign plates refuelling with RON95), with location and time automatically recorded.
- AI Verification System: Image recognition software will identify vehicle plates and match them with transport databases to confirm foreign registration.
- Alert Mechanism: Valid reports will trigger alerts to enforcement agencies for follow-up action.
- Data Analytics: Aggregated data for identifying hotspot locations and recurring offenders.

Methodology and Implementation Plan:

Phase 1: The Development and Pilot Testing (0–3 Months)

- Build a minimum viable product (MVP) of the app and web system.
- Conduct pilot tests in border areas: Johor Bahru, Padang Besar, and Bukit Kayu Hitam.
- Collect user feedback for refinement.

Phase 2: Nationwide Rollout (4–9 Months)

- Launch official mobile and web app nationwide.
- Partner with the Ministry of Domestic Trade and media agencies for public awareness campaigns.
- Provide petrol station operators with system guidance.

Phase 3: Integration & Policy Support (10–12 Months)

- Collaborate with agencies for enforcement (Ministry of Domestic Trade, Customs, Royal Malaysia Police).
- Regular data reporting to support policy reviews.
- Update features and expand system capacity based on usage trends.

NOVELTY

The novelty of the *RON95 Watch* lies in its integrated, citizen-centric approach to subsidy enforcement, featuring:

- Community Empowerment: Unlike traditional top-down enforcement, this system engages the public directly as active monitors of policy violations through a user-friendly mobile platform.
- AI-Powered License Plate Recognition (LPR): The use of AI for automatic detection of foreign-registered vehicles at fuel stations is a new application in the context of subsidy control in Malaysia.
- Real-Time Enforcement Linkage: Instant data sharing with relevant authorities enables swift intervention, setting it apart from delayed or manual reporting systems.

CONCLUSION

This framework is one of the early steps to plan for the prevention of the misuse of the RON95. The expected impact for this system will be the reduction in unauthorized RON95 fuel purchases by foreign nationals. This proposal outlines a monitoring system that aligns with Malaysia's commitment to good governance, fiscal discipline, and public empowerment. Furthermore, it will increase the public's involvement and shared responsibility in protecting national resources, provide more accurate data for policymaking on fuel subsidies and border control and improve trust in enforcement and transparency mechanisms. The misuse of subsidized RON95 by foreign entities is a national issue that demands immediate, intelligent, and inclusive action. Through *RON95 Watch*, the government can leverage citizen participation and digital technology to ensure fair usage, curb abuse, and safeguard public funds.

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PST015 - CHOCOSHIELD: PROBIOTIC CHOCOLATE FROM LOCAL LACTIC ACID BACTERIA AGAINST MULTIDRUG-RESISTANT FOODBORNE PATHOGENS

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ABSTRACT

This study investigated the antimicrobial potential of cell-free supernatants (CFS) from *Lacticaseibacillus paracasei* dan *Lactobacillus plantarum* K014 against key foodborne pathogens. *L. paracasei* was identified as the most promising strain isolated from 'musangking' durian, demonstrating strong bactericidal activity and targeted inhibition of selected pathogens. Synergistic testing with tetracycline revealed complex interactions, highlighting the importance of optimising combinations of natural and conventional antimicrobials. The novelty of this work lies in the strain-specific antimicrobial potential of locally isolated lactic acid bacteria, which supports their application as natural biopreservatives. The findings further provide a scientific basis for developing functional food products, such as probiotic chocolate bars, that deliver both health benefits and extended shelf life.

Keywords – bacteriocin, antibiotic-resistant foodborne pathogen, mechanism, lactic acid bacteria, functional food products

INTRODUCTION

The World Health Organization has identified Gram-negative bacteria as top-priority antibiotic-resistant pathogens due to their role in severe, often fatal infections and their impermeable outer membranes, which limit antibiotic entry and accelerate resistance spread (Mogasale et al., 2021; Butler et al., 2022). In Malaysia, national antibiotic resistance surveillance data from 2016 revealed that 18% of *Staphylococcus aureus* isolates were methicillin-resistant (MRSA). *Streptococcus pneumoniae* showed resistance to erythromycin in the range of 33.9–35.2% over the past four years, while *Enterococcus faecium* exhibited an increasing trend of vancomycin resistance (Chong et al., 2020). These alarming trends highlight the urgent need for novel antimicrobial strategies targeting resistant pathogens, including MRSA, Extended Spectrum Beta-Lactamase (ESBL) producing *E. coli, Klebsiella pneumoniae,* and carbapenem-resistant *Pseudomonas aeruginosa.*

In recent years, bacteriocins are small, ribosome-synthesized peptides with potent and often strain-specific activity against antibiotic-resistant pathogens. Their unique mechanisms, from conventional antibiotics, make them promising candidates for both therapeutic and food applications (Chong et al., 2020). Harnessing bacteriocin-producing probiotic strains in functional food products presents an innovative strategy that could improve food safety, extend shelf life, and deliver probiotic health benefits, thereby bridging the gap between clinical antimicrobial research and food biotechnology (Abdul Hakim et al., 2023).

OBJECTIVE

This study aims to assess the antimicrobial activity of bacteriocins produced by locally isolated *Lacticaseibacillus paracasei* against key multidrug-resistant foodborne pathogens and to examine their potential synergy with conventional antibiotics. It further seeks to evaluate the stability of these antimicrobial properties during storage and apply the findings to the development of functional probiotic chocolate bars, combining targeted pathogen inhibition with probiotic health benefits.

DESCRIPTION OF THE PROJECT

This project develops a probiotic chocolate bar enriched with *Lacticaseibacillus paracasei*, a locally isolated lactic acid bacterium that has shown strong antibacterial activity against *Escherichia coli*, *Listeria monocytogenes*, and *Vibrio harveyi* through inhibition zone analysis, minimum inhibitory concentration (MIC) testing, and synergy assays with conventional antimicrobials. Embedding live probiotic cultures in a chocolate matrix offers dual benefits—delivering health-promoting probiotics while providing natural antimicrobial protection to enhance food safety. The chocolate's low moisture and protective fat content help preserve probiotic viability during storage, making it an ideal functional food carrier. Current research is evaluating probiotic viability, antimicrobial efficacy, and sensory qualities to optimise the formulation for potential market introduction.

L. plantarum CFS against pathogen	
Pathogenic bacteria	Inhibition zone (mm)
Escherichia coli	4.3 ± 1.19
Listeria monocytogenes	3.5 ± 3.54
Vibrio harvery	6.0 ± 1.00
L. paracasei CFS against pathogen	
Pathogenic bacteria	Inhibition zone (mm)
Escherichia coli	2.2 ± 0.29
Listeria monocytogenes	10.0 ± 0.00
Vibrio harvery	6.3 ± 0.58
Nisin (control) against pathogen	
Pathogenic bacteria	Inhibition zone (mm)
Escherichia coli	9.0 ± 1.08
Listeria monocytogenes	5.5 ± 0.71
Vibrio harvery	2.0 ± 0.00

Figure 1:Analysis on the LAB against pathogen with targeted chocolate to produce probiotic chocolate bar

NOVELTY

This research explores the unique antimicrobial potential of locally isolated bacteriocin-producing *Lacticaseibacillus paracasei*, revealing novel inhibition mechanisms against multidrug-resistant foodborne pathogens. It will identify resistance patterns, determine optimal bacteriocin dosages, and compare their efficacy with conventional antibiotics. The integration of these potent probiotics into a chocolate matrix represents a pioneering approach, creating a functional probiotic chocolate bar that delivers targeted antimicrobial benefits while maintaining probiotic viability and consumer appeal.

CONCLUSION

This study confirms the strain-specific antimicrobial activity of *Lacticaseibacillus paracasei* CFS against *E. coli*, *L. monocytogenes*, and *V. harveyi*. These findings highlight its potential as an alternative or complementary agent against antimicrobial resistance. Current work focuses on incorporating *L. paracasei* into probiotic chocolate, combining viable beneficial bacteria with demonstrated antimicrobial activity to create a functional, health-promoting confectionery.

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PST016 - FAST, GREEN & CLEAN: 5-MINUTE DYE REMOVAL USING CHICKEN FEATHER ACTIVATED CARBON

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ABSTRACT

Water pollution from synthetic dyes such as methylene blue (MB) is a pressing environmental challenge, particularly in textile and related industries. Conventional treatment methods often require long contact times, high chemical usage, and generate secondary waste. In this innovation, we present an eco-friendly, cost-effective, and ultra-fast adsorbent derived from chicken feathers, an abundant agricultural by-product typically discarded as waste. Through a controlled activation process, chicken feathers are transformed into high-surface-area activated carbon (CFAC) with enhanced adsorption capacity. The novelty of this product lies in its ability to achieve 98–100% MB removal within just 5 minutes using only 0.1 g of CFAC in a 5 ppm dye solution. This rapid performance surpasses many commercial activated carbons, offering significant advantages in energy and time efficiency. Furthermore, the use of chicken feathers as the raw material addresses two sustainability goals simultaneously: Clean Water and Sanitation (SDG 6) and Responsible Consumption and Production (SDG 12). The usefulness of this innovation extends to various industrial applications, including textile wastewater treatment, laboratory-scale dye removal, and as a rapid-response solution for accidental dye spills. Its low production cost, minimal dosage requirement, and biodegradability make it suitable for adoption in both developed and developing regions. This innovation demonstrates that waste can be transformed into a powerful environmental solution, proving that clean water can be achieved fast, green, and clean.

Keywords – chicken feather activated carbon, methylene blue, agricultural by product

INTRODUCTION

Synthetic dyes such as methylene blue (MB) are widely used in the textile, printing, and paper industries (Paschoalini et al., 2019). Their discharge into water bodies, even at low concentrations, poses serious environmental and health risks due to toxicity, persistence, and resistance to natural degradation. Conventional dye removal methods often involve high operational costs, long treatment times, and generate secondary waste, making them unsuitable for rapid or on-site applications (Kofidis et al., 2018). Among various treatment methods, adsorption has emerged as an efficient and cost-effective technique for dye removal. Activated carbon (AC) is widely utilized due to its high porosity and large surface

area, making it an ideal adsorbent for MB (Paul Chen et al., 2003). However, commercially available AC is expensive, leading to research on alternative low-cost adsorbents derived from agricultural and industrial waste materials (Yadav et al., 2021).

At the same time, agricultural by-products such as chicken feathers are generated in large quantities by the poultry industry (Raji & Pakizeh, 2013). These keratin-rich wastes are typically discarded or incinerated, contributing to landfill accumulation and environmental pollution.

The motivation behind developing this product is to address two environmental challenges simultaneously: water pollution from synthetic dyes and the improper disposal of agricultural waste. By transforming chicken feathers into high-surface-area activated carbon, we create a low-cost, sustainable adsorbent capable of achieving 98–100% methylene blue removal within just 5 minutes using only 0.1 g of material (Sehat, 2025). This innovation offers a fast, green, and clean solution aligned with the principles of the circular economy and the United Nations Sustainable Development Goals (SDGs).

OBJECTIVE

i. To evaluate the adsorption performance of the developed activated carbon for methylene blue dye removal.
ii. To promote waste valorisation by converting agricultural by-products into high-value environmental remediation materials.

DESCRIPTION OF THE PROJECT

The developed product is an activated carbon (AC) derived from chicken feathers, a keratin-rich agricultural by-product that is often discarded as waste. It possesses a high surface area, a porous structure, and is both lightweight and eco-friendly. Only 0.1 g of this material is required for treatment, and it can achieve 98–100% removal of methylene blue (MB) within just 5 minutes, making it a highly efficient adsorbent. Remarkably, it can also achieve up to 99% removal at concentrations as high as 250 ppm within 1 hour using the same dosage, demonstrating its exceptional adsorption capacity (Figure 1).

In terms of functionality, this AC offers rapid adsorption of synthetic dyes, particularly methylene blue, from contaminated water. It works effectively at low dye concentrations (5 ppm) with minimal adsorbent usage. The presence of keratin protein from the chicken feathers enhances its surface properties, improving dye binding efficiency. Furthermore, it can be used in both batch and portable filtration systems, allowing flexibility in application.

The product is highly useful from an environmental and economic standpoint. It significantly reduces water pollution by efficiently removing toxic dyes, while also addressing waste management by valorising chicken feather waste and reducing landfill burden. Its low-cost raw materials and minimal dosage requirement make it affordable for large-scale use. Industrially, it is relevant for textile wastewater treatment, small-scale dye laboratories, and emergency dye spill clean-ups.

In terms of practicality, the AC is lightweight and easy to transport, making it ideal for use in rural or remote areas. Its preparation and application are straightforward, requiring no

advanced technical training. The production process is scalable for commercial or community-level applications and is compatible with existing wastewater treatment systems, ensuring ease of integration into current practices.

Figure 1: Adsorption of MB at an initial concentration of 250 mg/L.

NOVELTY

This product uniquely utilises keratin-rich chicken feathers to produce eco-friendly activated carbon capable of removing 98–100% methylene blue in just 5 minutes at 5 ppm, and up to 99% removal at 250 ppm within 1 hour using only 0.1 g. The combination of rapid adsorption, high capacity, minimal dosage, and sustainable waste valorisation makes it a rare dual-performance solution in dye wastewater treatment.

CONCLUSION

The developed chicken-feather activated carbon (CFAC) offers a sustainable, low-cost, and highly efficient solution for dye-contaminated wastewater treatment. It demonstrates exceptional performance, achieving 98–100% methylene blue removal within 5 minutes at low concentrations and up to 99% removal at high concentrations (250 ppm) within 1 hour using only 0.1 g of adsorbent. By transforming agricultural waste into a high-value product, this innovation addresses both environmental pollution and waste management challenges, aligning strongly with SDG 6 and SDG 12. The CFAC's combination of rapid action, high adsorption capacity, and environmental sustainability makes it a practical and impactful advancement for cleaner water systems.

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NSIEX+RS 2025
NEGERI SEMBILAN INTERNATIONAL EXPOSITION

PST017 - MEDIRANK: A LIGHTWEIGHT, WEB-BASED PRE-SCREENING TOOL USING EUCLIDEAN DISTANCE SIMILARITY

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ABSTRACT

MediRank is a web-based pre-screening diagnosis support tool designed to assist healthcare providers in rapidly identifying probable diseases based on patient symptoms and basic clinical parameters. Targeted for use in primary care and rural settings, where laboratory resources and specialist access may be limited, MediRank enables early case prioritisation and informed referral decisions. The system applies Euclidean Distance-based similarity analysis to compare a patient's symptom profile — including temperature, platelet count, white blood cell count, and selected clinical indicators — against a database of confirmed cases. The algorithm calculates the degree of similarity for each disease in the dataset, generating a ranked list of possible conditions from most to least likely. This process allows healthcare workers to quickly narrow down differential diagnoses before proceeding with confirmatory tests. MediRank's novelty lies in its lightweight, explainable, and real-time analysis framework. Built with Python and deployed using Streamlit, the tool runs directly in a web browser without installation, requires minimal computational resources, and produces transparent outputs that include similarity scores, ranked diagnoses, and visual comparisons. The integrated PDF export function enables instant documentation for patient records or referral purposes. As a pre-screening tool, MediRank is not intended to replace medical judgment but to support early triaging, improve diagnostic efficiency, and provide educational value for medical students learning about case similarity analysis. Its dataset-agnostic design allows adaptation to multiple medical domains, and future developments will explore weighted similarity measures, hybrid algorithms, and integration with electronic health record (EHR) systems.

Keywords – Euclidean distance, diagnosis support, similarity analysis, healthcare AI, medical ranking

INTRODUCTION

Accurate and timely diagnosis is crucial for effective healthcare, yet primary care and rural settings often face time constraints, limited specialist access, and inadequate technology. These challenges contribute to diagnostic errors, affecting about 5% of outpatient encounters globally (Nia et al., 2023), and are more pronounced in resource-limited environments where decisions often rely on experience rather than structured data (Ahmed et al., 2023).

AI-based decision support systems, including machine learning and neural networks, have shown promise in improving diagnostic accuracy (Orji et al., 2023). However, they often require large datasets, significant computational resources, and lack transparency, which can limit clinician trust (Fukuzawa et al., 2024). In contrast, Euclidean Distance-based similarity analysis offers a simple, interpretable, and computationally efficient.

OBJECTIVE

To develop a lightweight, web-based diagnosis support tool that applies a new mathematical model based on Euclidean Distance similarity analysis to compare patient symptoms with historical cases, generate a ranked list of possible conditions, and ensure the system is accessible, transparent, and adaptable for diverse healthcare settings.

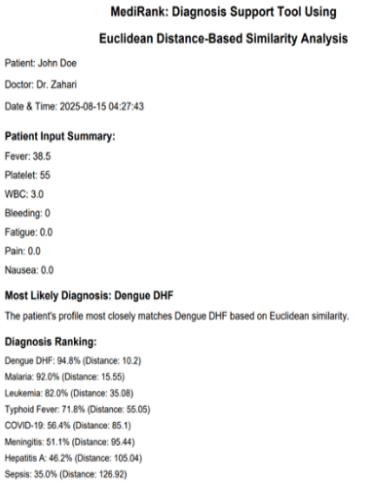
DESCRIPTION OF THE PROJECT

MediRank is a web-based pre-screening diagnosis support tool designed to help healthcare providers identify probable conditions from patient symptoms and clinical parameters. Built in Python with Pandas and NumPy, and deployed via Streamlit, it provides real-time browser access without installation, making it ideal for low-resource settings.

The system offers key features including: interactive input for symptoms and vitals (Figure 1), Euclidean Distance-based ranking of similar cases, instant results with similarity scores, historical case comparison, and portability for use on any internet-enabled device. The workflow begins with data entry, where patient details are encoded numerically. The Euclidean Distance formula compares the new case with stored records, ranking conditions from most to least similar. The PDF output (Figure 2) includes the patient summary, top diagnosis, and ranked list of possible conditions. To aid interpretation, MediRank includes visual analytics (Figure 3), with a similarity score chart and radar plot comparing the patient profile to the top diagnosis. These visualisations help in quick triaging and make results more explainable for both clinicians and patients.

In clinical use, MediRank supports early diagnosis and referral decisions; in education, it aids students in learning case similarity analysis. Its dataset-agnostic design allows adaptation to multiple medical fields.

Figure 1: MediRank input interface



MediRank: Diagnosis Support Tool Using Euclidean Distance-Based Similarity Analysis

Patient: John Doe

Doctor: Dr. Zahari

Date & Time: 2025-08-15 04:27:43

Patient Input Summary:

Fever: 38.5

Platelet: 55

WBC: 3.0

Bleeding: 0

Fatigue: 0.0

Pain: 0.0

Nausea: 0.0

Most Likely Diagnosis: Dengue DHF

The patient's profile most closely matches Dengue DHF based on Euclidean similarity.

Diagnosis Ranking:

Dengue DHF: 94.8% (Distance: 10.2)
Malaria: 92.0% (Distance: 15.55)
Leukemia: 82.0% (Distance: 35.08)
Typhoid Fever: 71.8% (Distance: 55.05)
COVID-19: 56.4% (Distance: 85.1)
Meningitis: 51.1% (Distance: 95.44)
Hepatitis A: 46.2% (Distance: 105.04)
Sepsis: 35.0% (Distance: 126.92)

Figure 2: PDF diagnostic output.

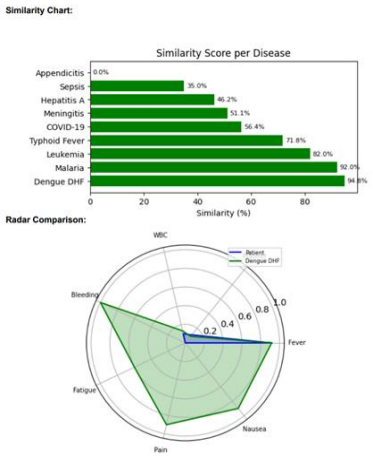


Figure 3: Similarity score and radar chart.

NOVELTY

MediRank is a real-time, browser-based diagnosis support tool using newly developed mathematical model for Euclidean Distance similarity for fast, explainable results. Unlike complex AI models, it is lightweight, resource-efficient, and adaptable to multiple medical datasets. It is transparent, accessible, and supports both clinical use and medical training, making it ideal for resource-limited settings.

CONCLUSION

MediRank applies Euclidean Distance-based similarity analysis in a lightweight, web-based tool that delivers fast, explainable diagnostic suggestions. Its user-friendly design and low resource requirements make it ideal for primary care, rural clinics, and medical education. Transparent similarity scores foster trust, while its dataset-agnostic design allows use across multiple specialties. Future work will explore additional similarity measures, weighted parameters, and electronic health record (EHR) systems integration to further enhance its clinical value.

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PST018 - ELECTRO LAND: REDOX REACTIONS LEARNING DIGITAL ESCAPE GAME

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ABSTRACT

Many students struggle with mastering the redox reaction topic due to their multi-step processes, including oxidation-reduction concepts, electron transfer, and the balancing of redox equations. To address this issue, an interactive escape game entitled Electro Land was developed using the Genially platform. Unlike traditional learning and teaching methods, this game combines gamification with curriculum-based redox chemistry content and it was designed based on the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) instructional design model to ensure a structured and effective learning experience. The game embeds redox chemistry content where students must answer questions correctly to progress and ultimately “escape” the challenge. This gamified approach aims to enhance conceptual understanding and student engagement on the redox topic. Positive feedback from students suggests increased motivation, deeper comprehension, and overall satisfaction with the learning experience. The success of Electro Land indicates that similar gamification strategies can be effectively applied to other chemistry topics to foster an engaging and interactive educational environment.

Keywords – redox reaction, ADDIE, escape game, gamification

INTRODUCTION

Electrochemistry involves the transfer of electrons in reduction and oxidation (redox) reactions and is often considered one of the most challenging topics in chemistry, possibly because it involves processes that cannot be directly observed, such as electron flow, and ion movement (Lin & Wu, 2021). Traditional education focuses on teaching and learning through teacher-directed lecturing, where learners primarily watch and listen to the teacher, often leading to difficulties in understanding the topic (Junior et al. 2025). One effective strategy to enhance students’ understanding and overcome low motivation in challenging topics is the use of gamification, which incorporates game design elements such as rewards and immediate feedback to make learning more effective and meaningful (Jaramillo-Mediavilla et al. 2024). In a study by Clapson et al. (2023), ChemEscape Battle Box puzzles were developed for a General Chemistry course, incorporating topics such as redox reactions. Among the four puzzles in the game, Puzzle 3 – Metal Redox Properties was found to be the most challenging for students. The game includes exam-style questions, and students reported that they could relate the gameplay to the course's

learning objectives. Cahyadhi and Lutfi (2021) has developed the Red and Ox Game for Android mobile devices to help balance redox equations. Based on the significant differences between pretest and posttest results, the game has proven to be effective. This paper describes the development of a redox reaction escape game called Electro Land, designed for students to enhance students' understanding of redox chemistry, with particular emphasis on the topic of balancing redox equations. The escape game requires participants to solve all the puzzles and complete all the tasks to exit the game (Roig et al. 2023).

OBJECTIVE

The main objective of this product is to create an interactive platform that not only enhances understanding of the fundamental principles but also fosters enthusiasm for the topic. Additionally, it was aimed to enhance student engagement and motivation in learning redox reaction through a gamified digital escape room. Furthermore, the game was designed to provide accessible resources to the educators that can be integrated into their teaching practices.

DESCRIPTION OF THE PROJECT

The Electro Land (Figure 1) game was developed as an interactive learning tool for students at the pre-diploma, diploma, matriculation, and degree levels. The development of the game was guided by the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) instructional design model to create structured and effective learning experience (Norouzkhani et al., 2025). The following phases outline the development of the Electro Land game based on the ADDIE model:

1. Analysis: An analysis was conducted to identify students’ challenges in understanding and applying the principles of redox reaction and balancing the reactions. The findings revealed that many students struggled with determining oxidation numbers, identifying oxidizing and reducing agents, and applying the balancing concepts effectively.

2. Design: The design phase included aligning game elements to learning objectives, creating the game’s structure, storyline and learning flow as well as embedding gamification elements such as time limits, rewards and feedback.

3. Development: The game was developed as a digital escape room using Genially, a web-based interactive media platform. The escape room had four checkpoints, each containing problems related to redox reactions. Students were required to solve all the challenges at each checkpoint to earn stuffed animals as rewards and eventually complete the game. The theme of each checkpoint included the following: checkpoint 1, throw the clown; checkpoint 2, mirror maze; checkpoint 3, horse race; checkpoint 4, the house of terror.

4. Implementation: The Electro Land game was embedded in the Chemistry for Pre Diploma II (CHM012) Massive Open Online Course (MOOC). This online course is available on UFUTURE, the online learning platform developed by Universiti Teknologi MARA (UiTM).

5. Evaluation: A structured Google Form was used to collect feedback from students on the effectiveness of the game in enhancing their understanding on redox reactions. The responses were then analyzed to identify areas for improvement.

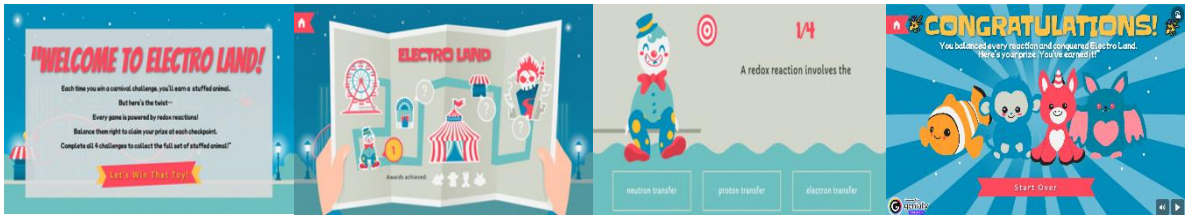

Figure 1: Image of the interface of the Electro Land game

NOVELTY

The novelty of the game lies in its integration of redox reaction concepts with a gamified escape room, developed using the free online interactive platform Genially. Unlike most existing games on similar concepts, which often employ simple game formats, Electro Land game offers an immersive learning environment enhanced with gamification elements. These features promote active learning, develops problem-solving and enhances students' motivation and engagement. Guided by the ADDIE model, it provides an engaging and pedagogically structured approach which is not found in the current chemistry education tools.

CONCLUSION

In summary, a virtual escape game in redox reactions represents an innovative approach that offers an alternative to passive online learning. This approach supports the development of gamification-based e-learning for higher education to create a more dynamic learning environment. Looking ahead, future developments will focus on expanding the game's content to include other electrochemistry concepts and adding more advanced interactive features and gamification elements. Additionally, further evaluation studies will be conducted to measure its effectiveness in improving learning outcomes across different educational levels.

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PST019 - SERENITYSENIOR:AN ELDERLY CENTERED DIGITAL MENTAL HEALTH PLATFORM

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ABSTRACT

This study introduces SerenitySenior, a mobile app that fulfills older persons' mental health needs. Accessible and personalized mental health support tools for older adults are needed due to the global demographic change toward an aging population. SerenitySenior is a user-friendly, culturally sensitive digital resource to improve seniors' mental health. Following a comprehensive literature analysis and digital health intervention best practices for older individuals, the study created a high-fidelity SerenitySenior prototype. Users with varying technological skills and physical constraints are accommodated by user-centric features like large, clear text, fast navigation, voice-activated instructions, and intuitive interaction techniques. Data collection has not yet occurred, but the app's features were built after a comprehensive examination of mental health solution studies to ensure relevance and accessibility. Guided meditation, mood-tracking tools, cognitive exercises, and educational materials on common mental health difficulties among older persons are available from SerenitySenior. Improve offline capabilities and add culturally varied material to better tailor the app to user needs. The study prioritized design concepts based on older folks' needs to make digital health interventions accessible and usable. This study shows that a user-centered, evidence-based approach can promote engagement and mental well-being in older adults using digital mental health care. Age-appropriate technology can help older populations with mental health difficulties, as SerenitySenior may be a valuable and accessible resource

Keywords – Mental health, Elderly people, user centered design, mobile app

INTRODUCTION

The world's aging population makes older mental health issues more significant. This generation faces social isolation, cognitive decline, depression, and anxiety, which lowers their quality of life. Depression, anxiety, cognitive decline, and social isolation can impair elderly quality of life. Depression in older persons is linked to women, social isolation, and pre-existing health concerns. A COVID-19 pandemic study of elderly Indians indicated that concomitant health concerns, social isolation, and financial suffering predicted depression (Ray, 2023). Depression affects health and social security in China, where 34.1% of seniors are depressed (Shao, Chen, & Ma, 2022). Despite increased demand, older adults have limited specialized mental health alternatives. Low digital literacy, stigma, and transportation constraints generate this shortage. Fewer digital mental health therapies are for older persons than younger ones. Current technologies may not be accessible to

elders' physical and cognitive limitations. This gap highlights the need for user-centered, innovative mental health support for seniors.

SerenitySenior, a senior digital platform, is introduced in this study. One of its primary innovations is its high-fidelity prototype, created after researching digital design and mental health intervention literature and best practices. This software encourages cultural awareness, accessibility, and usability using voice commands, simplified navigation, large print, and engaging mental health resources. This project will create and test a high-quality SerenitySenior prototype for older digital mental health. This method may improve seniors' mental health. This study prepares for implementation and testing with user-centric design. We seek to create more accessible and effective geriatric digital mental health solutions. The study introduces SerenitySenior, a cutting-edge mobile program that meets senior adults' mental health needs through a digital platform. Seniors require accessible and specialized mental health help as the population matures. SerenitySenior is a culturally appropriate, user-friendly online resource for senior mental health. A literature review and current aging digital health interventions informed this study's high-fidelity SerenitySenior prototype. Voice-activated commands, intuitive interaction modalities, simpler navigation, and large, easy-to-read text are user-centric features for all technological abilities and physical constraints. Even before data collection began, a thorough review of mental health solution research guaranteed the app's relevance and accessibility. These issues necessitate diverse methods. Studies show that wisdom and positive views about aging can reduce the implications of poor physical and mental health. Wisdom buffers and positive aging attitudes improve mental health (Zadworna & Ardelt, 2025). SerenitySenior provides cognitive activities, mood-tracking tools, guided meditation, and information on prevalent mental health issues in older adults. The app will be customized by providing culturally diverse content and offline features. Telepsychiatry, popular during the epidemic, must be used in geriatric care. Telepsychiatry can help older persons with poor computer skills access mental health care (Sivakumar et al., 2020). This study prioritizes older adult-centered design to improve senior digital health care accessibility and efficacy. This study reveals that user-centered, evidence-based approaches improve senior mental health and participation. Age-appropriate technology like SerenitySenior could aid seniors with mental health difficulties. In conclusion, older persons' mental health difficulties are complicated and require a profound understanding of their social, cognitive, and emotional requirements. These issues require healthcare, community support, and innovative mental health interventions (Rangarajan et al., 2021).

OBJECTIVE

i. To conduct a thorough assessment and analysis of current digital mental health therapies for older individuals, pinpointing essential characteristics and identifying existing deficiencies.
ii. To create a high-fidelity prototype of SerenitySenior, a digital platform designed to meet the mental health requirements of aged consumers.
iii. To integrate functionalities beneficial for senior users, like streamlined navigation, accessible information, and voice interaction, to improve usability.
iv. To evaluate the usability, accessibility, and user satisfaction of the SerenitySenior prototype by conducting tests with older adult volunteers.
v. To create a basis for subsequent research aimed at evaluating the deployment and efficacy of the platform in enhancing mental health outcomes for seniors.

DESCRIPTION OF THE PROJECT

An Elderly Mental Health Application, a digital platform, will be developed to support older adults' mental health. It will offer accessible features, including professional counseling, appointments with specialists, medication reminders, health tracking (blood pressure, glucose, activity, sleep, mood), and family notifications for missed appointments. The app prioritizes user-friendliness with a rich color palette and large buttons. Research emphasizes the need for senior-friendly digital health devices with features like contrasting colors, skeuomorphic design, icon-based navigation, and voice notifications. Complex interfaces hinder adoption. User-centered design, motivation, assistance, and training are crucial for increasing user experience and promoting connectivity. Wearable sensors for sleep monitoring can aid in mental health evaluation and communal caregiving. Effective digital interventions require simplified interfaces, easy navigation, and comprehensive support to enhance usefulness and socialization for older individuals.

NOVELTY

Our unique digital health app for seniors combines mental wellness, health monitoring, and social connection. It offers psychological support, biometric tracking, and family communication. Key features include senior-focused design (larger buttons, brighter colors), integrated social support with family notifications, on-call counselors and consultations, and secure fingerprint authentication. The app tracks vital signs, mental state, sleep, and physical activity for personalized health and early diagnosis. This platform improves geriatric mental health, especially for those with mobility issues, by improving self-monitoring, community support, and reducing loneliness. It’s a scalable, adaptive gerontechnology solution that enhances seniors' quality of life.

CONCLUSION

To conclude, creating this new digital mental health platform is a major step toward satisfying older adults' healthcare demands. The platform combines mental health help, real-time health monitoring, and social interaction features into a single, easy-to-use interface to improve older adults' quality of life. Its holistic approach provides medical and emotional care, develops community, and promotes independence, which are vital to mental and physical health. Wearable sensors, mobile apps, and data analytics let the platform provide personalized and proactive healthcare. This helps consumers get individualized care, detect health issues early, and keep in touch with doctors and family. Scaling and adapting to different scenarios indicates that it can make eldercare more accessible, efficient, and caring. As the global elderly population grows, these digital health solutions become more important. We should improve the user experience, protect data, and support underserved communities in the future. This platform shows how technology can be used in holistic elderly care. It can also make global aging populations healthier, more connected, and powerful.

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PST021 - COCO-FIT: FUNCTIONAL FAT FROM BAMBANGAN KERNET FAT STEARIN AS COCOA BUTTER IMPROVER FOR TROPICAL APPLICATIONS

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ABSTRACT

This project produced a cocoa butter improver (CBI) by fractionating pure bambangan seed fat and blending it with cocoa butter to assess its impact on cocoa butter properties. Various attributes, including physicochemical properties, fatty acid composition, solid fat content, and compatibility of the produced stearin with cocoa butter, were evaluated through analytical analysis, gas chromatography, and pulsed nuclear magnetic resonance. Twelve physical blends were prepared from the pure bambangan seed fat and the stearin with cocoa butter, with the proportion of cocoa butter increased by 20 %. Among these blends, COCO-FIT (bambangan stearin) improved the thermal properties of cocoa butter at a blending ratio of 20% COCO-FIT and 80% cocoa butter. No significant changes were observed in the physicochemical properties of cocoa butter, indicating that the fat is compatible with cocoa butter. The solid fat content shifted towards higher temperatures, with COCO-FIT improving the gradual decrease in solid fat content of cocoa butter towards 30 °C to 35 °C. These blends melted at body temperature, reached 0 % SFC at 40 °C, and showed ideal compatibility without eutectic effects. Therefore, COCO-FIT presents as a novel cocoa butter improver to improve the hardness and melting properties of chocolate in tropical climates.

Keywords – cocoa butter improver, bambangan kernel fat, tropical chocolate, physicochemical properties

INTRODUCTION

Cocoa butter (CB) is one of the most valuable and expensive fats in the food industry and serves as an essential ingredient in chocolate production due to its desirable melting profile, glossy appearance, and stable β-polymorphic form. It is mainly composed of stearic (36.5%), oleic (33.5%), and palmitic acids (25.8%), with triacylglycerols such as POS (40.2%), SOS (25.7%), and POP (17.6%), which together make up its unique texture and mouthfeel (Bahari & Akoh, 2018; Sonwai, Kaphuekngam & Flood, 2014). However, as CB faces supply constraints, high costs, and softening issues in tropical climates, acoconut butter, illipe butter, and sal fat. However, these natural CBIs are expensive and

limited, so the development of sustainable alternatives is essential. Bambangan seeds (*Mangifera pajang*), an underutilised by-product with a fat content of ~9.9%, have a fatty acid profile very similar to that of CB (Norazlina et al., 2020; Jahurul et al., 2019, 2018). By fractionation, bambangan seed fat BKF yields high-melting stearic fractions rich in SOS (55.83–64.70%) and stearic acid (44.72–48.50%), making them promising CB improver candidates. Blending the stearins with CB offers a cost-effective approach to improve physicochemical and thermal properties, especially for chocolate products destined for tropical markets. This study investigates the physicochemical, thermal, and compatibility properties of BKF and its stearin fractions blended with CB, focusing on the fatty acid composition, solid fat content, and optimal blending ratios that best reflect CB properties while improving melting stability under tropical conditions.

OBJECTIVE

The main objective of this innovation is the development of COCO-FIT, a cocoa butter improver produced from the fractionation of pure bambangan seed fat. In particular, the study aims to investigate the physicochemical, thermal, and compatibility properties, including fatty acid composition and solid fat content of bambangan seed fat and its stearin fractions blended with cocoa butter, and to identify blending ratios that best mimic the properties of cocoa butter while improving melt stability for tropical environments.

DESCRIPTION OF THE PROJECT

COCO-FIT is a functional fat produced from bambangan seed fat through a two-stage fractionation process. Derived from the underutilised seeds of *Mangifera pajang*, this sustainable ingredient valorises agricultural by-products while offering a high-SOS composition and desirable thermal properties. In this study, COCO-FIT (bambangan stearin) were physically blended with commercial cocoa butter (CB) and the results showed that the main fatty acids in COCO-FIT blends were palmitic (22.42–25.72%), stearic (37.23–37.63%), and oleic (31.83–33.79%), with blends containing 80% closely matching CB's FA profile. These blends exhibited iodine value 36.17–36.58 g I_2/100 g and slip melting point 28.83–29.17 °C slightly higher than C, providing enhanced heat resistance. Solid fat content curves indicated higher solids above 30 °C, complete melting at ~37 °C, and 0% SFC at 40 °C, making them ideal for tropical storage. Compatibility testing revealed no eutectic softening effects, and the best-performing blends delivered CB-like sensory and physical properties with improved thermal stability. COCO-FIT can be incorporated into cocoa butter at up to 20% without negatively affecting physicochemical characteristics, offering a cost-effective, sustainable cocoa butter improver for tropical chocolate applications.

Figure 1: COCO-FIT produced from the fractionation of bambangan seed fat

Table 1: Physicochemical properties of COCO-FIT

	COCO-FIT	Cocoa butter
Physicochemical properties		
Iodine value (g I_2/100 g)	36.17 - 36.58	33.08
Slip melting point (°C)	28.83 – 29.17	25.00
Fatty acid composition (%)		
Palmitic (C_{16})	21.73 ± 0.01	24.79 ± 0.04
Stearic (C_{18})	38.92 ± 0.13	36.33 ± 0.57
Oleic ($C_{18:1}$)	31.12 ± 0.11	33.00± 0.01
Solid fat content (%)		
25 °C	75.16	73.58
30 °C	48	35
35 °C	2	0
40 °C	0	0

NOVELTY

This research is the first to detail the physicochemical compatibility of the bambangan stearin with CB. It demonstrates that using 20% high-SOS stearin in CB yields cocoa butter-like fats with improved heat resistance, making them suitable for tropical chocolate manufacturing. This valorizes the bambangan seed, an agricultural by-product, into a high-value, sustainable functional fat for the confectionery industry.

CONCLUSION

The two-stage fractionation of bambangan seed fat has successfully produced functional fat (COCO-FIT) that can be mixed with cocoa butter. Blending 20 % COCO-FIT (bambangan stearin fractions) with 80 % CB did not lead to significant changes in the physicochemical properties, fatty acid composition, and solid fat content profile of CB, but improved its thermal stability. COCO-FIT can serve as a CB improver in tropical chocolate production, support waste utilisation, and reduce dependence on imported CB.

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NEGERI SEMBILAN INTERNATIONAL EXPOSITION

PST022 - RINDCHI : A ZERO-WASTE, FERMENTED DELICACY FROM WATERMELON RIND

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ABSTRACT

The white inner rind of the watermelon, an edible, nutrient-rich part that is usually discarded during fruit processing, is used to make RindChi, a novel, sustainable, plant-based kimchi that transforms food waste into a tasty, valuable fermented treat. RindChi, combines traditional kimchi-making methods with zero-waste innovation, offering a natural, flavourful and crunchy profile with no artificial additives. Natural lactic acid fermentation promotes gut health by utilising beneficial bacteria. The unique feature of this product is that it transforms an underutilised, locally available raw material into a functional food that supports resource efficiency, promotes environmental sustainability, and preserves cultural culinary traditions. This product is the preferred choice for environmentally conscious consumers looking for plant-based, health-conscious products. The product offers strong commercial potential by creating new revenue streams for micro-entrepreneurs, farmers, and food producers through upcycling initiatives. RindChi offers a scalable model for sustainable food innovation by combining strong flavour, nutritional benefits and an obvious environmental impact, focusing on creating products from waste and transforming them into a successful, profitable, and marketable product.

Keywords – watermelon rind, kimchi, food innovation, alternative ingredient

INTRODUCTION

Watermelon is a fruit that many people choose as a dessert. It contains many nutrients such as vitamins and is rich in antioxidants. Scientific studies on antioxidant content of the watermelon rind have shown that it offers various benefits. These antioxidants are important for reducing, neutralising and protecting the body's cells from free radical damage (Wakid and Harun, 2020; Wakid, 2024). The urgent need to combat food waste and promote sustainable food innovation led to the creation of RindChi. Although the white inner rind of watermelons is edible and nutrient-rich, it is often discarded during processingortunity. Inspired by the cultural heritage of kimchi making and driven by the principles of waste minimisation, RindChi was developed to transform this unused by-product into a functional, marketable food. RindChi enhances the flavour with a zesty, spicy profile that appeals to the modern consumer, while retaining the mild taste and crunchy texture of the watermelon rind through traditional fermentation

processes. The product addresses several problems simultaneously such as reducing the agricultural waste, extending the shelf life of perishable foods, improving gut health through natural lactic acid, fermentation and opening up new revenue streams for small farmers, food processors, and business owners. This innovation not only promotes environmental sustainability but also meets the growing consumer demand for plant-based, environmentally friendly, and culturally inspired foods.

OBJECTIVE

The objectives to develop this product are:

i. Transform food waste into value by upcycling the edible white rind of watermelon into a flavorful, fermented kimchi product.
ii. Promote sustainable food systems through zero-waste innovation that supports environmental, economic, and community well-being.
iii. Deliver a market-ready, health-conscious product that combines bold taste, natural fermentation benefits, and strong commercial potential

DESCRIPTION OF THE PROJECT

A summary of the product is shown in Figure 1.

Features	Functionality	Usefulness	Practicality
– Made from nutrient rich white watermelon rind – Naturally fermented with no additives – Tangy, spicy, crisp flavor – Plant-based and ecofriendly	– Upcycles agricultural by-products – Preserves freshness naturally – Supports gut health via natural probiotics	– Reduces organic waste – Generates income for small producers – Offers sustainable, nutritious side dish	– Uses low-cost raw materials – Simple equipment for production – Long shelf life for easy storage & distribution

Figure 1: Summary of product description.

NOVELTY

RindChi is the first known kimchi product made entirely from the white inner rind of the watermelon, an edible but largely neglected by-product of fruit consumption and processing. Unlike traditional kimchi, which uses cabbage or radish, RindChi transforms a nutrient-rich, moisture, -rich vegetable waste into a flavourful, crunchy, and naturally fermented delicacy, offering a zero-waste approach to food innovation. Its development combines cultural heritage with environmental responsibility, and provides a scalable model for upcycling agricultural waste into a marketable product. This combination of unique raw material, environmentally conscious production, and functional health benefits makes RindChi a distinctive product in the global fermented food market.

CONCLUSION

RindChi transforms the rind of watermelon, a frequently discarded by-product, into a flavourful, naturally fermented kimchi that combines sustainability, health benefits, and commercial potential. This innovative product is an example of zero-waste food innovation, and offers a delicious, environmentally conscious, and profitable solution for consumers and producers.

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PST023 - AI-POWERED MOBILE APPLICATION PROTOTYPE FOR *SURAH AL-MULK* MEMORISATION

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ABSTRACT

This study presents an AI-powered mobile application prototype for *Surah Al-Mulk* memorisation. The application applies a *one day, one verse* approach for beginners, which integrates the memorisation technique such as chunking, *Tasalsuli* and *Tasmi'* with Automatic Speech Recognition (ASR). The VARK model is embedded to create a multi-sensory and step-by-step learning experience that is suitable for beginners. Expert evaluation using the Fuzzy Delphi Method showed strong consensus confirming that the prototype is relevant for Quran memorisation education. Performance testing of the ASR module produced an average Character Error Rate (CER) of 13.69% and Word Error Rate (WER) of 13.13%, indicating moderate recognition accuracy. The novelty of this product lies in its integration of Qur'an memorisation techniques with AI-driven speech recognition and multi-sensory engagement strategies. The prototype provides an accessible and interactive platform that is suitable for beginners. It is also able to bridge the traditional pedagogy with modern technological innovation in Quran education.

Keywords – AI-Powered Mobile Application, Speech Recognition, Quran Memorisation

INTRODUCTION

Nowadays, many people are motivated to learn and memorize the Quran due to its benefits in spiritual and Islamic education. Thus, the tremendous growth of Quran memorisation classes, either physical or online, has made it accessible to learners of all ages. Among all the surahs in the Quran, Surah Al-Mulk is commonly chosen for memorisation due to its virtues. According to Hadith, Prophet Muhammad (ﷺ) has encouraged reciting it every night, and it is believed to protect from the punishment of the grave. Besides, this surah contains 30 verses, and it is an ideal choice for beginners. Traditional memorisation approaches, which rely on face-to-face learning called *tasmi,* are challenging due to time consuming and requiring full engagement with the teacher. Therefore, emerging technologies such as mobile applications and artificial intelligence (AI), particularly speech recognition, provide new opportunities to make memorisation more accessible, interactive, and effective. However, the existing mobile applications often do not provide the specific steps and guidance involved in memorising the Quran (Afzal et

al., 2023). This limitation hinders learners, especially beginners, who lack a clear understanding of how to initiate an effective memorisation of the Quran. This study, therefore, proposes a prototype of a mobile application specifically designed to support the memorisation of *Surah Al-Mulk*.

OBJECTIVE

The objective is to develop a mobile application prototype for surah Al-Mulk memorisation based on speech recognition. This application aims to enhance learner engagement and provide step by steps guided for beginners with one day one verse in memorising surah Al-Mulk.

DESCRIPTION OF THE PROJECT

The need analysis of this prototype was conducted based on the interview session with four experts from the Faculty of Quran and Sunnah Studies, USIM. Next, the prototype was developed as a proof of concept using FlutterFlow and Google Cloud AI-Speech-To-Text API for the Arabic language, which was integrated in the prototype as its Automatic Speech Recognition (ASR) Module. The mobile application can be executed using the Android OS. Figure 1 shows the conceptual framework of the integration of Quran memorisation with AI mobile application to develop a prototype. Figure 2 shows an example of a mobile application prototype.

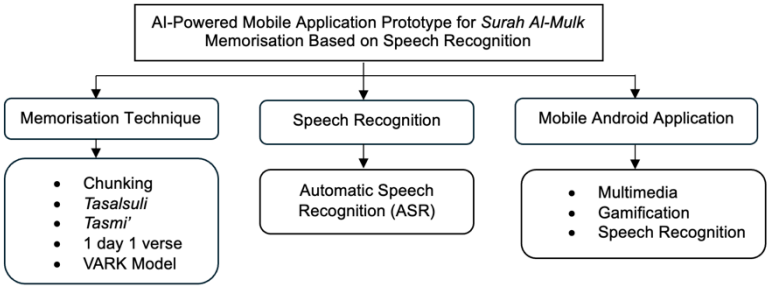
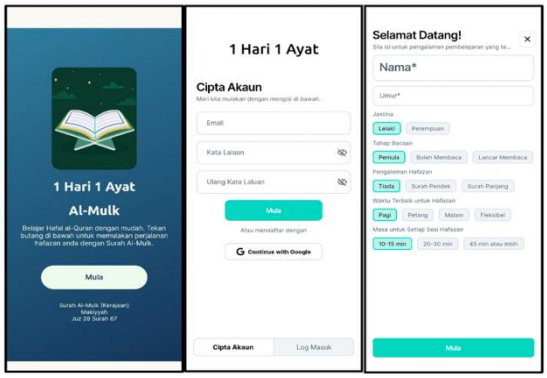
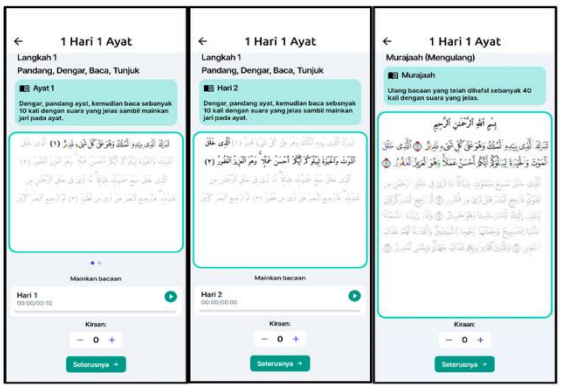


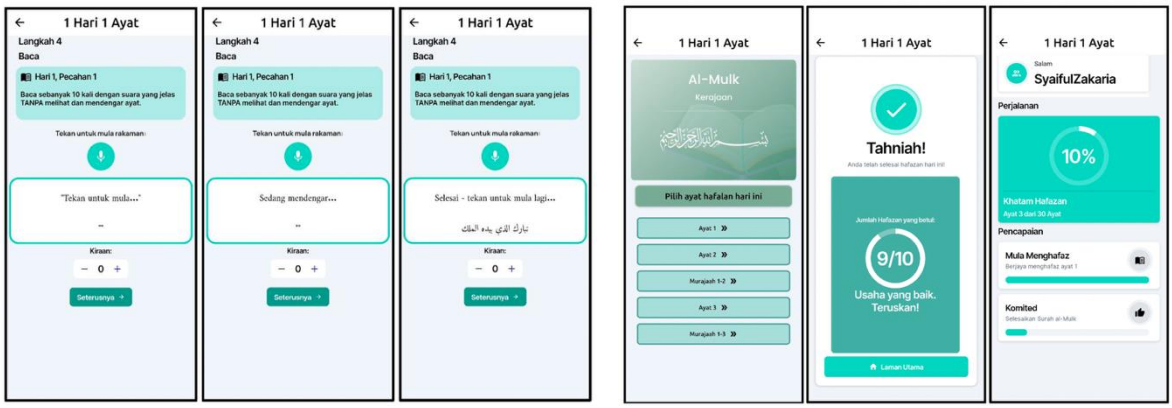
Figure 1: Conceptual framework



(a) Login page and user profiling



(b) *Tasalsuli, Tasmi'* and *VARK* element



(c) Speech recognition process on recited verse (d) Progress dashboard element

Figure 2: Mobile Application Prototype (a) Login page and user profiling, (b) *Tasalsuli, Tasmi'* and *VARK* element, (c) Speech recognition process on recited verse and (d) Progress dashboard element

The prototype was then evaluated using the Fuzzy Delphi Method with four experts. They completed a structured questionnaire with fourteen items rated on a five-point Likert scale. The analysis showed strong consensus on 13 out of 14 items in the framework components, indicating unified expert approval. However, the speech recognition component received significantly lower consensus, with only 50% expert agreement and concerns about recognition accuracy. In assessing the speech recognition performance, testing was conducted with four participants of varying demographics. Each participant performs 10 test runs, reciting a Quranic verse. The overall average CER and WER across all 40 test runs were 13.69% and 13.13% respectively, indicating a moderate level of recognition accuracy.

NOVELTY

The product prototype is novel as it integrates the memorisation technique and an AI mobile application using the approach of one day one verse in *Surah Al-Mulk,* which is suitable for beginners. The step-by-step guidance in the Quran memorisation technique, such as chunking, Tasalsuli and Tasmi' was embedded in the mobile application. The prototype also incorporates VARK (Visual, Aural, Read/Write & Kinesthetic) and speech recognition model to deliver multi-sensory engagement, helping learners see, hear, recite and interact with the Quranic verse.

CONCLUSION

This study developed an AI-powered mobile application prototype to support the memorisation of Surah Al-Mulk, integrating traditional Qur'an memorisation techniques with modern speech recognition technology. The prototype applied a structured one day, one verse approach and incorporated Quran memorisation methods such as chunking, *Tasalsuli*, and *Tasmi'*, and VARK-based multi-sensory engagement. It also provides step-by-step guidance for beginners. Fuzzy Delphi Method expert validation supported the framework's educational value and importance, with high consensus on most of the prototype components. The speech recognition module was found to have moderate accuracy but was recognized as an emergent property that can foster learner feedback

and autonomy. The novelty of this study is integrating traditional Quran memorisation practices with an AI Mobile application as interactive learning for beginners to memorise *Surah Al-Mulk*. The prototype highlights the potential of technology to complement, rather than replace, teacher-guided memorisation, making Quran memorisation more accessible for learners of all ages. Future work should focus on refining the speech recognition accuracy, expanding testing with larger groups of learners, and developing the prototype into a high-fidelity application for wider use.

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PST024 - ULTRASONIC POWERFLOW: A CAVITATION-DRIVEN FLOW SYSTEM FOR CELL DISRUPTION

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ABSTRACT

Ultrasound disinfection represents a significant technological advancement with potential applications across multiple domains, such as water and wastewater treatment, food processing, and industrial settings. Practically, the ultrasonic treatment was performed to minimize negative environmental impacts by producing zero by-products without the addition of any additives. Thus, this study aims to explore safer and more efficient disinfection methods that address this issue, focusing on the use of Ultrasonic PowerFlow cavitation-driven. The advanced system utilizes frequency ultrasound waves to generate microbubbles that collapse under pressure, producing high shear forces that effectively inactivate pathogenic cells. Flow cell ultrasound was fabricated as a continuous flow process and adjusted to a loop reactor operating at 30 kHz, with a variation of power increments to the system (14, 35, 50, 64 and 92 %). The evaluation performance of flow cell ultrasound based on the disruption of *Escherichia coli* wild-type cells as a model organism and kinetic disinfection analysis. By identifying optimal conditions: 60 minutes of sonication, 35% power increments, Inoculum 10^8 Colony Forming Unit (CFU)/ml and a flow rate of 55 ml/min. The present investigation adhered to a first-order kinetics model and achieved a higher inactivation rate constant of 0.0286 min^{-1} (R^2 = 0.992) for the cells as a function of time in the kinetic process. This study demonstrates that the flow cell ultrasonic reactor is a highly effective and energy-efficient method for disinfection, offering a green alternative to traditional chemical methods. Indeed, the present findings support the goals of the Green Technology Master Plan Malaysia 2017–2030 by promoting sustainable and environmentally friendly solutions in the water and wastewater technology sectors.

Keywords – Flow cell ultrasound, bacterial disruption, disinfection process, kinetic disinfection, ultrasound treatment

INTRODUCTION

Water disinfection and microbial control are crucial challenges in many industries, including water/wastewater treatment, food processing and industrial settings (Golfinopoulos et al., 2024). The conventional methods frequently depend on detrimental chemicals. The ultrasonic treatment was conducted to eliminate negative environmental impacts by generating zero by-products without the addition of any additives (Zou and

Tang, 2019). By examining the impact of irradiation throughout the treatment process, this study seeks to determine the impact of kinetic cell inactivation on the system. Thus, the **Ultrasonic PowerFlow** system addresses these limitations by leveraging the power of ultrasound cavitation to remove contaminants and inactivate cells without relying on chemical agents, making it a sustainable alternative.

OBJECTIVE

This invention develops an ultrasound-driven flow system that uses a cavitation mechanism to disinfect and inactivate the cells. It explores safer and more efficient disinfection methods and innovates to revolutionise water treatment by offering a greener, more efficient, and sustainable alternative to conventional disinfection approaches.

DESCRIPTION OF THE PROJECT

Ultrasound PowerFlow with a piezoelectric transducer was fabricated as a continuous flow process and adjusted to a continuous loop reactor (Figure 1). The specification of ultrasound operating at 30 kHz, a generator was used to provide electricity at various output levels with a variation of power increments to the system (14, 35, 50, 64 and 92 %), and 60 minutes of treatment duration. The operation of Ultrasound PowerFlow in a single input for the sample influent and a single exit for the treated sample was constructed at the unit.

The evaluation performance of **Ultrasonic PowerFlow** based on the kinetic degradation of *Escherichia coli* wild-type cells as a model organism against the irradiation effect. The kinetic inactivation impact is subjected to [ln (living *E. coli* cells after irradiation)/ (initial number of *E. coli* cells)] over the treatment time. The inactivation rate constant (k, min^{-1}) values were interpreted from the cell inactivation of ultrasonic reactor performance, together with the correlation coefficients (R^2). The kinetic degradation of *E. coli* against irradiation effect followed first-order kinetics expression with a correlation value of 0.0286 min^{-1} and R^2 = 0.992 for the linear fitting line.

The mechanism employed in cell damage inactivation via cavitation effect corresponds to numerous processes associated with energy dissipation in the irradiated region. The technical operation of an ultrasonic cylindrical curvature reactor produces numerous processes, including creating cavitation bubbles (Lei et al. 2023). These bubbles collapse, leading to a mechanism cavitation effect (Song et al. 2024), and finally, they employed the lethal impact on the model organism.

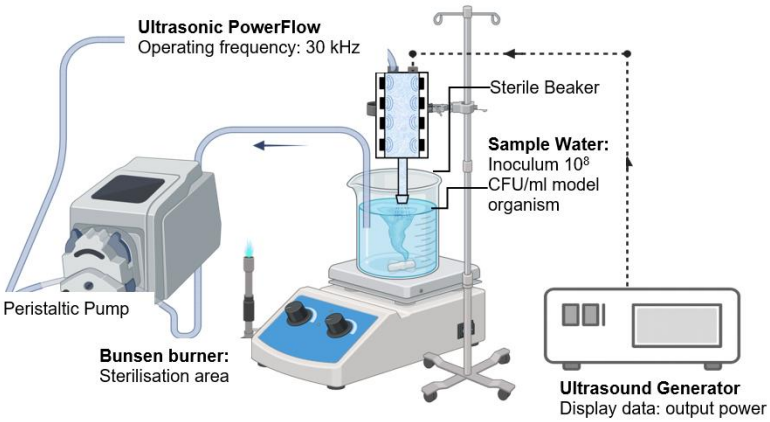

Figure 1: Schematic Diagram of Unltrasonic PowerFlow Experimental Setup

NOVELTY

The mechanical inactivation of pathogenic bacterial cells by the disinfection process employing the cavitation mechanism. The geometrical transducer curvatures of the flow cell ultrasound reactor, as equipped with multiple transducers, produce greater effects within the acoustic cavitation zone. Therefore, it demonstrates enhanced efficiency relative to the preceding ultrasound reactor.

CONCLUSION

This study demonstrates that the flow cell ultrasonic reactor is a highly effective and energy-efficient method for disinfection, offering a green alternative to traditional chemical methods. This study implemented a first-order kinetics model and discovered that the cells had a higher deactivation rate constant of 0.0286 min^{-1} and an R^2 value of 0.992. The present results contribute to the Green Technology Master Plan Malaysia 2017-2030 by encouraging sustainable and environmentally friendly solutions in the water and wastewater technology sectors.

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THEME 5

RESEARCH SYMPOSIUM (SOCIAL SCIENCE)

RSSS001 - THE EFFECTIVENESS OF HAND FOLD PACK IN PACKAGING DESIGN

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ABSTRACT

This study explores the effectiveness of the Hand Fold Pack as an assessment tool to enhance technical skills, creativity, and conceptual understanding among Diploma in Print Media Technology students at Politeknik Muadzam Shah, within the framework of Technical and Vocational Education and Training (TVET). The Hand Fold Pack was developed as a low-cost, multifunctional product that incorporates elements of design, assembly, and print finishing processes. Its uniqueness lies in providing students with a tactile, practice-based learning experience that complements digital approaches. By experimenting with folding techniques, layout arrangements, and visual design principles, students were able to strengthen both fine motor skills and creative problem-solving abilities competencies highly valued in the printing industry. The tool integrates manual skill acquisition with critical design thinking, effectively bridging the gap between practical execution and conceptual understanding. Findings from the implementation with diploma-level students revealed significant improvements in their ability to visualize, design, and produce functional printed materials. Students also reported higher levels of engagement, creativity, and confidence, noting that the hands-on approach deepened their understanding of layout, spatial organization, and product structuring. Overall, the Hand Fold Pack demonstrates strong potential as an innovative assessment tool in TVET, supporting industry-relevant skill development and preparing students for future professional practice.

Keywords – hand fold pack, printing technology, technical skills, creativity

INTRODUCTION

In the era of the Fourth Industrial Revolution, the printing industry demands a skilled and innovative workforce. Technical and Vocational Education and Training (TVET) institutions play a vital role in equipping graduates with industry-relevant competencies. As noted by Baharudin et al. (2021), TVET should emphasize experiential learning that integrates technical proficiency with critical thinking and creativity.

In the field of Printing Technology, students are required to master both theoretical knowledge of design and production as well as practical skills such as folding, layout, and print finishing. However, many institutions continue to rely heavily on theory-driven and software-based teaching methods, which may restrict students' understanding of the physical and structural aspects of printed products (Ismail et al., 2020). To bridge this gap, an innovative teaching tool, the Hand Fold Pack, was developed. This dual-function, low-cost product integrates physical assembly with visual communication design, enabling

students to apply technical skills while fostering creativity. Kolb (1984) emphasized that active, hands-on engagement enhances students' learning and reflective abilities.

Although theory-based and digital methods provide flexibility and visualization, they often fall short in cultivating the tactile skills required in printing. Studies show that students without sufficient hands-on training struggle to apply theoretical design knowledge in production contexts (Mohd Yunos et al., 2018). Moreover, current teaching tools tend to be one-dimensional, limiting instructors' ability to assess students' understanding of layout logic, folding mechanics, and print execution holistically (Aziz & Rashid, 2019). The lack of integrated learning tools also reduces student engagement. Ahmad et al. (2022) found that opportunities for physical creation significantly enhance students' motivation and creativity.

The Hand Fold Pack addresses these challenges by offering an innovative, practice-based solution that enhances teaching effectiveness, promotes active learning, and supports holistic assessment of technical, creative, and conceptual skills among Printing Technology students.

OBJECTIVES

i. To enhance students' technical skills in folding techniques, layout arrangement, and print finishing through hands-on engagement with a physical learning tool.

ii. To foster creativity and visual communication abilities by allowing students to design, construct, and evaluate their own printed products using the Hand Fold Pack.

METHODOLOGY

Research Design

This study adopted an action research design to develop and evaluate the instructional product, the Hand Fold Pack. The design enabled the researcher to implement, observe, and assess the product's impact within an authentic classroom setting. Action research is particularly suited for educational innovation as it fosters reflective practice and supports continuous improvement through iterative cycles of implementation and real-time feedback.

Product Development Phase

The Hand Fold Pack was designed as a dual-function instructional and assessment tool tailored to the learning needs of Printing Technology students. Its development integrated key aspects of print production, including layout design, folding structures, finishing techniques, and creative application. To ensure content validity and instructional relevance, the initial prototype was reviewed by two subject matter experts in print media and a senior design lecturer, who provided critical feedback on its design and pedagogical suitability.

Participants

The study involved 30 final-semester students enrolled in the Diploma in Print Media Technology program at Politeknik Muadzam Shah. All participants had previously completed courses in digital design, prepress, and production, providing them with

foundational knowledge relevant to the study. Participation was voluntary, and informed consent was obtained from all students.

Data Collection Instruments and Procedures
Pre- and post-questionnaires were administered to evaluate students' self-perceived improvements in technical skills, creativity, and conceptual understanding before and after using the Hand Fold Pack.

Data Analysis
Quantitative data from the pre- and post-questionnaires were analyzed using descriptive statistics, including mean, percentage, and standard deviation, to compare changes in students' perceptions and learning outcomes.

Implementation Timeline
The study was carried out over six weeks and was structured into the following phases:

1. Week 1: Introduction of the product and training session
2. Weeks 2–4: Hands-on implementation and product development by students
3. Week 5: Presentation and evaluation of folded product
4. Week 6: Post-assessment, interviews, and reflection

RESULTS AND DISCUSSION

The quantitative findings demonstrate that the Hand Fold Pack markedly enhanced students' learning outcomes:

Table 1: Result the pre test and post test.

Measure (5-point scale unless noted)	Pre-test *M* (SD)	Post-test *M* (SD)	*t*(29)	p	Cohen's d
Technical skill self-rating	3.05 (0.47)	4.26 (0.42)	10.78	< .001	2.45
Creativity self-rating	2.97 (0.55)	4.18 (0.48)	11.02	< .001	2.37
Concept-understanding self-rating	3.15 (0.50)	4.35 (0.45)	12.05	< .001	2.55
Product rubric (0–100)	-	86.4 (5.7)[1]	-	-	-
Engagement observation (1–5)	-	4.61 (0.32)	-	-	-

Technical mastery
A 40% mean gain in self-rated competency for folding, layout, and finishing (large effect size, d = 2.45) indicates that repeated tactile practice effectively bridged the gap between screen-based design knowledge and manual execution skills. This finding is consistent with Mohd Yunos et al. (2018), who emphasized that hands-on exposure is essential for translating theoretical knowledge into production practice.

Creativity development
Creativity scores increased by 1.21 points (large effect size, d = 2.37). Although not presented here, interview data indicated that the freedom to vary folds and graphics

fostered experimentation, supporting Ahmad et al.'s (2022) observation that project-based tasks enhance intrinsic motivation and stimulate idea generation.

Conceptual understanding
The greatest improvement (Δ = 1.20; d = 2.55) was observed in design concept comprehension, reinforcing Kolb's (1984) experiential learning premise that concrete experience, followed by reflection, enhances the development of conceptual schemas.

Product quality
A mean rubric score of 86 % confirms that most students produced structurally accurate, aesthetically cohesive folded pieces, providing external validation of the self-report gains.

Engagement
Observed engagement averaged 4.61/5, well above the programme's norm (≈3.8), suggesting that the low-cost kit captured attention better than conventional software-only labs.

CONCLUSION

The quantitative evidence demonstrates that the Hand Fold Pack is an effective and economical tool for concurrently teaching and assessing technical, creative, and conceptual skills in Printing Technology programmes, thereby advancing the experiential learning agenda within TVET.

Implications

Curriculum design.
Integrating dual-function kits such as the Hand Fold Pack offers a practical means of embedding psychomotor training into print-media courses without requiring substantial capital investment.

Assessment.
By demonstrating both process and product learning within a single artefact, the Hand Fold Pack enables instructors to gain a holistic view of students' competencies, effectively addressing the rubric-alignment concerns highlighted by Aziz and Rashid (2019).

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RSSS002 - ENHANCING CROSS-CULTURAL LEADERSHIP COMPETENCIES THROUGH EXPERIENTIAL LEARNING: A STUDY OF INDERALOKA INTERNATIONAL FESTIVAL

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ABSTRACT

As global societies become increasingly interconnected, effective leadership requires not only decision-making skills but also cultural sensitivity, adaptability, and inclusive collaboration. This study examines the impact of experiential learning on cross-cultural leadership competencies through the Inderaloka International Festival. A total of 458 students from Malaysia, Indonesia, and Japan participated in a pre- and post-festival assessment measuring self-perceived attributes including communication, teamwork, adaptability, and cultural awareness. Quantitative data were analyzed using SPSS, with results indicating statistically significant improvements across all domains. Regression analysis further demonstrated that pre-festival confidence was a strong predictor of post-festival leadership development. Complementing these findings, qualitative reflections underscored the importance of real-time multicultural collaboration in shaping leadership outcomes. Overall, the study affirms the transformative potential of experiential learning in cultivating cross-cultural leadership competencies essential for the next generation of global leaders.

Keywords – Cross-Cultural Leadership, Experiential Learning, Inderaloka

INTRODUCTION

In today's interconnected world, leadership extends beyond managing tasks or making decisions; it also requires the ability to engage across cultural boundaries with empathy, adaptability, and purpose. Cross-cultural leadership has thus become a critical competency for students preparing to enter globalized professional and community environments (Chiu et al., 2013; Goodman, 2020). While many universities integrate multicultural content into curricula, few provide immersive opportunities that allow students to actively develop these skills through practice (Mohamad et al., 2024). The Inderaloka International Festival was established to address this gap in traditional education. Conceived as a cultural and leadership immersion program, the festival brought together students from Malaysia, Indonesia, Japan, and regional partners to collaboratively plan, execute, and reflect on a large-scale international event. Participants were challenged to co-lead multicultural teams, coordinate logistics, make time-sensitive decisions, and adapt to diverse communication styles and cultural norms. Grounded in Kolb's (1984) experiential learning framework, the festival's primary aim was to use hands-on, real-world

engagement as a transformative approach to strengthen cross-cultural leadership competencies.

The motivation for the Inderaloka Festival emerged from two interrelated challenges. First, while many young leaders possess technical capabilities, they often lack exposure to intercultural environments that cultivate adaptability and emotional intelligence (Pierre, Rathee, & Rathee, 2021). Second, higher education institutions have increasingly recognized the limitations of conventional classroom-based leadership training, particularly in multicultural contexts (Bennett, 2019). To bridge this gap, the festival was designed as a real-world leadership laboratory where students could learn, reflect, and grow in a diverse and dynamic setting. This study therefore examines the extent to which participation in the Inderaloka International Festival enhanced students' self-perceived leadership and cultural competencies, drawing on both quantitative assessments and qualitative reflections.

OBJECTIVES

i. To analyze changes in leadership competencies among participants before and after the festival.
ii. To examine the relationship between pre-festival confidence and post-festival leadership development.
iii. To explore students' reflections to understand which cross-cultural leadership lessons were most impactful.

METHODOLOGY

This study adopted a quantitative research design to examine the impact of the Inderaloka International Festival on the development of cross-cultural leadership competencies among undergraduate students. Data were collected through a structured, self-administered questionnaire administered before and after the festival, enabling pre–post comparative analysis of students' perceived leadership growth. The sample comprised 458 students from higher education institutions in Malaysia, Indonesia, and Japan, representing a range of academic disciplines and levels of study. The inclusion of participants from three culturally distinct contexts enriched the analysis by capturing a wider spectrum of intercultural learning outcomes. Participation was voluntary, and all respondents completed both the pre- and post-assessment sections of the instrument. The questionnaire was organized into four major sections, as summarized in Table 1.

Table 1. Structure of the Survey Instrument

Sec	Description	No. of Items	Scale Type
A	Demographic Information	5	Categorical
B	Pre-Festival Self-Assessment	10	5-point Likert (1 = Strongly Disagree to 5 = Strongly Agree)
C	Post-Festival Reflection	12	5-point Likert
D	Open-ended Reflection Questions	3	Open response

Sections B and C were designed to evaluate core leadership competencies such as communication, decision-making, team collaboration, adaptability, cultural sensitivity, and time management. Items were developed based on prior leadership development frameworks and intercultural competency literature (Chiang, 2013; Kolb, 1984; Pierre, Rathee, & Rathee, 2021). Internal consistency of both sections was confirmed during pilot testing, with Cronbach's alpha values exceeding 0.80, indicating high reliability. The instrument was administered in two phases: the pre-festival survey was completed during participant onboarding, while the post-festival survey was conducted immediately following the completion of the festival. The surveys were distributed digitally through Google Forms, and participants used personal devices to submit their responses. Quantitative data were analyzed using IBM SPSS Statistics (Version 28). Descriptive statistics were used to summarize participant characteristics and item-level trends. A paired-sample t-test was applied to compare pre- and post-festival competency scores and assess the statistical significance of the change. To further explore the influence of initial perceptions on post-festival outcomes, a simple linear regression analysis was conducted using mean pre-festival scores as predictors for post-festival leadership development. In addition, the qualitative responses collected from open-ended questions were subjected to thematic analysis, following Braun and Clarke's (2006) six-phase approach. This enabled triangulation of data and deeper insight into the specific experiences and leadership lessons students reported as most valuable.

RESULTS AND DISCUSSION

This section presents the findings from the quantitative and qualitative analysis of the pre- and post-festival assessments. The results are discussed in relation to the study objectives, theoretical framework, and relevant literature on cross-cultural leadership and experiential learning.

Descriptive Overview of Participant Responses

A total of 458 valid responses were analyzed. While the demographic data in full were not extracted from the form output, participants represented three primary nationalities which are Malaysian, Indonesian, and Japanese with balanced gender distribution and varied academic disciplines. This diverse sample enabled the study to assess leadership development in authentically multicultural contexts, consistent with the aims of the Inderaloka International Festival.The pre-festival and post-festival items were aggregated to generate individual mean scores for each participant. Descriptive analysis indicated an upward shift in all assessed competencies following the festival.

Pre- and Post-Festival Competency Comparison

A paired-sample t-test was performed to determine whether the changes in leadership competencies were statistically significant. The results are presented in Table 2.

Table 2. Paired-Sample T-Test of Leadership Competencies

Assessment Phase	Mean Score	Standard Deviation	t-value	p-value
Pre-Festival	3.20	0.70		
Post-Festival	3.80	0.70	44.36	< 0.001

The test revealed a highly significant difference ($p < 0.001$) between pre- and post-festival mean scores, with post-festival perceptions of leadership competencies showing marked improvement. This suggests that the experiential learning embedded in the Inderaloka

Festival had a measurable and positive effect on participants' self-perceived leadership development. This outcome aligns with prior studies highlighting the transformative effect of international experiential programs on leadership and intercultural skills (Chiu et al., 2013; Pierre et al., 2021). Specifically, it reinforces Kolb's (1984) experiential learning model, which posits that learning through concrete experience, reflective observation, abstract conceptualization, and active experimentation leads to meaningful growth.

Regression Analysis: Predicting Post-Festival Competency

A simple linear regression analysis was conducted to examine whether initial confidence predicted leadership development, using the mean pre-festival score as the independent variable and the mean post-festival score as the dependent variable. The regression results are presented in Table 3.

Table 3. Linear Regression Predicting Post-Festival Leadership Score

Predictor	β Coefficient	t-value	p-value	R^2
Constant	1.54	21.56	< 0.001	
Mean Pre-Festival Score	0.70	37.47	< 0.001	0.75

The regression model was statistically significant ($p < 0.001$), accounting for 75% of the variance in post-festival scores ($R^2 = 0.75$). These results suggest that participants with higher initial confidence in their leadership abilities were more likely to demonstrate greater growth. A plausible interpretation is that such individuals tend to engage more actively and assume initiative in cross-cultural contexts, conditions regarded as critical for leadership development (Goodman, 2020).

Thematic Analysis of Qualitative Reflections

Thematic analysis of over 300 participant reflections identified five key leadership themes developed through the festival experience:

i. **Adaptability:** Participants highlighted the need to remain calm and flexible when managing unexpected changes and logistical challenges.
ii. **Communication:** Many reported improved skills in articulating ideas clearly and resolving misunderstandings across language and cultural barriers.
iii. **Cultural Sensitivity:** Respondents gained greater appreciation for diverse values, traditions, and social norms, fostering empathy and global awareness.
iv. **Teamwork:** Cross-cultural collaboration emphasized the importance of inclusivity, mutual respect, and shared responsibility.
v. **Confidence:** The festival environment encouraged students to lead proactively, take initiative, and engage outside their comfort zones.

These emergent themes reinforce the value of experiential learning in cultivating intercultural leadership, consistent with prior research (Bennett, 2019; Deardorff, 2006) and Kolb's (1984) experiential learning cycle. They also validate the role of reflection in transforming experience into leadership insight.

CONCLUSION

This study examined the impact of the Inderaloka International Festival on students' cross-cultural leadership development through an experiential learning approach. The findings revealed a significant improvement in participants' self-perceived leadership

competencies, particularly in areas such as communication, adaptability, and cultural sensitivity. The combination of quantitative and qualitative data suggests that real-life multicultural engagement can effectively strengthen leadership confidence and intercultural awareness. Overall, the festival served not only as a cultural exchange platform but also as a practical training ground for emerging leaders in a global context. These results highlight the importance of integrating experiential and international learning opportunities into higher education to prepare students for leadership in diverse and dynamic environments.

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RSSS003 – STUDENT AND SUBJECT TEACHER ATTITUDE FACTORS CONTRIBUTING TO TRUANCY AMONG STUDENTS: A CASE STUDY

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ABSTRACT

School truancy is one of the issues currently being discussed within society. This study is a case study conducted at a daily secondary school in the Kuala Muda District, Sungai Petani, Kedah. It explores the influence of student's and subject teacher's attitudes as contributing factors to truancy at SMK Sungai Pasir Kechil, Sungai Petani, Kedah. The study involved 35 out of 100 Form Five students who were enrolled in the Economics subject for the year 2025. A quantitative research method was employed in this study. The data were analysed using descriptive statistics, specifically mean scores, with the assistance of E-Views software Version 20.00. The findings revealed that the overall mean score for student attitude factors was at a moderate level (mean = 3.58), while the mean score for teacher-related factors was high (mean = 4.25). Furthermore, the role of subject teachers in contributing to truancy also showed a high mean score of 3.73. Additionally, the findings indicated that teachers did not utilise teaching aids (ABM) and instructional materials (BBM) in line with 21st Century Education (PAK-21), with a high mean score of 4.45. This suggests that teacher-related factors significantly impact school truancy. In conclusion, both parents and teachers must work together to address and reduce truancy among students.

Keywords – Student attitude and teacher attitude, School truancy

INTRODUCTION

Truancy has increasingly emerged as a significant behavioral and disciplinary issue within the education system. Azizi Yahya et al. (2007) define truancy as absenteeism from school without valid justification over a specified period. Between 1994 and 2023, the incidence of truancy among Malaysian students has escalated, becoming a more pressing concern. Data from the Ministry of Education Malaysia (2018) indicate a steady rise in truancy cases, particularly within secondary schools. The problem is most prevalent among students aged 14 to 16, with male students contributing disproportionately compared to their female counterparts. Wee Ka Siong classifies truancy as a serious form of misconduct, comparable to fighting and bullying. This perspective aligns with Johari et al. (2010) and Arsathamby et al. (2014), both of whom identify truancy as a major social issue

in Malaysian education. Similarly, Yahya B. Buntat et al. (2010) describe it as absenteeism without reasonable justification. Multiple factors underpin truancy among secondary school students, including family circumstances, peer influence, student–teacher conflicts, and environmental conditions. Nevertheless, research consistently highlights family-related and school-related issues as the dominant determinants.

PROBLEM STATEMENT

Research indicates that multiple factors contribute to student truancy, with parental and teacher-related influences being particularly significant. This study seeks to identify the factors associated with truancy among Form 5 students. Evidence suggests that truancy is more prevalent among students from rural areas, where challenges related to living conditions, socio-economic background, and peer interactions are more pronounced. Patterson (1996) emphasized that negative attitudes and destructive family environments are unlikely to improve without intervention from responsible parties. Parental influence is often highlighted as a major determinant. Parents who are preoccupied with work or material pursuits may have limited time to engage with their children, thereby weakening parental supervision and emotional support. Such conditions can foster disengagement and contribute to truancy. At the same time, school-related factors also play an important role. Conflicts between students and teachers, particularly when disciplinary actions are perceived as unfair or excessively punitive, may intensify student resentment and encourage absenteeism. Thus, while parental factors are central to the issue of truancy, teacher-related dynamics within the school environment likewise exert considerable influence, suggesting that truancy results from the interaction of both family and school contexts rather than a single contributing factor.

OBJECTIVES

Specifically, the objectives of this study are as follows:

a) General Objective

To analyze parental and teacher-related factors contributing to the truancy problem at SMK Sungai Pasir Kechil, Sungai Petani, Kedah.

b) Specific Objectives

i. To identify and explain the parental factors contributing to the truancy problem at SMK Sungai Pasir Kechil, Sungai Petani, Kedah.
ii. To identify and explain the teacher related factors contributing to the truancy problem at SMK Sungai Pasir Kechil, Sungai Petani, Kedah.

METHODOLOGY

Research Methodology

Population of the Study

The population of this study comprised Form 5 students in the year 2025 at Sekolah Menengah Kebangsaan Sungai Pasir Kechil, Sungai Petani, Kedah (SMKSPK). This school was selected due to its notably high truancy rate, recorded at over 60 percent according to the *Aplikasi Pangkalan Data Murid (APDM, 2025)*. The selection of this population was therefore appropriate, as it provided a relevant context in which to examine the factors influencing truancy.

Sample of the Study

According to Mohd Najib (1999), the determination of sample size is crucial as it affects the reliability and generalizability of research findings. In this study, a cluster random sampling technique was employed, focusing specifically on Form 5 students at SMKSPK. This approach was chosen to ensure that the sample would represent the wider student population while minimizing selection bias. From a total of 184 Form 5 students, 100 were randomly selected, a number considered sufficient to provide meaningful insights while remaining manageable for data collection and analysis.

Research Instrument

Data were collected using a structured questionnaire, which served as the primary research instrument. Questionnaires are widely used in survey-based research because they enable systematic collection of data from a relatively large number of respondents within a limited timeframe. Furthermore, standardized questions facilitate the measurement of attitudes and perceptions while enhancing the validity and reliability of the findings. The use of this instrument was therefore considered suitable for addressing the objectives of the study.

RESEARCH FINDINGS

Are parents the cause of truancy?

Table 3 shows the mean scores for parental factors. The overall mean score for parental factors is at a moderate level, with a mean of 3.58. The lowest mean score was 2.65, indicating that respondents felt their parents did not show much concern towards them. The highest mean score was 4.25 for the item stating that parents allowed them to go out with friends.

Table 3: Mean Score for Parental Factors

Variable	Sub-variable	Score	Overall Mean Score
Parents	Parents allow me to go out with friends	4.25	
	Parents are always busy with work	3.80	
	Parents spend little time with children	4.02	
	Parents provide phones and allow internet/gaming at home	3.20	
	Parents show little concern about me	2.65	**Mean = 3.58**

Are subject teachers' attitudes the cause of truancy?

Table 4 shows the mean scores for teacher-related factors. The overall mean score is at a high level, with a mean of 3.73. The lowest mean score was 3.20, indicating that respondents felt subject teachers did not provide motivation or praise. The highest mean score was 4.45 for the item stating that teachers did not use teaching aids aligned with 21st Century Learning (PAK-21).

Table 4: Mean Score for Teacher-Related Factors

Variable	Sub-variable	Score	Overall Mean Score
Teachers	Subject teachers do not provide motivation and praise	3.20	
	Teachers do not use topical modules in lessons	3.76	
	Teachers ask students to copy notes from textbooks	3.89	
	Teachers show favoritism among students	3.36	
	Teachers do not use teaching aids aligned with PAK-21	4.45	
	Teachers assign excessive homework	4.23	
	Teachers poorly manage the class during teaching and learning (PdPc)	3.25	**Mean = 3.73**

DISCUSSION

The research findings indicate that most respondents come from rural areas, where they lack the freedom to go into nearby towns. Among parental factors, the most influential variable encouraging truancy was the permission given by parents to go out with friends. This view is supported by Norazah et al. (2018) and Azizi Yahaya et al. (2021). Regarding teacher-related factors, the highest mean score (4.45) was for the variable where teachers did not use teaching aids in line with 21st Century Learning (PAK-21). This shows that subject teachers are a significant factor contributing to student truancy, as they often fail to create engaging and enjoyable classroom activities.

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NEGERI SEMBILAN INTERNATIONAL EXPOSITION

RSSS004 - FUNCsiFlex: AN INNOVATIVE DIGITAL FRAMEWORK FOR ENHANCING FUNCTIONAL WORKFLOW EFFICIENCY IN HIGHER EDUCATION

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ABSTRACT

FUNCsiFlex, initiated by the Innovative and Creative Group (KIK) from Faculty of Administrative Science and Policy Studies (FSPPP), aims to revamp the Faculty's Quality Manual by introducing a digital and function-based structure. The manual had previously faced challenges such as outdated content, poor accessibility, and lack of clarity in procedures. Leveraging internal expertise, the new approach embeds a functional process flow that reflects real tasks across five core management areas. This innovation enhances documentation transparency, staff understanding, and procedural compliance. The initiative contributes to institutional governance excellence and boosts audit performance, with significant potential for replication and commercialization across faculties and other higher learning institutions.

Keywords – Quality Management System, Functional Documentation, Administrative Innovation

INTRODUCTION

Quality Manual is part and parcel of quality management system in an organisation. It serves as a pivotal guideline used by all departments to arrange and systematically coordinate policies, objectives and standard operating procedures, across all levels. There were several key issues had been identified in Laporan Audit Luar iQMS 2023 (FSPPP) regarding its documentation management, such as the manual's content not being updated regularly, information that is difficult to understand, and the absence of a centralized access platform. These issues have also impacted compliance with work procedures, uniformity in practices, and work redundancies, which in turn affect the efficiency and effectiveness of the service delivery system (Universiti Teknologi Malaysia, 1999; Amran et al., 2013; Mohd Hasan Al-Banna et al., 2016). Hence, this project is introduced to improve the faculty's documentation management and as to support the digital initiative in tertiary education administration for enhancing accountability and efficiency, besides being relevant throughout the time (KPT, 2021).

Quality Manual is part and parcel of the quality management system in an organisation. It serves as a pivotal guideline used by all departments to arrange and systematically coordinate policies, objectives, and standard operating procedures across all levels. Several key issues were identified in Laporan Audit Luar iQMS 2023 (FSPPP) regarding documentation management, such as outdated content, information that is difficult to understand, and the absence of a centralized access platform. These issues have impacted compliance with work procedures, uniformity in practices, and work redundancies, which in turn affect the efficiency and effectiveness of the service delivery system.

To address these challenges, this project introduces FUNCsiFlex, a dynamic and digitally integrated documentation system tailored for the Faculty of Administrative Science and Policy Studies (FSPPP). FUNCsiFlex is built upon a functional chart framework that maps out core operational domains: Management and Administration, Academic Affairs, Student Affairs (HEP), Research and Alumni, and Quality Management. It consolidates key documents, standard operating procedures, and workflow references into a centralized, user-friendly platform that is easily accessible and regularly updated. By streamlining documentation and enhancing clarity, FUNCsiFlex supports the faculty's digital transformation agenda in tertiary education administration. It promotes accountability, operational efficiency, and long-term relevance (KPT, 2021).

OBJECTIVE

The primary objective of the FUNCsiFlex project is to develop a centralized, user-friendly, and digitally accessible documentation system that enhances the quality management practices within the Faculty of Administrative Science and Policy Studies (FSPPP). Specifically, the project aims to:

i. Reconstruct the faculty's Quality Manual based on functional charts and actual work processes across five core domains: Management and Administration, Academic Affairs, Student Affairs (HEP), Research and Alumni, and Quality Management.
ii. Ensure the documentation is systematically structured, regularly updated, and easily accessible to all stakeholders.
iii. Improve staff understanding and compliance with standard operating procedures, thereby reducing redundancy and enhancing service delivery.
iv. Support UiTM's strategic goals in quality assurance, governance, and digital transformation in higher education administration.

METHODOLOGY

The FUNCsiFlex project adopts a structured and collaborative methodology based on the PDCA (Plan–Do–Check–Act) cycle, supported by functional analysis and stakeholder engagement:

Table1: PDCA of FUNCsiFlex

Phase	Key Activities
Plan (Nov–Dec 2024)	Identified outdated/inaccessible documents, did needs analysis, set objectives, planned functional chart restructure.
Do (Jan–Apr 2025)	Held workshop with InQA experts, developed unit-based functional charts, reviewed & endorsed drafts.
Check (May–Jun 2025)	Conducted internal reviews & compliance checks, gathered staff feedback, incorporated external audit input.
Act (Jul–Aug 2025)	Uploaded finalized charts to website, launched new Quality Manual, set continuous improvement plans.

This methodology ensures that the product is not only technically sound but also contextually relevant, inclusive, and sustainable for long-term use.

RESULTS AND DISCUSSION

The FUNCsiFlex project has successfully addressed critical documentation challenges within FSPPP by introducing a centralized, structured, and digitally accessible Quality Manual. The results are based on pre- and post-implementation surveys, stakeholder feedback, and audit evaluations.

The survey results show marked improvements following the implementation of FUNCsiFlex. Staff understanding of SOPs increased from 52% to 91%, representing a 39% improvement. Accessibility of documents rose significantly from 48% to 94%, an improvement of 46%. Compliance with work procedures improved from 55% to 89% (+34%), while satisfaction with documentation increased from 50% to 92% (+42%). Additionally, the audit score for the documentation section improved from 68% to 95%, reflecting a 27% increase.

Key Features and Advantages of FUNCsiFlex

FUNCsiFlex is the first digital Quality Manual in UiTM structured using functional charts. The system is designed to be user-friendly, with easy navigation and access via the faculty website. Its content is customised according to the actual roles and responsibilities of each unit, reducing redundancy and improving clarity in task execution. FUNCsiFlex fully complies with ISO 9001:2015 and UiTM's quality assurance standards, aligning with initiatives for digital transformation and operational efficiency.

Benefits to Stakeholders

The implementation of FUNCsiFlex delivers significant benefits to various stakeholders. For staff, it provides clearer task references, reduces confusion, and improves compliance (estimated improvement: 85%). The faculty benefits from enhanced governance, better audit performance, and more streamlined operations (80%). At the university level, the system supports strategic goals in quality assurance and digital transformation (75%). Students benefit from improved service delivery and academic support systems (70%), while the community gains from strengthened institutional credibility and public trust (65%). Nationally, FUNCsiFlex contributes to higher education reform and administrative excellence (60%).

Potential for Commercialization

FUNCsiFlex holds strong potential for commercialization through various avenues. It can be replicated across faculties within UiTM as well as in other public universities. The system also offers opportunities for the development of training modules and micro-credential courses on quality documentation and governance. Additionally, consultation services can be provided to institutions seeking to digitize and restructure their documentation systems. Furthermore, FUNCsiFlex can be integrated into national quality platforms such as e-QA or iCEPS for broader institutional adoption.

CONCLUSION

The FUNCsiFlex project marks a significant milestone in enhancing documentation governance and quality assurance within the Faculty of Administrative Science and Policy Studies (FSPPP). By restructuring the Quality Manual based on functional charts and actual work processes, the project has successfully addressed longstanding issues of outdated content, limited accessibility, and lack of clarity in procedural references.

The implementation of FUNCsiFlex has led to measurable improvements in staff understanding, compliance, and operational efficiency, as evidenced by pre and post survey results and audit evaluations. The product's novelty lies in its integration of digital accessibility, functional alignment, and user-centric design, making it a pioneering model within UiTM.

Beyond internal benefits, FUNCsiFlex contributes positively to the faculty, university, and broader community by promoting a culture of quality, transparency, and strategic alignment. Its potential for replication, commercialization, and integration into national platforms further underscores its value as a scalable innovation in higher education administration.

In essence, FUNCsiFlex is not merely a documentation tool. It is a transformative framework that empowers institutional excellence, supports continuous improvement, and strengthens stakeholder confidence in the faculty's governance and service delivery.

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RSSS005 - THE INFLUENCE OF SOCIAL MEDIA ON BUILDING BRAND EQUITY AMONG SME IN MALAYSIA

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ABSTRACT

In the contemporary business landscape, social media has emerged as a pivotal driver of brand equity, particularly for Small and Medium Enterprises (SMEs) in Malaysia. This study investigates the influence of various aspects of social media usage - surveillance, social interaction, information sharing, remuneration, and entertainment content on brand equity, and examines the subsequent impact of brand equity on purchase intention. A quantitative, cross-sectional survey was conducted with 138 SME owners and managers across diverse industries in Malaysia. Data were analysed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to assess both measurement and structural models. The study addresses a critical research gap by integrating multiple dimensions of social media usage within a single framework and testing the mediating role of brand equity. The findings are expected to provide empirical evidence on how targeted social media strategies can strengthen brand equity and drive consumer purchase decisions. By bridging the gap between theory and practice, this research offers actionable insights for SME practitioners to optimise their digital marketing efforts and for policymakers to design supportive interventions that enhance SME competitiveness in the digital economy.

Keywords – Social Media Usage, Brand Equity, Purchase Intention, SMEs, Digital Marketing

INTRODUCTION

The rapid evolution of digital technologies has transformed the way businesses interact with consumers, with social media emerging as a powerful platform for communication, engagement, and brand building. In Malaysia, SMEs represent the backbone of the economy, contributing significantly to GDP and employment. However, SMEs often face challenges in establishing and maintaining strong brand equity due to limited marketing budgets and resources.

Social media platforms such as Facebook, Instagram, and TikTok have opened new opportunities for SMEs to enhance their visibility, engage with customers, and differentiate themselves in competitive markets. Despite the increasing adoption of social media marketing, there is a need to understand the specific mechanisms by which different aspects of social media usage influence brand equity and, subsequently, purchase intention.

Recent empirical studies in Malaysia highlight the significance of entertainment and interactive strategies in driving consumer engagement and purchase intention. For instance, Syaharizad, Nor Azrin, and Azilahwati (2023) found that perceived enjoyment and ease of use on social media positively affect SME brand equity. Similarly, Ho, Zakaria, and Foo (2024) demonstrated that entertainment, interaction, and electronic word-of-mouth significantly influence purchase intention in the Malaysian property industry. These findings underscore the importance of validating how such mechanisms operate specifically within Malaysia's SME context.

This study addresses this gap by empirically investigating the influence of surveillance activities, social interaction, information sharing, remuneration, and entertainment content on brand equity, and further analysing the mediating role of brand equity in the relationship between social media usage and purchase intention. The study aims to provide both theoretical contributions to marketing literature and practical recommendations for SME brand management strategies in the digital era.

OBJECTIVE

The overarching objective of this study is to investigate the role of social media usage in building brand equity and its subsequent effect on purchase intention among SMEs in Malaysia. The specific objectives are:

i. To assess the contribution of surveillance activities on social media to brand equity formation among SMEs in Malaysia.
ii. To explore how social interaction and engagement strategies on social media affect brand equity among SMEs in Malaysia.
iii. To examine the impact of information sharing through social media on brand equity among SMEs in Malaysia.
iv. To investigate the role of remuneration, such as incentives or rewards, in enhancing brand equity through social media for SMEs in Malaysia.
v. To evaluate the influence of entertainment content on social media platforms on brand equity among SMEs in Malaysia.
vi. To analyze the relationship between brand equity and purchase intention among consumers of SMEs in Malaysia.
vii. To assess the mediating role of brand equity in the relationship between social media usage and purchase intention among SMEs in Malaysia.

DESCRIPTION OF THE PROJECT

This project investigates how social media usage contributes to building brand equity and, in turn, influences purchase intention among Small and Medium Enterprises (SMEs) in Malaysia. The study focuses on five key dimensions of social media usage: surveillance, social interaction, information sharing, remuneration, and entertainment. Each dimension captures a unique feature of how SMEs engage with consumers in the digital space.

Features and Functionality

The framework developed in this project integrates these five dimensions into a single model, with brand equity as the mediator and purchase intention as the outcome. The model was tested using quantitative data collected from 138 SMEs across various sectors

in Malaysia. Purposive sampling was used, targeting SME owners and managers across sectors. A total of 210 invitations were distributed, yielding 138 valid responses (65.7% response rate). Reliability and validity were confirmed (Cronbach's Alpha & CR > 0.70; AVE > 0.50), ensuring robustness in measurement quality. SmartPLS software was used to perform Partial Least Squares Structural Equation Modelling (PLS-SEM), ensuring rigorous analysis through reliability, validity, and mediation testing.

Usefulness

The results demonstrate that social media is not merely a promotional tool but a strategic mechanism for brand building. In particular, entertaining and interactive content emerged as the strongest drivers of brand equity, highlighting the importance of creative engagement in Malaysia's consumer culture. This is highly relevant for SMEs with limited budgets, as it provides cost-effective pathways to strengthen brand equity compared to traditional advertising.

Practicality.

For SME practitioners, the findings offer actionable guidance:

- Entertainment-driven content such as TikTok videos and livestreams enhances brand attractiveness.
- Two-way social interaction builds trust and loyalty with customers.
- Incentive-based strategies (e.g., discounts, vouchers, loyalty rewards) are particularly effective in Malaysia's price-sensitive market.
- Market surveillance and information sharing help SMEs stay relevant, transparent, and responsive to customer needs.

Ethical Considerations

All responses were collected anonymously, and confidentiality was assured. Participation was voluntary, and no sensitive personal data were collected. Ethical approval was deemed not required for this minimal-risk survey.

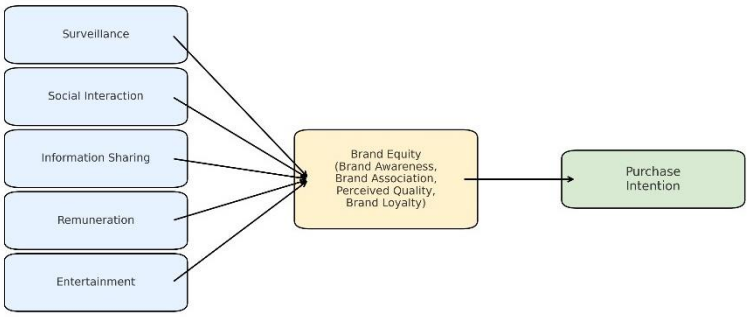

Figure 1: Illustrates the conceptual framework tested in this project.

NOVELTY

This study introduces several novel contributions:

- **Integration of dimensions** - Unlike previous studies that examined single factors, this research integrates five dimensions of social media usage into a unified framework.
- **Cultural insight** - The study demonstrates that in Malaysia's emerging market context, entertainment-driven content is the most powerful driver of brand equity.

- **Role of remuneration** - While often insignificant in developed markets, this study reveals remuneration is still effective in Malaysia, highlighting contextual differences in consumer behaviour.
- **Mediating mechanism** - The confirmation that brand equity fully mediates the relationship between social media usage and purchase intention strengthens theoretical understanding of how digital engagement translates into consumer behaviour.

To the best of our knowledge, this is one of the first empirical studies to holistically integrate these five social media dimensions and test their collective impact on SME brand equity in Malaysia.

CONCLUSION

This study confirms that social media usage significantly influences brand equity, which in turn drives purchase intention among SMEs in Malaysia. Entertainment and relational engagement emerged as key predictors, reflecting cultural preferences for interactive and visually engaging content. The findings underscore that social media activities do not directly translate into purchases; rather, they first build brand equity, which subsequently drives consumer behaviour.

For theory, the study enriches brand equity literature by integrating multiple digital engagement dimensions and validating brand equity's mediating role. For practice, it provides SMEs with evidence-based strategies to build stronger brands using cost-effective digital marketing.

Future research should consider larger samples, longitudinal designs, and cross-country comparisons to expand on these findings within the ASEAN context. These insights provide a foundation for future comparative studies within ASEAN, supporting both academic discourse and policy design for SME competitiveness in the digital economy.

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RSSS006 - WISE MENTOR OF HISTORY

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ABSTRACT

This study was conducted to help students remember historical facts through the History Wise Mentor Technique. The technique was introduced as an alternative to attract students' interest in History, a subject often considered boring due to the need to memorize many facts. Using tools such as cards, short notes, question cards, and digital applications, historical information is transformed into simple notes and engaging visuals. Findings show a significant improvement – from students answering only at least 4 out of 10 questions in the pre-test to 90% of students successfully answering well after applying this technique. It not only enhances memory of historical facts but can also be applied to other subjects. This technique serves as an effective teaching aid for both teachers and students, contributing to improved academic performance.

Keywords: History Wise Mentor Technique, history fact remembering method, student performance improvement

INTRODUCTION

History is often perceived by students as a less interesting subject due to the large amount of facts that must be memorized. Many students struggle to recall these facts, which affects their academic performance in both internal and external examinations. Observations and pre-tests revealed that most students could only answer about four out of ten history questions correctly. This problem highlighted the need for a more engaging and effective learning approach. The History Wise Mentor Technique was developed as an alternative teaching strategy to address this challenge. It offers a creative, student-friendly method to help learners remember historical facts through visually appealing notes, cards, and digital tools, making the learning process more interactive and less stressful.

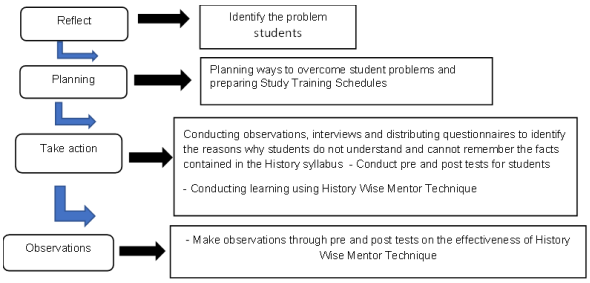
OBJECTIVE

The main objectives of developing the History Wise Mentor Technique are:

i. To help students remember historical facts more effectively.
ii. To make learning history more interesting and enjoyable for students.
iii. To improve students' performance in history examinations.
iv. To provide teachers with an alternative teaching aid that aligns with students' learning styles.

METHODOLOGY

The development of the History Wise Mentor Technique began with identifying students' difficulties in memorizing historical facts. A pre-test was conducted to assess their baseline knowledge, revealing low accuracy rates. The technique was then introduced using a variety of materials such as topic-based fact cards, short notes, question cards, and digital applications. Students actively participated in creating their own visual learning aids, translating facts into simplified notes and illustrations. The approach emphasized short, focused learning sessions that matched students' moods and attention spans. After a period of guided practice, a post-test was conducted to measure improvement. The results showed that 90% of the students could correctly answer the training questions, indicating significant improvement in fact retention and understanding.



Action 1: Reflect
The researcher has reflected on the teaching and learning of the SVM 2ETE1 KVBP class. When the researcher reviewed the exercises given to the students, he found that almost all the students in the class did not answer the exercises given well. This clearly shows that the students did not pay attention at all by not reviewing the subtopic titles taught in class. The researcher has discussed with the students and they have stated that they cannot recall the facts that have been learned. Although the researcher and other History teachers have made thorough preparations in the Pdp such as explaining sentences that are easy to understand, making mind map notes on the board and so on. The main problem of the students is to remember the facts in the subtopics that are taught. When they cannot remember the facts from the topics that have been studied previously, the topics for the next one also cause them to be uninterested in learning. The main problem that can be detected until calling the researcher to do this study is the problem of students remembering the facts of the History topic. When students cannot remember the facts of History, it leads to the problem of boredom and not being interested in learning History. This is coupled with the fact that students have to remember many historical facts that are included in the syllabus. In addition, these students do not like to read textbooks, which further complicates the problem of remembering historical facts.

Action 2: Planning
The researcher conducted the study according to the prepared schedule. If unexpected problems occur, the time and date can be changed according to the needs and current circumstance.

Action 3: Take action
This study was conducted focusing on the problem of students' failure to remember History facts. If students cannot remember History facts well, it has a negative impact on the achievement of History exam scores. In connection with this problem, an initiative has been made to help students easily remember History facts through History Wise Mentor

Technique. The development of the History Wise Mentor Technique began with identifying students' difficulties in memorizing historical facts.. This has become a catalyst in P&P (Ehwan Supangat 2005). The concept of learning using the internet is also not new, in fact, the Malaysian government since 1997 has launched the Malaysian Smart School (The Malaysian Smart School, 1997) in line with the Multimedia Super Corridor (MSC) idea. This is coupled with the "chalk and talk" method needing to be replaced with a more dynamic and creative method, in line with 21st Century Education.

Table 1: Steps for Using The History Wise Mentor Technique

Step 1	Students are given a topic as found in the textbook
Step 2	Students are given in-depth explanations by the teacher based on the facts contained in the textbook.
Step 3	After the teacher has finished explaining, students are asked to reread the discussion of the topic through the textbook.
Step 4	• Identifying Mentors & Mentees Teachers identify students who excel or have good mastery of a certain topic to act as smart mentors. Other students, especially those at average or weak levels, become mentees. Selection can be based on test results, teacher observation, or diagnostic activities. • Briefing & Explanation of the Technique Teachers explain the learning objectives, the role of mentors, and the role of mentees. Mentors are guided on how to assist without dominating, focusing more on facilitation. • Forming Small Groups Students are divided into small groups (2–5 members) according to specific history topics or themes. Each group is assigned one smart mentor. • Collaborative Learning Activities Smart mentors guide group discussions, answer questions, and help organize historical facts. Methods such as i-Think maps, history quizzes, KBAT (Higher-Order Thinking Skills) drills, role plays, or document analysis are applied to strengthen understanding. The teacher acts as a facilitator and ensures active participation in all groups. • Presentation / Sharing Session Each group presents their discussion results, such as event chronology, factors of historical events, or analysis of figures. The mentor may present or allow mentees to present to build confidence.

Step 5	Reflection & Assessment The teacher summarizes the main points based on students' work. Mentors and mentees make brief reflections on what they have learned and achieved. Assessment can be conducted through short quizzes, Q&A sessions, or exit tickets. Recognition of Smart Mentors Teachers provide recognition such as praise, small certificates, or merit points to smart mentors to boost motivation.

CONCLUSION

This 25-day study revealed several strengths and weaknesses. Among the strengths, the researcher gained new knowledge, useful scientific resources, and improved pedagogical skills. The use of the History Mentor Technique made topic explanation easier, enhanced student idea generation, encouraged collaborative learning, and helped organize students' thinking. Teachers became more confident in delivering lessons, while students were more active, remembered facts faster, and felt confident in answering questions. This technique is student-centered, aligns with 21st-century learning, saves cost and preparation time, and strengthens interpersonal skills through cooperation, idea sharing, and a fun learning atmosphere.

However, the weaknesses identified include the short duration of the study and device-related issues that disrupted student presentations. The researcher recognizes the need for alternative solutions to these challenges, with the belief that every problem has its solution.

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NEGERI SEMBILAN INTERNATIONAL EXPOSITION

THEME 6

RESEARCH SYMPOSIUM (SCIENCE AND TECHNOLOGY)

NSIEX+RS 2025
NEGERI SEMBILAN INTERNATIONAL EXPOSITION

RSST001 - FACTORS AFFECTING RUBBER PRICES IN MALAYSIA

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ABSTRACT

Rubber prices in Malaysia fluctuate significantly due to a range of factors. This research investigates how both external market conditions and environmental variables influence these price changes. In particular, this study examines the impact of rubber exports, crude oil prices, exchange rates, temperature, and rubber planted area. Excel and Minitab were used to analysed secondary data collected from 1990 to 2022 using time series regression. The results indicate that crude oil prices and rubber exports significantly affect rubber prices, while temperature, exchange rates, and rubber planted area exhibit weaker impacts. These findings provide valuable insights into stabilizing rubber prices and enhancing economic resilience within Malaysia's rubber industry.

Keywords – Rubber prices, crude oil, exchange rates, rubber exports, rubber planted area, temperature

INTRODUCTION

Natural rubber has become one of Malaysia's flagship commodities since its first tree plantation in the early 1900s, approximately after two decades many smallholder-owned plantations were established. Natural rubber or called as Hevea Brasiliensis scientifically has played a significant role in our economy across various sectors. Due to the COVID-19 pandemic, its role in the economy has become more prominent, especially in high-demand items such as gloves. The Department of Statistics Malaysia (2021) reported that, in October 2021, Malaysia earned around RM63.2 billion from exporting natural rubber and rubber products. This marks a 70.7% rise compared to 2020.

Issues with volatility and instability of rubber prices have been well-known problems that arise in the rubber market globally affecting farmers, manufacturers, and policymakers. Recently, Malaysian government added an increment for the Rubber Production Incentive (IPG) activation pricing level to RM3 per kilogram which was announced in Budget 2024 (Malaysia Ministry of Finance, 2024). According to Pareed *et al*. (2017), the income of the rubber tappers was influenced by the rubber price volatility in the long run, which caused difficulties in planning their economic activities. It is also hard to achieve a suitable price every year. In order to stabilize the market and ensure a good economy, it is essential to understand the factors influencing rubber prices. Therefore, this research will examine the determinant of rubber prices in Malaysia which can be categorised into external and internal influences.

This research is pivotal as it aims to investigate various factors affecting the rubber price in Malaysia, a country where natural rubber acts as the main commodity in the economy. It is also able to provide an understanding of rubber price volatility in the rubber market by identifying factors such as export, exchange rate, crude oil price, rubber planted area and temperature. For example, by understanding the relationship between crude oil price and rubber price can help both the producers and manufacturers of the rubber market to forecast the company's future loss and profit. Thus, the commodity price volatility and agriculture economic are able to enhance broader academic and practical discussions. This study fills a gap in existing literature specifically regarding the effects of external factors and environmental factors and understand how these factors interplay with the rubber price.

OBJECTIVE

The objectives of this research are to investigate the determinants that significantly affect the rubber prices.

METHODOLOGY

In this study, the secondary data collected on an annual basis from 1990 to 2022 were utilized. As previously stated, rubber price will be used as the dependent variable whereas rubber export, exchange rate, crude oil, rubber planted area and temperature acted as the independent variables.

Augmented Dickey-Fuller test

First thing that need to be considered when constructing a time series regression, is to check the stationarity of the data. Hence, the data is said to be stationary if the mean, variance and autocorrelation structure remains constant over period of time. Augmented Dickey-Fuller (ADF) test is one of the most commonly used approach used to check the model stationarity.

Multicollinearity test

Multicollinearity is a problem that occurs when two or more independent variables are highly correlated with each other. Multicollinearity existence can lead to unreliable and unstable coefficient estimates. Variance Inflation Factor (VIF) can be used to detect the presence of multicollinearity. VIF value range from 1 to 5 indicates low correlation while VIF value between 5 and 10 indicates moderate correlation. If the VIF value greater than 10, the independent variables are highly correlated.

Multiple linear regression

Time series regression was used in this research to accomplish the primary objective which is to identify whether rubber price volatility was more tolerant towards global factors or environmental factors. Exchange rate and crude oil price are the global factor whilst rubber planted area and temperature are the environmental factor. The regression model can be constructed as below:

$$RP_t = \beta_0 + \beta_1 EXP + \beta_2 EXR + \beta_3 CP + \beta_4 ACRE + \beta_5 TEMPT + \varepsilon_t$$

where *RP, EXP, EXR, CP, ACRE* and *TEMP* representing rubber price, rubber export worldwide (Billion Dollars), exchange rate (MYR/Dollar), crude oil price, rubber planted area, and mean annual temperature. The estimated coefficients are denoted as β_i, where $i = 0, 1, 2, \ldots, 5$ and ε_t is the error term.

RESULTS AND DISCUSSION

Augmented Dickey-Fuller test

The results demonstrate that all variables achieve stationarity after first differencing, as their test statistics are lower than the critical value at the 5% significance level, and the corresponding p-values are below 0.05. Hence, the rejection of the null hypothesis across all variables ensures that the data meets the requirements for time series analysis.

Multicollinearity test

The VIF value for each independent variables and variables such as rubber planted area (VIF = 6.78) and average annual Brent crude oil price (VIF = 5.81) have relatively higher VIF values, suggesting moderate multicollinearity, which may slightly inflate the standard errors of these coefficients. Currency exchange rate (VIF = 3.01) and annual mean temperature (VIF = 2.34), exhibit lower VIF values, indicating weaker multicollinearity. These results suggest that while multicollinearity exists, it is manageable and should not critically affect the interpretation of individual variable contributions.

Time series regression

$$RP_t = -12.5 + 24.62\,EXP - 32.3EXR + 3.43CP - 369ACRE + 33TEMPT + \varepsilon_t$$

Table 1: Estimated coefficient

Variables	Coefficient	t-stat	p-value
Constant	-12.5	-0.44	0.665
Rubber export	24.62	2.56	0.017
Exchange Rate (MYR/USD)	-32.3	-0.37	0.716
Crude oil price	3.43	2.04	0.052
Rubber planted area	-369	-0.65	0.521
Temperature	33	0.26	0.793

Based on the result generated from Minitab, it's shown that only crude oil price and rubber export were significant where the respective p-values were less than 10% significance level, (0.017) and (0.052). It could be interpreted that, for every 1 USD increase in the average annual Brent crude oil price, SMR20 prices increase by approximately 3.43 sen/kg, assuming all other factors remain constant. As for rubber export, for each 1 billion USD increase in rubber export value, SMR20 prices rise by approximately 24.62 sen/kg, holding other factors constant.

As for currency exchange rate, regression analysis indicates that the currency exchange rate (MYR/USD) has a coefficient of -32.3. It could be interpreted as for every 1 USD increase in the exchange rate (MYR/USD), SMR20 prices decrease by approximately 32.3 sen/kg, assuming all other factors remain constant. However, the p-value of 0.716 suggests that this relationship is statistically insignificant.

CONCLUSION

In conclusion, this study provides a significant insight into the factors influencing rubber prices in Malaysia, a key commodity in the nation's economy. The findings indicate that external factors, particularly currency exchange rate, crude oil prices and rubber exports, play pivotal roles in determining rubber prices, while environmental variables such as temperature and rubber planted area demonstrate weaker, less consistent impacts. This research contributes to broader academic and policy discussions, providing a foundation for future studies to refine and expand on the complex interrelations affecting agricultural commodity prices.

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RSST002 - FORECASTING DAILY LRT AMPANG LINE RIDERSHIP USING SARIMA MODEL

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ABSTRACT

Accurate forecasting of public transport ridership is crucial for effective urban transit planning and operations. In particular, short-term prediction of LRT ridership in Kuala Lumpur plays a pivotal role in optimizing scheduling and resource allocation. The main objective of this study is to develop a reliable statistical model for forecasting the daily ridership of the LRT Ampang line. This study employs the Seasonal Autoregressive Integrated Moving Average (SARIMA) model based on Box-Jenkins methodology to analyze daily ridership data obtained from the Malaysia Official Open Data Portal. The dataset covers the period from January 2023 to May 2025. Model identification and estimation involved stationarity checks, ACF and PACF analysis, and parameter selection using AIC and BIC. The final model selected, SARIMA$(1,1,2)(0,1,1)_7$, demonstrated strong forecasting performance with a MAPE of 9.78%. Residual analysis confirmed model adequacy through the ACF plot of residuals and the Ljung-Box test. This study concludes that SARIMA is a robust and interpretable statistical method for forecasting daily LRT ridership. It offers a structured statistical approach that contributes to improved decision-making in public transportation planning through short-term ridership forecasting.

Keywords – LRT Ridership, Box-Jenkins, SARIMA, time series analysis

INTRODUCTION

Forecasting is vital in modern urban transit planning, especially in fast-developing cities where transport demand is highly dynamic. The Light Rail Transit (LRT) system in Kuala Lumpur is among the most significant modes of public transportation, serving thousands of commuters daily. Accurate ridership forecasts are critical to ensure sufficient train frequency, avoid overcrowding, and allocate operational resources effectively. Despite the growing availability of transport data, traditional methods often fall short in capturing seasonality and autocorrelation in time series data, underscoring the need for models specifically designed to address these features.

Recent international evidence demonstrates that the Seasonal Autoregressive Integrated Moving Average (SARIMA) model remains a robust and interpretable tool for short-term ridership forecasting, particularly in contexts with clear seasonal fluctuations. For example, a study on metro passenger demand in Beijing showed that SARIMA effectively captured recurring patterns with high accuracy, making it suitable for operational planning in rail

networks (Li et al., 2021). Similarly, research in China and India confirmed that SARIMA and its hybrid variants provided reliable forecasts of subway and bus passenger flows, reinforcing its relevance as a baseline model for transport applications (Patel et al., 2025; Zhang, 2024). More recent work also demonstrated that SARIMA remains valuable when integrated into ensemble frameworks for metro ridership forecasting, further validating its effectiveness in diverse settings (Sun et al., 2020).

In Malaysia, forecasting studies on public transport ridership remain comparatively underexplored, particularly at the daily level for rail services. Earlier work on the Ampang Line applied ARIMA models with monthly data, which provided baseline insights but did not capture short-term fluctuations in passenger demand (Shitan et al., 2014). More recently, Al Nafees et al. (2024) examined Rapid Bus KL ridership using machine learning techniques and reported that Random Forest substantially outperformed ARIMA, achieving R^2 of 0.9656 and MAPE of 3.4%. While this demonstrates the growing interest in advanced approaches, daily-level ridership forecasting for Malaysia's rail systems remains scarce, and empirical evidence on the applicability of SARIMA to this context is still relatively limited. The main objective of this study is to apply the SARIMA model to develop a time series forecasting model for predicting the daily ridership of the LRT Ampang line, contributing new evidence of SARIMA's capability to generate accurate and interpretable forecasts that can support short-term operational planning and provide a methodological baseline for future comparative studies in transport demand forecasting.

METHODOLOGY

SARIMA is a time series forecasting model that accounts for seasonal and non-seasonal variations. This study used open-access secondary data on LRT Ampang ridership from the Malaysia Open Data Portal, which contained no personal or sensitive information; therefore, ethical approval was not required. The dataset covered the period from January 2023 to May 2025 and contained daily ridership records, providing sufficient observations for forecasting seasonal and short-term patterns. The dataset was divided into training and testing subsets using a 90:10 split. The general form of the SARIMA $(p,d,q)(P,D,Q)_s$ can be expressed as Equation (1):

$$\phi_P\left(B^S\right)\varphi_p\left(B\right)\nabla_S^D\nabla^d y_t = \Theta_Q\left(B^S\right)\theta_q\left(B^q\right)a_t \tag{1}$$

where $p,d,$ and q represent the non-seasonal autoregressive, differencing, and moving average orders respectively, and P,D,Q represent their seasonal counterparts with seasonality period s. To stabilize variance, the Box-Cox transformation was applied, and the Augmented Dickey-Fuller (ADF) test was conducted to confirm stationarity in the mean (Osborne, 2010) . The autocorrelation (ACF) and partial autocorrelation (PACF) plots guided the selection of model parameters. Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) was used to identify the optimal SARIMA configuration. Residual analysis and the Ljung-Box test Ljung & Box (1978) validated the model fit, with all procedures following the Box-Jenkins methodology (Box et al., 2015).

RESULTS

The time series plot in Figure 1 illustrates daily fluctuations in LRT Ampang line ridership from January 2023 to May 2025, revealing distinct seasonality and short-term variability in the data. The training dataset included data from 1st January 2023 to 3rd March 2025, while the testing dataset covered the remaining observations through the end of May 2025. Following the four stages of the Box-Jenkins methodology, model identification, parameter estimation, diagnostic checking, and forecasting, the best model selected was SARIMA(1,1,2)(0,1,1)$_7$. The model was chosen using the auto.arima function, which selected the model with the lowest AIC and BIC values. The model captured weekly seasonality and underlying ridership patterns. Figure 2 presents the diagnostic plots of residuals, where the ACF showed no significant autocorrelation. The Ljung-Box test results at lags 12, 24, and 36 produced *p*-values of 0.605, 0.658, and 0.936, respectively, greater than 0.05. This indicates that the null hypothesis of no autocorrelation could not be rejected, confirming that the residuals behave like white noise and supporting the adequacy of the selected model.

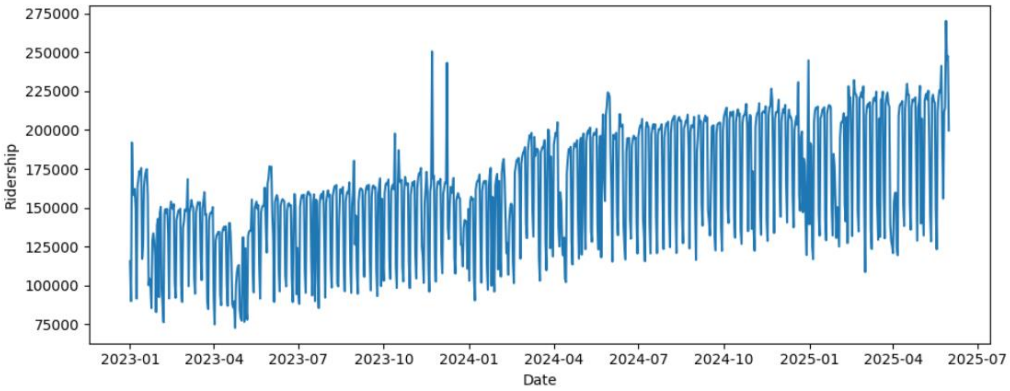

Figure 1: Daily LRT Ampang ridership trends from 1st January 2023 to 31st May 2025

Following the four stages of the Box-Jenkins methodology, model identification, parameter estimation, diagnostic checking, and forecasting, the best model selected was SARIMA(1,1,2)(0,1,1)$_7$, which captured weekly seasonality and underlying ridership patterns. Figure 2 presents the diagnostic plots of residuals. The residuals exhibited no significant autocorrelation and were approximately normally distributed, supporting the adequacy of the selected model.

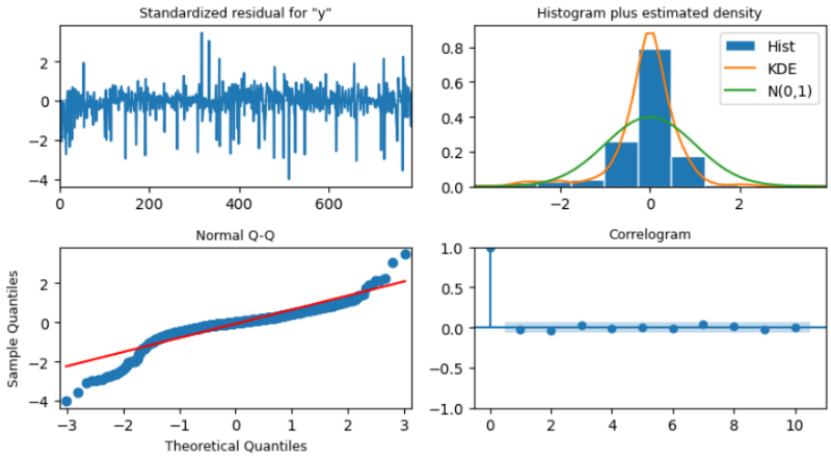

Figure 2: Diagnostic plots of the SARIMA(1,1,2)(0,1,1)$_7$ residuals

The Mean Absolute Percentage Error (MAPE) stood at 9.78%, which, according to Lewis (1982) indicates good predictive performance, as shown in Table 1. Figure 3 compares the actual ridership values with the SARIMA(1,1,2)(0,1,1)$_7$ forecasts for the testing period. The model followed the observed data trend, including the weekly fluctuations, with minimal forecast error.

Table 1: Interpretation of typical MAPE

MAPE(%)	10%	10%-20%	20%-50%	>50%
Evaluation	High accuracy prediction	Good prediction	Reasonable prediction	Inaccurate prediction

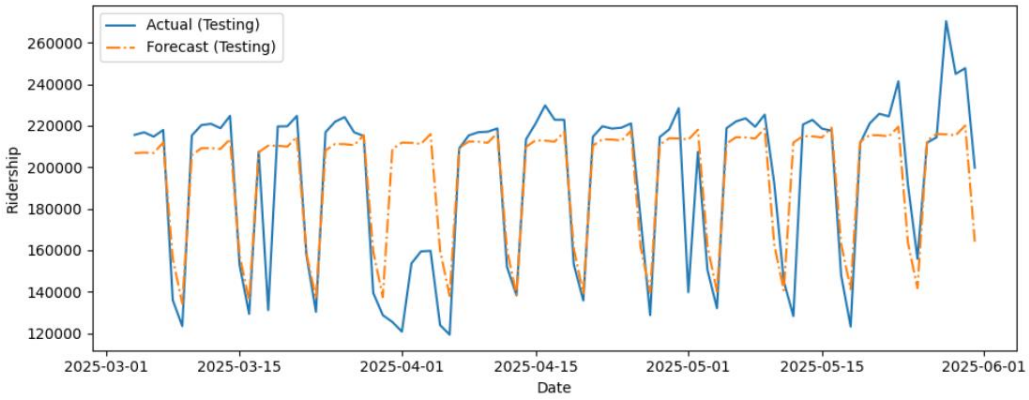

Figure 3: Actual vs forecasting plot of the SARIMA(1,1,2)(0,1,1)7

DISCUSSION AND CONCLUSION

Implementing the SARIMA model in this study demonstrates its effectiveness as a forecasting tool for public transportation systems. The model successfully captured the trend and seasonality in LRT Ampang's ridership data, making it a reliable planning and resource allocation approach. These forecasts can assist transport agencies in scheduling trains more efficiently during peak and off-peak hours, reducing overcrowding, and improving passenger flow management. Moreover, anticipating demand enables better resource allocation, such as optimizing staff deployment, maintenance scheduling, and energy usage.

SARIMA offers transparency and interpretability, essential for policy-making and operational decisions. The methodology used in this study can be extended to other urban transit systems with similar seasonal and trend-driven dynamics. Future work may consider hybrid models or incorporate external variables such as weather conditions, public holidays, and special events to improve forecasting accuracy further.

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RSST003 - UNVEILING ANTIOXIDANT PROPERTIES OF*RHODOMYRTUS TOMENTOSA* (KEMUNTING): A COMPARISON BETWEEN ITS LEAF AND FRUIT

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ABSTRACT

Rhodomyrtus tomentosa (kemunting), a native plant of Southeast Asia, has long been used in traditional medicine and is now attracting attention for its antioxidant potential. This study compared the antioxidant properties of its leaves and fruits through the determination of total phenolic content (TPC), total flavonoid content (TFC), total anthocyanin content (TAC), and antioxidant activity using DPPH and FRAP assays. The leaf extract exhibited significantly higher TPC (115.90±1.72 mg GAE/g), DPPH activity (84.10±1.43%), and FRAP value (121.96±1.42 mg TE/g), indicating stronger antioxidant capacity. In contrast, the fruit extract showed higher TFC (316.52±6.79 mg QE/g) and TAC (86.11±4.40 mg/L), reflecting its richness in flavonoids and anthocyanins. These findings highlight the distinct antioxidant profiles of kemunting leaves and fruits and emphasize the potential of this underexplored native plant for functional applications in Malaysia.

Keywords –Rhodomyrtus tomentosa (Kemunting), Antioxidant activity, DPPH, FRAP, anthocyanin

INTRODUCTION

Rhodomyrtus tomentosa (Ait.) Hassk, locally known as kemunting, belongs to the Myrtaceae family and is native to southern and Southeast Asia, including Malaysia, Sulawesi, southern China, and the Philippines (Zhao et al., 2020). Traditionally, it has been used in treating gynecopathy, heartburn, abscesses, wounds, and colic diarrhea due to its broad pharmacological applications (Lai et al., 2015). Natural antioxidants play the main role in preventing oxidative stress-related diseases by neutralizing free radicals and reactive oxygen species (Wu et al., 2015). Previous studies have confirmed that *R. tomentosa* contains significant levels of phenolics, flavonoids, and anthocyanins that contribute to its strong antioxidant properties (Cui et al., 2013; Abd Hamid et al., 2017).

OBJECTIVE

This study aimed to determine the phenolic, flavonoid, and anthocyanin contents of *Rhodomyrtus tomentosa* leaves and fruits, and to evaluate their antioxidant capacity using DPPH and FRAP assays.

METHODOLOGY

Fresh leaves and fruits of *R. tomentosa* were collected, freeze-dried, ground into fine powder, and extracted using 80% methanol. TPC was determined using the Folin–Ciocalteu method (Abd Hamid et al., 2017), TFC was measured with the aluminum chloride colorimetric method, and TAC evaluated using the pH differential method (Cui et al., 2013). Antioxidant capacity was assessed using the DPPH radical scavenging assayand the FRAP assay. Data were analyzed using independent t-tests, with results expressed as mean ± standard deviation.

RESULTS AND DISCUSSION

Total Phenolic Content (TPC)

The total phenolic content (TPC) of *Rhodomyrtus tomentosa* was determined using gallic acid standards (0–500 ppm) at 725 nm. The leaf extract showed the highest TPC (115.90±1.72 mg GAE/g) compared to the fruit extract (58.02±2.00 mg GAE/g), indicating a significant difference. This aligns with Zhao et al. (2020), who reported that the leaves generally accumulate more phenolics than fruits. Phenolic compounds play an important role in antioxidant defense by protecting plants against stressors and contributing to their strong radical scavenging activity (Idris et al., 2022; Abd Hamid et al., 2017).

Total Flavonoid Content (TFC)

The total flavonoid content (TFC) of *R. tomentosa* was determined using quercetin standards at 510 nm. The fruit extract showed significantly higher flavonoid levels (316.52±6.79 mg QE/g) compared to the leaf extract (140.96±7.80 mg QE/g). Wu et al. (2015) similarly reported that R. tomentosa berries have exceptionally high flavonoid levels, exceeding those in cranberries and other fruits.

Total Anthocyanin Content (TAC)

Fruit extracts recorded significantly higher TAC (86.11±4.40 mg C3G/100g DW) than leaves (3.06±0.35 mg C3G/100g DW). This is consistent with Cui et al. (2013), who identified cyanidin-3-O-glucoside as the dominant anthocyanin in R. tomentosa fruits.

DPPH Radical Scavenging Activity

The antioxidant capacity of *R. tomentosa* was evaluated using the DPPH assay with ascorbic acid as the standard at 517 nm. The leaf extract exhibited significantly higher radical scavenging activity (84.10±1.43%) compared to the fruit extract (58.61±1.56%), indicating stronger antioxidant potential in the leaves. This result is aligned with Idris et al. (2022), stated the potent antioxidant activity in *R. tomentosa* leaf extracts. Comparative studies of extracts with different solvent systems have also reported similar observations, indicating the role of leaves as a rich source of bioactive compounds contributing to free radical scavenging (Abd Hamid et al., 2017).

Ferric Reducing Antioxidant Power (FRAP)

The FRAP values of leaf extracts (121.96±1.42 mg TE/g) were significantly higher than those of fruits (75.79±1.90 mg TE/g), suggesting greater reducing power due to higher phenolic and flavonoid contents. These findings support previous evidence linking phytochemical content to antioxidant activity in R. tomentosa (Wu et al., 2015; Lai et al., 2015).

CONCLUSION

This study investigated the antioxidant properties of *Rhodomyrtus tomentosa* leaves and fruits using freeze-dried samples. The leaf extract showed higher total phenolic content with value 115.90±1.72 mg GAE/g, 84.10±1.43% of DPPH activity, and 121.96±1.42 mg TE/g of FRAP value indicating stronger antioxidant capacity. In contrast, the fruit extract had higher total flavonoid content and anthocyanin with value 316.52±6.79 mg QE/g and 86.11±4.40 mg C3G/100g DW, respectively. To conclude, the leaf exhibited greater antioxidant activity, while the fruit was richer in flavonoids and anthocyanins.

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RSST004 - DEVELOPMENT OF A MULTILINGUAL WEB-BASED EDUCATIONAL APPLICATION TO PROMOTE CULTURAL LITERACY THROUGH NASI DAGANG

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ABSTRACT

In an increasingly globalized education landscape, promoting cultural awareness through local culinary heritage offers an engaging pathway for cross-cultural learning. This paper presents the development of Nasi Dagang Explorer, a multilingual web-based educational application designed to introduce the traditional Malaysian dish, *Nasi Dagang*, to a diverse audience through interactive content. The innovation was inspired by the Festival Nasi Dagang event, which highlighted the lack of digital tools integrating cultural narratives with language education. The application consists of five modules: a multilingual introduction, ingredient glossary, bilingual cooking recipe, East Coast dialect phrases, and interactive games. It was developed using lightweight tools such as Streamlit, Canva Web, and JSON-based dictionaries, with audio integration and quizzes. The methodology included content curation, interface design, multilingual translation, and user testing with 30 international student participants. Results from pilot testing indicated that 90% of users agreed the application improved both cultural and language understanding. This study demonstrates the potential of food-based educational technologies to support inclusive, interactive, and culturally anchored learning experiences. It contributes to the fields of digital humanities, educational technology, and cultural studies by providing a replicable model for similar initiatives focused on traditional cuisines and languages.

Keywords – Multilingual Education, Cultural Heritage, Educational App, Nasi Dagang, Web-Based Learning

INTRODUCTION

In today's globalized higher education, cultural integration is crucial. International students often face language and social barriers, and food can act as a universal connector. Positive attitudes and social norms influence their willingness to explore local cuisines, fostering cultural identity and belonging (Hussein et al., 2024; Razalli & Shariffuddin, 2018). Food-based experiential learning has shown strong potential in promoting cultural awareness. Activities such as simulating Malay dining etiquette or using game-based pedagogy help learners appreciate culinary traditions while building unity (Razalli & Shariffuddin, 2018; Ishak et al., 2020; Kamaruzaman, 2020). Nasi Dagang, an iconic East Coast dish, embodies Malay heritage but remains underutilized in multilingual education (Ishak & Ismail, 2021).

The idea for Nasi Dagang Explorer emerged during the Festival Nasi Dagang Antarabangsa 2024 at UTeM, where multilingual cooking demonstrations drew enthusiastic participation from international attendees. This highlighted the potential of food, language, and culture as a powerful integrated learning medium (Hussein et al., 2024). The application leverages text, images, and audio in five languages to promote cultural empathy, language acquisition, and unity through food (Razalli & Shariffuddin, 2018; Ishak & Ismail, 2021; Kamaruzaman, 2020).

OBJECTIVE

The objectives of this study are as follows:

i. To develop a lightweight, multilingual learning platform based on Nasi Dagang as a cultural medium.
ii. To enhance international students' understanding of Malaysian culture through food-based content.
iii. To evaluate user engagement and learning effectiveness through interactive modules and quizzes.

METHODOLOGY

A design-based research (DBR) approach was adopted, involving three iterative phases.

Design & Development

This phase began with the creation of a modular structure consisting of five core components: (1) What is Nasi Dagang?, (2) Ingredient Glossary, (3) Recipe with Translation, (4) Learn the Lingo, and (5) Mini Game/Quiz. Each module was prototyped using lightweight tools suitable for educational deployment, including Streamlit for web interfacing and H5P for interactive elements. Multilingual support included Bahasa Melayu, English, Mandarin, Arabic, and Japanese. JSON-based dictionaries and embedded audio files enhanced language learning.

Implementation

The implementation phase involved developing a minimum viable product (MVP) that could be deployed and tested through a controlled beta session involving 30 international students. Feedback from this testing round was collected using structured questionnaires and usability testing rubrics.

Evaluation

The evaluation phase focused on user satisfaction, multilingual comprehension, and interactive engagement. Quantitative data was collected to assess the tool's usability, engagement, and learning outcomes, while qualitative data from open-ended feedback informed iterative improvements. This methodology ensured alignment with the product's educational goal and cultural outreach intent.

RESULTS AND DISCUSSION

The prototype produced a fully functional web-based application with five interactive modules: cultural introduction, ingredient glossary with pronunciation, bilingual recipe, dialect learning, and gamified quizzes.

User Testing and Engagement Metrics

User testing was conducted with a sample of thirty (30) participants, comprising international students from five linguistic backgrounds (Malay, English, Arabic, Mandarin, and Japanese). Table 1 presents user engagement feedback collected via a structured post-interaction questionnaire, adapted from the System Usability Scale (SUS) and Cultural Learning Index (CLI).

Table 1: User Evaluation Metrics for Nasi Dagang Explorer (n=30)

Evaluation Criteria	Mean Score (out of 5)	SD
Ease of Navigation	4.5	0.54
Language Accessibility	4.7	0.42
Visual Appeal	4.6	0.50
Cultural Learning Effectiveness	4.8	0.40
Overall Satisfaction	4.6	0.49

Participants reported high satisfaction, particularly for cultural learning effectiveness (M = 4.8, SD = 0.40), confirming that the multilingual and interactive design enhanced their understanding of Malaysian food heritage.

Discussion

Findings validate the feasibility of integrating cultural heritage education into digital, multilingual platforms. The tool effectively supported language learning while fostering appreciation of Malaysia's culinary traditions. Similar to recent studies in digital humanities (Zhao et al., 2022; Kamaludin & Ismail, 2023), embedding cultural elements into educational applications strengthens intercultural dialogue and identity preservation. Limitations included requests for expanding dialect modules and developing a mobile version for portability. These will be considered in future iterations.

CONCLUSION

This study introduces Nasi Dagang Explorer as a novel approach to food-based, multilingual learning that not only promotes language acquisition but also enhances cultural appreciation among international learners in Malaysia. The positive reception from user testing supports its potential for further development and institutional integration, such as in orientation programs, cultural workshops, or mobile microlearning modules. Future work will include expanding the content to other traditional dishes (e.g., Laksa, Roti Canai), improving chatbot interactivity, and conducting large-scale testing for broader validation.

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RSST005 - SUSTAINABLE TREATMENT OF AGRICULTURAL EFFLUENT USING SUGARCANE BAGASSE AND ALUMINIUM SULFATE

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ABSTRACT

Agricultural activities often lead to water pollution due to fertilizer use, which can cause eutrophication and harm ecosystems. This study aims to evaluate the effectiveness of sugarcane bagasse extract and aluminum sulfate as coagulants in treating agricultural effluent, focusing on turbidity, pH, and nitrate removal. A jar test experiment was conducted using various dosages to determine the optimum level for each coagulant. Sugarcane bagasse extract showed its best performance at 12 mg/L, removing about 42% turbidity, while aluminum sulfate achieved 100% turbidity removal at 48 mg/L. However, aluminum sulfate lowered the pH to 3.91, making it less suitable for irrigation. In contrast, sugarcane bagasse maintained a safer pH of 4.705. For nitrate removal, aluminum sulfate showed consistent and stable performance, while sugarcane bagasse results were more variable. Overall, aluminum sulfate is highly effective in removing turbidity and nitrate but may not be ideal for applications requiring a neutral pH. Sugarcane bagasse extract shows potential as a natural coagulant but requires pre-treatment to improve its performance.

Keywords – agricultural effluent, aluminium sulphate, coagulant, sugarcane bagasses

INTRODUCTION

One of the key issues contributing to water pollution is the rapid growth of the human population, which leads to increased demand for clean water, particularly in the agricultural sector (Lal & Gupta, 2009). This study focuses on agricultural effluents from paddy fields, where extensive use of fertilizers has led to water quality concerns. In many cases, untreated water from these fields is discharged directly into nearby drainage systems. As a result, fertilizer residues often pollute streams and drains, adversely affecting aquatic ecosystems and communities that depend on clean water (Norlida et al., 2021).

A common method for treating such wastewater is the coagulation-flocculation process, traditionally using chemical coagulants such as aluminium sulfate (alum). However, long-term use of aluminium-based coagulants has been associated with health concerns, including a possible link to Alzheimer's disease (Flaten, 2021). Therefore, exploring alternative, natural coagulants has become increasingly important.

This study aims to evaluate the efficiency of sugarcane bagasse and aluminium sulfate as coagulants in reducing contaminants from agricultural effluent, and to determine the optimum dosage for each. Sugarcane bagasse is a biodegradable and eco-friendly byproduct of sugar production, making it a promising alternative due to its abundance and low cost, especially in developing countries.

A series of laboratory experiments were conducted to compare the effectiveness of sugarcane bagasse extract and aluminium sulfate solution in removing water quality parameters such as turbidity, pH, chemical oxygen demand (COD), nitrate, and ammonia nitrogen. The ultimate goal is to assess the potential of sugarcane bagasse as a sustainable coagulant and to contribute to cost-effective water treatment strategies in rural agricultural communities. Previous studies by Fermino et al. (2017) and Ghebremichael (2004) support the use of natural coagulants for reducing treatment costs and improving accessibility in areas lacking adequate treated water supply.

OBJECTIVE

This study aims to investigate the effectiveness of different coagulants in treating agricultural effluent, specifically from paddy field runoff. The primary objective is to assess the efficiency of sugarcane bagasse, a natural and eco-friendly material, in reducing key water contaminants. Additionally, the study evaluates the performance of aluminium sulfate, a widely used conventional coagulant, for comparison purposes. Finally, the research seeks to determine the optimum dosage for both sugarcane bagasse and aluminium sulfate to achieve the most effective treatment outcomes in terms of contaminant removal.

METHODOLOGY

Sugarcane bagasse was collected from a local vendor in Pekan Sekinchan, Selangor, in wet condition due to its availability from the sugarcane juice extraction process. After washing with tap water, the bagasse was sun-dried for approximately 6 hours daily over four days. It was then ground and sieved through a 500-micron mesh to obtain a fine powder. To prepare the extract, 5 grams of sugarcane bagasse powder was mixed with 1 liter of distilled water, heated to 100°C for 3 minutes, and stirred for 2 hours using a magnetic stirrer. The solution was filtered using vacuum extraction and stored at 4°C. A 10 g/L aluminium sulfate solution was also prepared as a conventional chemical coagulant.

Effluent samples were collected from paddy fields in Sekinchan using a motorcycle, which was more suitable for accessing narrow field roads. A total of 6 liters of agricultural effluent was collected and stored at room temperature. Laboratory experiments were then conducted to evaluate the treatment performance of both sugarcane bagasse extract and aluminium sulfate. The Jar Test method was employed to simulate coagulation-flocculation. Samples were rapidly mixed at 200 rpm for 1 minute, followed by slow mixing at 80 rpm for 30 minutes. The mixtures were then allowed to settle for 1 hour to observe floc formation and sedimentation.

To assess the efficiency of each coagulant, several water quality parameters were analyzed. pH was tested using a pH meter and 100 mL beakers to compare untreated samples with those treated with various coagulant dosages. These tests aimed to observe

the physical and chemical changes in water quality after treatment. Further analysis included nitrate and ammonia nitrogen testing. Nitrate was measured using NitraVer3 and NitraVer6 reagent pillows, with treated samples analyzed in sample cells to evaluate nutrient pollution removal.

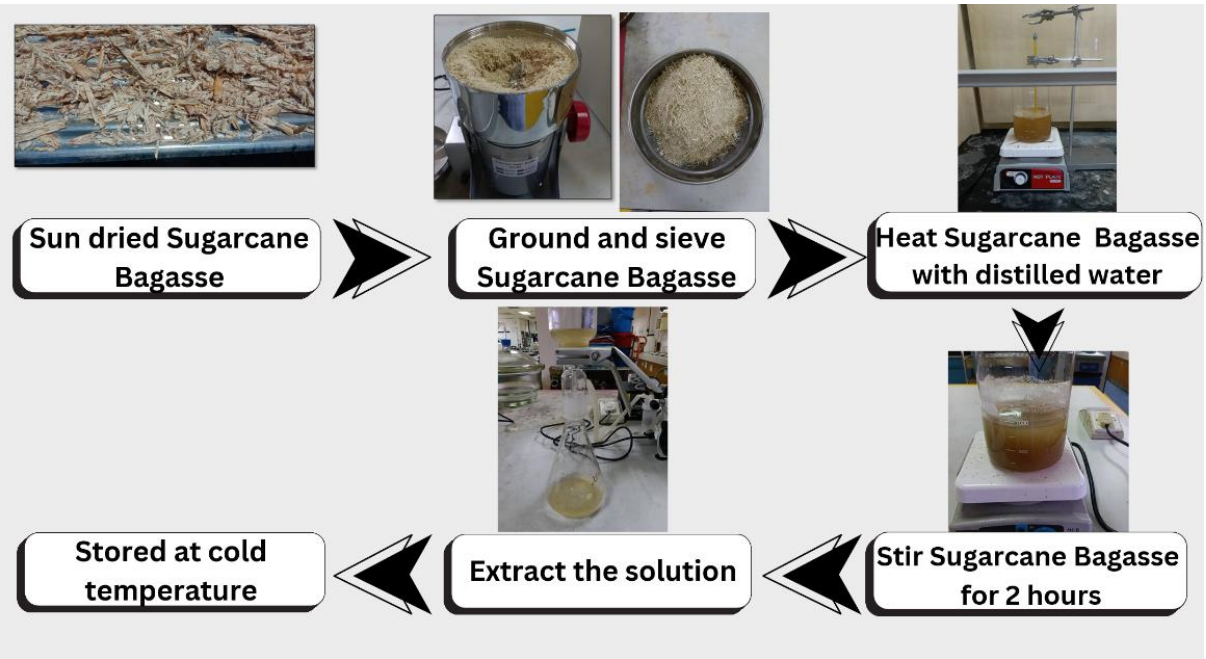

Figure 1: The process of making sugarcane bagasses coagulant

RESULTS AND DISCUSSION

The result shows that aluminium sulfate removed turbidity very effectively, reaching almost 100% removal at 48 mg/L dosage. This makes 48 mg/L the best dosage for aluminium sulfate. Sugarcane bagasse had little effect on pH. The pH remained between 4.7 and 5.5 across all dosages, meaning it does not significantly change the acidity of the water. In contrast, aluminium sulfate reduced the pH steadily as the dosage increased. At 120 mg/L, the pH dropped to about 3.2, showing strong acidification. This suggests that aluminium sulfate may require pH adjustment after treatment, while sugarcane bagasse is more pH-friendly and safer for the environment.

Aluminium sulfate gave better overall nitrate removal, reaching up to 60% removal at higher dosages (around 100–120 mg/L). The removal increased steadily with dosage, showing a more stable trend. Meanwhile, sugarcane bagasse showed some nitrate removal at lower dosages (up to 40% at 20 mg/L), but its performance was inconsistent and dropped at certain points. Although less effective than aluminium sulfate, sugarcane bagasse still shows potential as a natural coagulant for moderate nitrate removal, especially at lower dosages.

CONCLUSION

Sugarcane bagasse showed optimum turbidity removal (42%) at 12 mg/L, but performance dropped at higher doses. Aluminum sulfate performed better, removing

100% turbidity at 48 mg/L. However, it lowered the pH to 3.91, while sugarcane bagasse maintained a pH closer to the original (4.705), making it more suitable for irrigation. For nitrate removal, aluminum sulfate was more effective (62.16%) compared to the inconsistent results from sugarcane bagasse.

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RSST006 - FUNCTIONAL GROUP ANALYSIS AND ADSORPTION EFFICIENCY OF UNTREATED AND TREATED SPENT COFFEE GROUNDS IN CRYSTAL VIOLET REMOVAL

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ABSTRACT

This study investigates the potential of untreated and thermally treated spent coffee grounds (SCG) as low-cost biosorbents for the removal of crystal violet (CV) dye from aqueous solutions. Structural characterization using Fourier-transform infrared spectroscopy (FTIR) revealed functional groups such as hydroxyl, carbonyl, and aromatic groups involved in the adsorption process. Batch adsorption experiments were conducted at various SCG dosages (2–20 g/L) to determine percent removal and adsorption capacity for both untreated and treated SCG. Findings showed that untreated SCG performed slightly better than treated SCG, achieving a maximum CV of 99.7% removal and 231.0 mg/g adsorption capacity, whereas treated SCG consistently showed around 92% removal and 230.7 mg/g adsorption capacity. FTIR analysis suggested that while thermal treatment intensified certain functional groups, it may also reduce porosity and active site accessibility, negatively impacting adsorption performance. These findings highlight the promise of SCG as an eco-friendly and cost-effective adsorbent for dye-contaminated wastewater treatment.

Keywords – Spent coffee grounds, crystal violet, adsorbent, wastewater treatment, functional group characterisation

INTRODUCTION

CV is a cationic triphenylmethane synthetic dye widely used in textiles, paper, leather, printing inks, and biological staining, yet it poses serious environmental and health risks due to its toxicity and resistance to degradation (Loulidi et al., 2025). When released into water bodies, CV disrupts aquatic ecosystems and can harm human health. Traditional removal methods like coagulation, membrane filtration, and advanced oxidation are effective but expensive and energy-intensive (Homagai et al., 2022). As a result, sustainable alternatives are needed. Among emerging solutions, agro-waste-based adsorbents are gaining attention for their affordability and environmental friendliness. SCG, a major waste from global coffee consumption, is rich in cellulose, lignin, and functional groups such as hydroxyl and carboxyl that make it a promising biosorbent (Kang et al., 2022),

In Malaysia, about 31,200 tonnes of spent coffee grounds (SCG) are generated annually from coffee consumption (Omar et al., 2022), while global production reached 10 million tonnes in 2022 and is expected to rise to 12 million tonnes by 2030 (Yusufoğlu et al., 2024). Previous studies have demonstrated that SCG and its derivatives can adsorb heavy metals and synthetic dyes. However, most studies focus on treated SCG, with limited data available for raw or untreated SCG. This study evaluates the adsorption efficiency of untreated and treated SCG for CV removal, highlighting their role as an affordable and sustainable adsorbents that aligns with the United Nations Sustainable Development Goals (SDGs), particularly SDG 6 (Clean Water and Sanitation), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 12 (Responsible Consumption and Production).

OBJECTIVE

This research aims to characterize the structural and surface properties of untreated and thermally treated SCG to identify the functional groups involved in the adsorption process. It also evaluates the percent removal and adsorption capacity of CV dye using both types of SCG at various adsorbent dosages.

METHODOLOGY

SCG was collected, washed, and oven-dried at 105°C for 24 hours to remove moisture. The dried SCG was sieved through a U.S.A. Standard Sieve with a mesh size range of 850 µm to obtain a uniform particle size, and referred to as untreated SCG. A portion was thermally treated in a muffle furnace at 300°C for 2 hours (El Gheriany et al., 2020) to produce thermally treated SCG. Both forms were tested for dye adsorption performance and functional group characterization using FTIR. Spectral data were collected in the range of 4000–600 cm^{-1} with 32 scans per sample. Batch adsorption was conducted using SCG dosages from 2–20 g/L in a 100 mg/L CV solution. The mixtures were agitated at 150 rpm for 3 hours at room temperature. After equilibrium was reached, the solutions were filtered and analyzed for residual dye concentration using a UV–Visible spectrophotometer at a maximum absorbance wavelength of 590.5 nm. Percent removal and adsorption capacity were calculated to determine adsorption performance using the equations below.

$$Percent\ removal\ = \frac{(C_i - C_e)}{C_i} \times 100\%$$

Where,
C_i is the initial dye concentration (mg/L), C_e is the equilibrium dye concentration (mg/L).

$$adsorption\ capacity, q_e = \frac{(C_i - C_e)V}{m}$$

Where,
C_i is the initial dye concentration (mg/L), C_e is the equilibrium dye concentration (mg/L), V is the volume of the solution (L), m is the mass of the biosorbent (g).

RESULTS AND DISCUSSION

FTIR Characterisation of Untreated and Treated SCG

Both untreated and treated SCG showed broad O-H stretching peaks at 3337 cm^{-1} and 3330 cm^{-1}, respectively. The stronger O–H peak in treated SCG suggests more hydroxyl groups due to treatment, possibly through the removal of surface impurities or decomposition of lipids and proteins (Kang et al., 2022). The C=O stretching vibrations were observed at 1744 and 1706 cm^{-1} in untreated SCG and slightly shifted to 1741 and 1702 cm^{-1} in treated SCG. This minor shift may indicate chemical rearrangement or changes in the ester or carboxylic acid groups after treatment. Both O–H and C=O groups enable hydrogen bonding with CV molecules.

The C=C aromatic peak also shifted from 1653 to 1604 cm^{-1}, possibly due to changes in the lignin structure or interaction with electron-withdrawing groups introduced during treatment. The presence of C=C in CSG might facilitate π–π interactions with the aromatic rings of CV (Loulidi et al., 2025). The C–O stretching peak shifted from 1022 cm^{-1} in untreated SCG to 1063 cm^{-1} in the treated SCG. This is likely due to polysaccharide degradation and increased surface exposure of C-O-C linkages in cellulose or lignin (Jóźwiak et al., 2021). These changes suggest more active sites were available for dye adsorption. Additionally, a minor shift in the C–N group from 1154 cm^{-1} to 1161 cm^{-1} could be attributed to oxidation or hydrolysis of amine groups (Zuluaga et al., 2024). These nitrogen-containing groups can attract the positively charged CV through electrostatic or hydrogen bonding interactions.

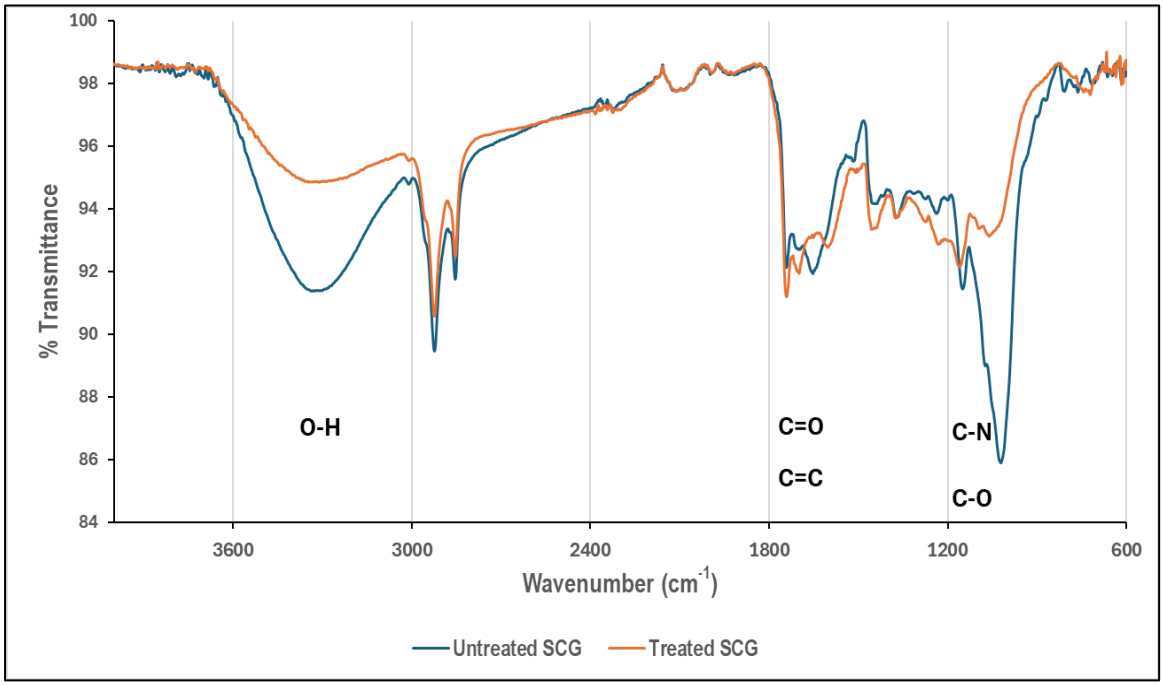

Figure 1: FTIR spectra for untreated and treated SCG

Adsorption Efficiency

At a low adsorbent dosage of 2 g/L, both untreated and treated SCG demonstrated high percent removal above 92%, with adsorption capacities of 231.0 mg/g and 230.7 mg/g, respectively. As the dosage increased, untreated SCG reached a maximum percent removal of 99.7% at 0.8 g, while its adsorption capacity dropped to 24.9 mg/g. In contrast,

treated SCG maintained a nearly constant percent removal of around 92%, regardless of dosage, and showed a similar decrease in adsorption capacity to 23.1 mg/g. Table 1 presents a detailed comparison between untreated and treated SCG.

Table 1: Percent removal and adsorption capacity of CV by untreated and thermally treated SCG at varying dosages

Dosage (g/L)	Untreated SCG		Thermally treated SCG	
	Removal (%)	Adsorption capacity (mg/g)	Removal (%)	Adsorption capacity (mg/g)
2	92.4	231.0	92.3	230.7
4	92.5	115.7	92.2	115.2
8	96.5	60.3	92.4	57.7
12	99.3	41.4	92.1	38.4
16	99.8	31.2	92.4	28.9
20	99.7	24.9	92.4	23.1

The high adsorption capacity at low dosages can be attributed to the abundance of available active sites relative to the number of dye molecules. As dosage increases, the relative number of active sites exceeds the dye concentration, resulting in site underutilization and a drop in adsorption capacity (mg/g), despite higher overall percent removal (Homagai et al., 2022). Despite treatment intensifying certain functional groups like O-H, it did not improve overall adsorption. This could be due to the breakdown of larger structures such as lignin or hemicellulose, leading to a more compact and less porous structure, which limits dye access to binding sites (El Gheriany et al., 2020).

CONCLUSION

Both untreated and treated SCG exhibit strong potential as biosorbents for CV dye. However, untreated SCG demonstrated better performance, particularly in terms of removal efficiency at higher adsorbent masses. FTIR analysis confirmed the presence of functional groups responsible for effective dye interactions, but also revealed that excessive treatment may diminish surface accessibility. Therefore, raw SCG may offer a more cost-effective and structurally favorable option for practical wastewater dye removal applications.

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RSST007 - DEVELOPMENT OF MUSHROOM PROTEIN HYDROLYSATE AS FLAVOUR ENHANCER: ITS PHYSICOCHEMICAL PROPERTIES AND SENSORY ACCEPTABILITY

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ABSTRACT

The increasing demand for natural and healthier flavour alternatives has spurred interest in mushroom protein hydrolysates (MPH) as potential substitutes for monosodium glutamate (MSG). This study developed MPH from *Agaricus bisporus* and *Pleurotus ostreatus* using bromelain enzyme and evaluated their physicochemical properties and flavour-enhancing potential. The hydrolysates were characterized based on degree of hydrolysis (DH), moisture, crude protein, ash, pH, colour analysis, amino acid composition using High-Performance Liquid Chromatography (HPLC) with a fluorescence detector together with amino acid column and identification of volatile compounds using gas chromatography-mass spectrometry (GCMS). Additionally, their sensory acceptability was evaluated by incorporating different concentrations (3% and 5%) of MPH into chicken soup formulations. A 9-point hedonic scale was used to assess consumer perception in terms of colour, aroma, umami, saltiness, aftertaste and overall acceptability. The results revealed that *A. bisporus* hydrolysate demonstrated a significantly higher degree of hydrolysis, crude protein, ash and total amino acids compared to *P. ostreatus*. Notably, *A. bisporus* contained higher levels of flavouractive amino acids such as glutamic acid and aspartic acid, indicating greater umami potential. However, sensory evaluation showed that MSG remained the most preferred. Among the mushroom hydrolysates, *P. ostreatus* at 3% concentration had the highest overall acceptability suggesting its suitability as a natural flavour enhancer in soup products. The novelty of this research lies in its comparative analysis of two mushroom species for hydrolysate development using enzymatic hydrolysis. Its significance is reflected in the potential application of MPH as a clean-label alternative to synthetic additives, contributing to healthier food innovation.

Keywords – mushroom protein hydrolysates, flavour enhancer, MSG, A. bisporus, P. ostreatus

INTRODUCTION

The rising demand for clean-label and natural food products has driven the development of alternative flavour enhancers that are both functional and health-promoting (Ang & Ismail– Fitry, 2019). Mushrooms, particularly *A. bisporus* and *P. ostreatus* are well-known for their nutritional value and unique umami flavour profile. Through enzymatic hydrolysis, these mushrooms can be converted into mushroom protein hydrolysates (MPH) which release amino acids and peptides that enhance savoury flavours (Ang & Ismail–Fitry, 2019; Babu et al., 2024; Kimatu et al., 2017). MPH also offers additional health-related benefits such as improved digestibility and the presence of bioactive compounds that make it a promising substitute for synthetic additives like monosodium glutamate (MSG) (Sheng et al., 2022).

Despite existing research, there is limited comparative data on the physicochemical properties and flavour-enhancing compounds of MPH derived from different mushroom species. Additionally, consumer acceptance of MPH at various concentrations in food products such as soups has not been clearly established in relation to MSG. This study was developed to address these gaps by analysing the compound profiles and sensory acceptability of MPH produced from *A. bisporus* and *P. ostreatus* with a focus on determining their suitability as natural flavour enhancers.

The motivation behind this research lies in the global shift toward healthier and more sustainable food systems. MPH offers a natural and plant-based solution that aligns with consumer trends while potentially reducing sodium content in savoury products. The identification of the potential mushroom species and suitable concentration levels for flavour enhancement supports the food industry's innovation efforts and addresses both health and sensory quality demands. This product also contributes to Sustainable Development Goals (SDG) such as SDG 3 (Good Health and Well-being), SDG 9 (Industry, Innovation and Infrastructure) and SDG 12 (Responsible Consumption and Production).

OBJECTIVE

This study was carried out with two main objectives. The first objective is to evaluate the physicochemical properties and compound profiling of mushroom protein hydrolysates (MPH) prepared from *A. bisporus* and *P. ostreatus*. This includes the analysis of degree of hydrolysis, moisture, crude protein, ash content, pH, colour, amino acid composition and volatile compounds. The second objective is to assess the sensory acceptability of soups incorporated with different concentrations of MPH in comparison to monosodium glutamate (MSG) using a 9-point hedonic scale to determine consumer preference.

METHODOLOGY

The production of mushroom protein hydrolysate (MPH) involved several stages: sample preparation, enzymatic hydrolysis, physicochemical analysis and sensory evaluation. Fresh mushrooms (*A. bisporus* and *P. ostreatus*) were cleaned, sliced and blended with water to form a slurry. Enzymatic hydrolysis was carried out by adding bromelain (0.5% w/w) to the slurry, the pH was adjusted to 6.5 and incubated at 50–60 °C for 3 hours. The enzyme was inactivated at 85 °C for 20 minutes, followed by cooling, centrifugation and

collection of the supernatant. The supernatant which contains MPH was then freeze-dried at –60 °C to obtain the final powder. Physicochemical analyses were conducted to determine moisture, ash, protein, pH, colour, degree of hydrolysis and yield. Compound profiling was performed using High-Performance Liquid Chromatography (HPLC) with a fluorescence detector for amino acids and Gas Chromatography–Mass Spectrometry (GC-MS) for volatile compounds. Lastly, sensory evaluation was conducted by incorporating MPH was into chicken soup formulations at 3% and 5% concentrations. These were compared to a control sample with 3% monosodium glutamate (MSG) and a plain sample without any enhancer. Sensory acceptability was evaluated using a 9-point hedonic scale to assess umami, aroma, colour, saltiness, aftertaste and overall liking. Statistical analysis was conducted to determine significant differences among samples.

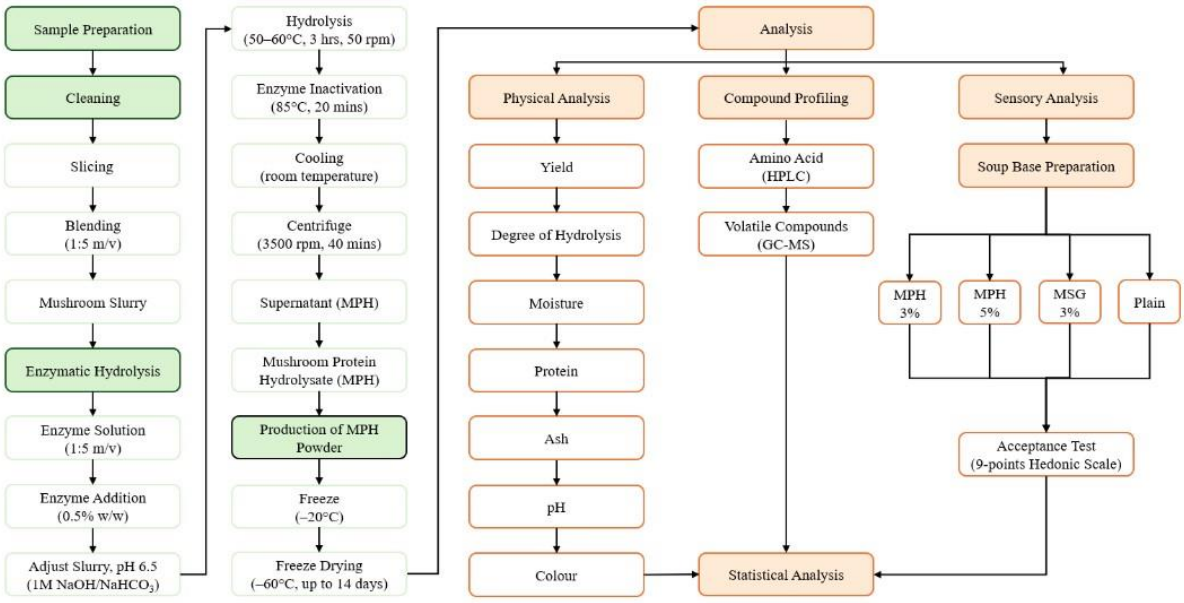

Figure 1: Overall experimental design of development of mushroom protein hydrolysate

RESULTS AND DISCUSSION

The physicochemical analysis of mushroom protein hydrolysates (MPH) revealed notable differences between the two mushroom species. *A. bisporus* hydrolysate demonstrated a higher degree of hydrolysis, crude protein, ash content and total amino acid concentration compared to *P. ostreatus*. The moisture content for both hydrolysates fell within the recommended range of 5–8% (Rubina & Aivars, 2021) with slightly higher levels attributed to the naturally porous and fibrous structure of mushroom tissues which contributes to increased moisture retention during drying (Sharma et al., 2024). Although ash content is not directly flavour-active, it plays a role in the nutritional value and may influence the perceived saltiness due to the presence of soluble minerals and their contribution to the ionic strength of the hydrolysate (Granite, 2024). Additionally, amino acid profiling using High Performance Liquid Chromatography (HPLC) with a fluorescence detector showed that *A. bisporus* contained higher levels of glutamic acid and aspartic acid, both of which are associated with umami taste enhancement. Volatile compound analysis using Gas Chromatography–Mass Spectrometry (GC-MS) revealed that *A. bisporus* exhibited higher levels of fatty acid esters, contributing to a creamier and milder aroma profile. In contrast, *P. ostreatus* showed a greater presence of phenolic compounds that result in a more intense and bitter aromatic character.

Sensory evaluation was conducted by incorporating MPH into chicken soup formulations at 3% and 5% concentrations alongside a plain control and a 3% MSG as negative and positive control. Among all samples, MSG was the most preferred. However, *P. ostreatus* at 3% concentration received the highest scores among the MPH samples particularly in terms of overall acceptability which suggest a more balanced flavour profile. Despite *A. bisporus* showing higher levels of flavour-active compounds, the sensory results indicate that consumer perception may favour the milder characteristics of *P. ostreatus* at lower concentration levels. These findings support the potential of MPH as a natural alternative to synthetic flavour enhancers with each mushroom species offering unique functional and sensory advantages for application in savoury food products.

CONCLUSION

This study successfully evaluated the physicochemical properties and sensory acceptability of mushroom protein hydrolysates (MPH) derived from *A. bisporus* and *P. ostreatus* as natural alternatives to monosodium glutamate (MSG). The findings revealed that *A. bisporus* hydrolysate exhibited a higher degree of hydrolysis, protein content, ash and total amino acids including glutamic acid and aspartic acid suggesting its stronger flavour enhancing potential. However, sensory evaluation results showed that *P. ostreatus* at 3% concentration achieved the highest overall acceptability among MPH samples despite MSG still being the most preferred. This highlights the potential of *P. ostreatus* to serve as a natural flavour enhancer in savoury soup formulations. Overall, the study demonstrates that mushroom protein hydrolysates offer promising clean-label alternatives to synthetic flavour enhancers with each mushroom species presenting unique functional and sensory advantages. These findings support the development of healthier and more sustainable food products in line with current consumer trends.

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NEGERI SEMBILAN INTERNATIONAL EXPOSITION

RSST008 - A REVIEW OF INNOVATIONS IN MOBILE AND REMOTE INSPECTION TECHNOLOGIES FOR THE CONSTRUCTION INDUSTRY (2020 TO 2025)

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ABSTRACT

This paper reviews recent innovations in mobile and remote inspection technologies applied to the construction industry from 2020 to 2025. Using a structured literature review of 673 peer-reviewed studies retrieved from Scopus, the study synthesises trends in Building Information Modelling (BIM), cloud-driven platforms, Internet of Things (IoT), unmanned aerial vehicles (UAVs), robotics, and artificial intelligence (AI) applications. Results indicate that digital and ICT frameworks dominate research output, followed by AI-based defect detection and innovations in construction materials. In contrast, UAV-enabled inspection and IoT integration remain underrepresented although they are highly relevant to safety and accessibility. The analysis highlights benefits such as reduced inspection time, improved accuracy, and enhanced stakeholder communication, while persistent barriers include cost, interoperability, and digital literacy challenges, especially for small and medium-sized enterprises (SMEs). The review identifies a research gap in integrating emerging tools such as digital twins, robotics, and renewable energy linked inspection frameworks. It concludes with recommendations for cost-effective deployment, targeted training, and regulatory support to strengthen the adoption of Construction 4.0 practices.

Keywords – Mobile inspection, remote inspection, construction technology, BIM integration, digital twin, SME adoption

INTRODUCTION

Mobile and remote inspection technologies have advanced rapidly over the past five years, offering innovative solutions to improve monitoring, assessment, and documentation processes in construction projects. This review synthesises recent literature on mobile applications, smartphone-based tools, and virtual inspection platforms, with emphasis on their applications in both building and infrastructure projects and adoption by small and medium-sized enterprises (SMEs). Key innovations include real time defect logging,

automated compliance checklists, and integration with Building Information Modelling (BIM) (Boje et al., 2020; Hu et al., 2022). Emerging tools such as unmanned aerial vehicles (UAVs), laser scanning, and digital twin frameworks enable predictive maintenance and enhance safety oversight (Mohammadi et al., 2021; Saback et al., 2024). Benefits include faster inspection processes, improved stakeholder communication, and greater transparency, although barriers such as digital literacy gaps, inconsistent connectivity, and high implementation costs persist (Dah & Hussin, 2021).

The construction industry has traditionally relied on manual inspection methods that are time consuming, resource intensive, and prone to human error. Recent advancements in mobile and remote inspection technologies have created opportunities for more efficient and reliable quality monitoring in both building and infrastructure projects (Baduge et al., 2022). SMEs, which make up a significant portion of the sector, face unique challenges in adopting such innovations due to limited resources and technical capacity. The shift toward Construction 4.0 underscores the importance of integrating digital solutions such as mobile applications, BIM, UAVs, IoT sensors, and digital twins to enhance project quality, safety, and productivity (Saback et al., 2024).

However, despite these advances, most studies remain concentrated on digital and ICT frameworks and AI applications, while UAV adoption, IoT integration, and SME-focused research are still limited. This gap highlights the need for a comprehensive review that not only synthesises technological innovations but also identifies barriers and opportunities for more inclusive adoption within the framework of Construction 4.0.

OBJECTIVE

The objectives of this review are to:

i. Examine key innovations in mobile and remote inspection technologies in the construction industry.
ii. Analyse benefits, challenges, and opportunities for SMEs in adopting these technologies.
iii. Provide recommendations for broader industry implementation within the framework of Construction 4.0.

METHODOLOGY

A systematic review was conducted using the Scopus database covering publications from January 2020 to July 2025. A comprehensive Boolean search strategy was designed to capture studies focusing on inspection technologies, construction applications, and innovation adoption. The inclusion criteria were peer-reviewed journal articles and conference papers published in English that clearly addressed construction inspection. From an initial pool of 1,791 records, 673 studies met the criteria. Thematic synthesis was then applied to group studies into categories such as BIM integration, UAV inspections, AI-driven defect detection, IoT adoption, and SME implementation.

RESULTS AND DISCUSSION

The findings demonstrate that digital and ICT frameworks, with 317 studies, dominate the research landscape, underscoring their role in enabling interoperability and real time reporting (Boje et al., 2020; Hu et al., 2022). AI and machine learning, represented in 150 studies, show growing application in computer vision and predictive modelling (Baduge et al., 2022). Innovations in construction materials, covered in 200 studies, are frequently associated with inspection feasibility and quality assurance. IoT sensors, found in 109 studies, and robotics, in 76 studies, indicate significant potential although they remain moderately represented. UAV-based inspection is reported in only 11 studies, despite its importance in reaching hazardous or inaccessible areas (Mohammadi et al., 2021). Emerging technologies such as digital twins and mixed reality, with 94 studies, illustrate promising directions but are not yet widely adopted (Saback et al., 2024).

The review identifies key benefits such as faster inspection processes, higher accuracy, and better communication among stakeholders. However, barriers persist. SMEs in particular encounter difficulties due to high initial costs, limited expertise, and inconsistent connectivity (Dah & Hussin, 2021). The uneven distribution of adoption suggests the need for more inclusive strategies that enable wider participation in Construction 4.0.

CONCLUSION

Mobile and remote inspection technologies represent a major transformation in construction quality management. Evidence from 673 reviewed studies shows that ICT frameworks and AI applications are the dominant focus, while UAVs, IoT, and robotics remain underutilised although they offer significant practical advantages. Addressing adoption challenges, particularly those faced by SMEs, will require cost effective solutions, targeted training, and regulatory support. Strengthening integration across ICT, AI, UAV, IoT, and digital twin systems will be critical for achieving the productivity, safety, and sustainability objectives of Construction 4.0. Based on these findings, it is recommended that industry stakeholders prioritise affordable deployment models, invest in capacity building programmes, and develop clear regulatory standards for interoperability. In addition, collaboration between industry, government, and academia should be encouraged to ensure that technological innovations lead to wider adoption and tangible improvements in construction practice.

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RSST010 - COMPARATIVE ANALYSIS OF KETO BREAD FORMULATIONS: SENSORY, SHELF-LIFE, AND QUALITY ATTRIBUTES

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ABSTRACT

The rising popularity of ketogenic diets, particularly among individuals managing diabetes or pursuing weight loss, has driven demand for low-carbohydrate bread alternatives. However, substituting wheat flour with low-carbohydrate, high-fat flours can alter sensory qualities and affect consumer acceptance, and research on their quality and shelf-life remains limited. This study compared sensory, shelf-life, and quality attributes of keto bread made with almond, oat fiber, coconut and walnut flours, using standard wheat bread as a control. Shelf-life was assessed via microbial counts and pH over 12 days, while quality parameters included loaf volume, texture, moisture, and colour. Sensory evaluation using a 9-point hedonic scale involved 50 panellists. Almond flour bread showed the highest microbial stability, while oat fiber bread has the smallest pH variation and highest moisture content. Both almond and oat fiber breads had the highest absolute loaf volume, though wheat bread recorded the highest specific volume. Almond flour bread also had the softest, most springy crumb, wheareas coconut flour bread achieved highest overall preference among keto variants. These findings provide a scientific basis for optimising keto bread formulations with improved sensory quality and stability.

Keywords – ketogenic diet, low-carbohydrate, high-fat, keto bread

INTRODUCTION

Bread has been a dietary staple for thousands of years, with current average annual consumption estimated at 59-70 kg per person (Dong & Karboune, 2021, Mesta-Corral et al., 2024). Traditionally made from wheat flour, bread provides protein, complex carbohydrate, dietary fiber, vitamins, and minerals (Dong & Karboune, 2021). However, wheat bread is classified as a high-glycemic index (GI) food due to its fast-difesting polysaccharides, which can cause rapid spike in blood glucose levels (Mesta-Corral et al., 2024). The increasing popularity of ketogenic diet and gluten-free diets that is characterised by low carbohydrate, high fat, and moderate protein intake has created demand for alternative bread formulations (Gillespie & Ahlborn, 2021; Hopkin et al., 2022). Such diets are popular among individuals managing diabetes, seeking weight loss, or addressing neurological conditions like autism, Alzheimer's and parkinson's disease (Gillespie & Ahlborn, 2021). Since wheat flour is unsuitable for keto bread, low-carbohysrate flours derived from nuts, seeds, soy, and certain legumes are preferred (Gillespie & Ahlborn, 2021; Hopkin et al., 2022). Despite rising interest in ketogenic

products, keto bread production faces sensory and textural challenges due to the absence of gluten, potentially reducing consumer acceptance (Gillespie & Ahlborn, 2021). Existing keto bread options are limited, with almond flour being the most common base, and little research exploring other low-carbohydrate, high-fat flours. There is a lack of scientific data on the shelf-life, colour, and other quality attributes of these breads despite colour is a key factor in consumer perception (Spence, 2018). This knowledge gap limits variety and innovation in the ketogenic bread market.

OBJECTIVE

This study aims to determine and compare the shelf-life and quality properties of keto bread prepared with different types of flours against conventional wheat bread. It also seeks to evaluate consumer acceptability of the various keto bread formulations through sensory analysis, assessing factors such as taste, texture, aroma, and overall preference. Furthermore, the research intends to identify the best keto bread formulation by integrating findings from microbial analysis, quality assessment, and sensory evaluation, ensuring an optimal balance of safety, quality, and consumer satisfaction.

METHODOLOGY

Four keto bread formulaions were prepared by using almond flour (AF), oat fiber flour (OF), coconut flour (CF), or walnut flour (WF), alongside a wheat flour as control sample (CTRL). Ingredients were weighed according to standardised recipes, mixed, proofed for 40 minutes and baked at 175℃ for 50 minutes for keto breads, and 22 minutes for control. Shelf-life analysis was conducted over 12 days at 3-day intervals, comprising of microbial analysis by using a hemocytometer, with bread suspensions diluted, stained with methylene blue, and counted microscopically. The shelf-life analysis also comprises of pH measurement by blending bread with distilled water to get 1:10 suspension, filtering, and recording pH with a calibrated pH meter. Next, quality attributes were measured 24 hours after baking, comprising of loaf volume analysis using the rapeseed displacement method to determine absolute and specific volume. Secondly, moisture analysis using the AACC two-stage bread moisture method. Thirdly, texture analysis was done by using a Texture Profile Analysis with a cylindrical probe. Lastly, colour analysis was done by using a calibrated chroma meter to get the data of L*, a* and b*. Sensory evaluation involved 50 untrained panelists at UiTM Kuala Pilah using a 9point hedonic scale to rate the appearance, aroma, texture, taste, and overall acceptability. Samples were coded with random three-digit numbers, and water was provided for palate cleansing. All data were analysed by using the IBM SPSS version 27. Two-way ANOVA was used for microbial and pH data, and one-way ANOVA for loaf volume, moisture, texture, colour, and sensory results, with significance at $p < 0.05$.

RESULTS AND DISCUSSION

Table 1: Cells concentration of different keto breads and wheat bread for 12 days with 3 days interval.

Day	Concentration Of Cells (cells/mL)	Bread variation				
		AF	OF	CF	WF	CTRL
0		$2.18\times10^{7}\pm 2.55\times10^{6}$ ^{Ab}	$1.64\times10^{7}\pm1.70\times10^{7}$ ^{ABb}	$1.76\times10^{7}\pm2.26\times10^{6}$ ^{Ab}	$2.5\times10^{7}\pm5.37\times10^{6}$ ^{Bb}	$2.90\times10^{7}\pm2.83\times10^{5}$ ^{Bb}
3		$1.04\times10^{7}\pm 3.96\times10^{6}$ ^{Ab}	$1.74\times10^{7}\pm1.98\times10^{6}$ ^{ABb}	$2.16\times10^{7}\pm1.13\times10^{6}$ ^{Ab}	$2.22\times10^{7}\pm5.94\times10^{6}$ ^{Bb}	$3.80\times10^{7}\pm6.79\times10^{6}$ ^{Bb}
6		$1.06\times10^{9}\pm1.41\times10^{8}$ ^{Aa}	$1.40\times10^{9}\pm6.79\times10^{8}$ ^{ABa}	$1.22\times10^{9}\pm8.49\times10^{7}$ ^{Aa}	$8.20\times10^{8}\pm2.55\times10^{8}$ ^{Ba}	$7.20\times10^{8}\pm2.26\times10^{8}$ ^{Ba}
9		$8.60\times10^{8}\pm1.41\times10^{8}$ ^{Aa}	$1.06\times10^{9}\pm2.55\times10^{8}$ ^{ABa}	$1.14\times10^{9}\pm3.11\times10^{8}$ ^{Aa}	$1.06\times10^{9}\pm8.49\times10^{7}$ ^{Ba}	$1.18\times10^{9}\pm2.83\times10^{7}$ ^{Ba}
12		$6.80\times10^{8}\pm2.26\times10^{8}$ ^{Aa}	$7.00\times10^{8}\pm8.49\times10^{7}$ ^{ABa}	$1.86\times10^{9}\pm3.68\times10^{8}$ ^{Aa}	$8.80\times10^{8}\pm0.00^{Ba}$	$7.60\times10^{8}\pm5.66\times10^{7}$ ^{Ba}

Note: Upper case letters represent difference between bread variations and lower case letters represent differences of each variation at different day, Values with common letters are not significantly different ($p < 0.05$)

Microbial activity which is the analysis under shelf-life analysis, showed low initial microbial counts for all breads, indicating clean production. OF bread had the lowest count on day 0, likely due to the antibacterial properties of plant fibers (Zamora-Mendoza et al., 2022). Microbial growth increased over storage, with coconut (CF) bread reached the highest count by day 12, possibly from its higher moisture retention (Al-Zoghbi et al., 2025). AF bread exhibited the greatest microbial stability, consistent with the antimicrobial properties of almond skin extracts (Badalamenti et al., 2022).

Table 2: pH value of different keto bread formulations and control bread for 12 days with 3 days interval

Day	Bread variation				
	AF	OF	CF	WF	CTRL
0	8.26 ± 0.03^{Da}	9.04 ± 0.03^{Aa}	8.56 ± 0.02^{Ba}	8.63 ± 0.02^{Ca}	5.55 ± 0.02^{Ea}
3	7.63 ± 0.02^{Db}	8.89 ± 0.03^{Ab}	8.36 ± 0.02^{Bb}	7.95 ± 0.07^{Cb}	5.54 ± 0.01^{Eb}
6	7.08 ± 0.02^{Dc}	8.68 ± 0.01^{Ac}	8.03 ± 0.10^{Bc}	7.75 ± 0.06^{Cc}	5.48 ± 0.01^{Ec}
9	7.02 ± 0.04^{Dd}	8.53 ± 0.03^{Ad}	7.36 ± 0.04^{Bd}	7.63 ± 0.03^{Cd}	5.26 ± 0.02^{Ed}
12	6.95 ± 0.03^{De}	8.21 ± 0.03^{Ae}	7.34 ± 0.03^{Be}	7.43 ± 0.03^{Ce}	5.13 ± 0.01^{Ee}

Note: Upper case letters represent differences between bread variations and lower case letters represent differences of each variation at different day, values with common letters are not significantly different ($p < 0.05$)

pH values of all keto breads decreased during storage, likely due to microbial metabolism producing acidic by-products (Preetha & Narayanan, 2020). OF bread had the smallest pH change which is from 9.04 to 8.21, suggesting strong pH stability. Meanwhile, CTRL bread was consistently more acidic, providing a more favourable environment for spoilage organisms.

Table 3: Absolute volume and specific volume of different keto bread formulations and wheat bread

Bread variation	Absolute volume (cm^3)	Specific volume (cm^3/g)
AF	438.33±47.52[a]	1.80±0.23[b]
OF	438.33±16.07[a]	1.76±0.09[b]
CF	361.67±59.65[a]	1.43±0.20[b]
WF	370.00±0.00[a]	1.46±0.20[b]
CTRL	211.67±40.10[b]	2.93±0.72[a]

Note: Values with common letters are not significantly different ($p < 0.05$)

AF and OF breads recorded the highest absolute loaf volumes among keto breads, showing that these flours can support better gas retention during proofing. This may be due to almond flour's protein content aiding structure formation and oat fiber's ability to absorb water that improved dough viscosity. However, CTRL bread had the highest specific loaf volume, reflecting the structural advantage of gluten in trapping fermentation gases (Monteiro et al., 2021). CF and WF breads had lower volumes, possibly due to denser crumb structures from their high fiber and fat content, which can hinder gas expansion.

Table 4: Moisture of different keto bread formulations and wheat bread

		Bread variation			
Moisture (%)	**AF**	**OF**	**CF**	**WF**	**CTRL**
	49.47±0.75[a]	51.82±1.14[a]	49.06±1.73[a]	50.12±0.88[a]	35.53±2.45[b]

Note: Values with common letters are not significantly different ($p < 0.05$)

OF bread had the highest moisture content that can be linked to the water-binding ability of its soluble and insoluble fibers. High moisture may improve perceived softness but it also can shorten shelf-life due to microbial susceptibility (Zambrano et al., 2019). AF and WF breads showed moderate moisture levels, while CF bread had relatively low moisture, which may lead to its denser texture but also prolong its shelf-life if water activity is reduced.

Table 5: Texture attributes of different keto bread formulations and wheat bread

Bread variation	Firmness (g)	Springiness (%)
AF	295.95±45.70[c]	57.51±0.27[a]
OF	723.11±28.14[b]	51.51±2.25[b]
CF	1966.95±168.74[a]	52.04±1.25[b]
WF	1819.62±116.25[a]	52.84±1.70[b]
CTRL	737.62±61.75[b]	54.29±2.13[ab]

Note: Values with common letters are not significantly different ($p < 0.05$)

CF bread had the highest firmness, indicating a dense and hard crumb, while AF bread was the softest, likely due to its high fat content that promotes softer texture (Barreca et al., 2020; Hao et al., 2014). AF bread was also less firm than OF bread, consistent with the finding that oat fiber's strong water-binding ability contributes to greater firmness (Gillespie & Ahlborn, 2021). Among keto breads, OF had the most similar firmness to wheat bread (CTRL). In terms of springiness, AF bread had the highest value and differed significantly from other keto breads but not from CTRL. Since keto breads lack gluten, their springiness is derived from high fat, protein, and fiber content that help to maintain resilience and texture over time (Gillespie & Ahlborn, 2021).

Table 6: Value of L*, a* and b* for crumb of different keto bread formulations and wheat bread

	Colour of crumb		
Bread variation	**L***	**a***	**b***
AF	43.65±4.12^{b}	2.15±0.02^{b}	19.04±1.79^{a}
OF	42.77±2.84^{b}	2.61±0.29^{b}	19.04±1.09^{a}
CF	47.19±0.60^{b}	2.06±0.2^{b}	18.80±0.09^{a}
WF	42.04±4.86^{b}	5.50±0.32^{a}	13.57±1.53^{b}
CTRL	57.54±1.97^{a}	-2.81±0.05^{c}	16.00±0.68^{ab}

Note: Values with common letters are not significantly different ($p < 0.05$)

Table 7: Values of L*, a* and b* for crust of different keto bread formulations and wheat bread

	Colour of crust		
Bread variation	**L***	**a***	**b***
AF	31.46±1.40^{ab}	9.84±0.48^{a}	16.24±0.94^{b}
OF	35.72±1.35^{a}	6.25±0.23^{c}	19.66±0.52^{a}
CF	24.33±0.75^{c}	7.64±0.64^{bc}	13.15±0.28^{c}
WF	28.97±2.79^{bc}	7.87±0.78^{b}	14.96±1.46^{bc}
CTRL	25.51±2.04^{c}	10.47±0.54^{a}	14.10±0.42^{bc}

Note: Values with common letters are not significantly different ($p < 0.05$)

Colour values (L*, a*, b*) varied significantly among formulations. AF and CF breads had lighter crumbs as indicated by the higher L* value, compared to WF and OF breads. The crust of AF bread exhibited higher browning with lower L* and higher b* value, potentially enhancing visual appeal. Colour differences are influenced by flour pigmentation, Maillard browning, and sugar content, with keto flours generally producing less intense browning than wheat flour due to lower sugar levels. (Spence, 2018).

Table 8: Sensory properties of keto bread

Attributes		**Bread variation**		
	AF	OF	CF	WF
Colour	6.72±1.51^{a}	6.88±1.15^{a}	6.90±1.31^{a}	5.80±1.88^{b}
Aroma	5.76±1.91^{a}	5.72±1.71^{a}	6.18±1.99^{a}	5.68±1.95^{a}
Taste	4.88±1.81^{ab}	4.62±1.84^{b}	5.70±2.02^{a}	5.68±2.18^{a}
Aftertaste	4.86±1.82^{bc}	4.44±1.88^{c}	5.86±1.91^{a}	5.68±2.01^{ab}
Eggy flavour	4.48±1.81^{b}	4.10±1.84^{b}	5.74±1.69^{a}	5.48±1.96^{a}
Overall acceptability	5.20±1.88^{ab}	4.82±1.98^{b}	6.16±1.86^{a}	5.82±1.98^{a}

Note: Values with common letters are not significantly different ($p < 0.05$)

Panellists rated CF bread the highest for colour, followed by OF bread, with WF bread was the lowest. This aligns with instrumental colour data, where CF bread had the highest crumb lightness (L*) and WF bread was the lowest, indicating a preference for lighter crumbs (Spence, 2015). Aroma scores showed no significant differences among keto breads, suggesting flour type did not significantly affect aroma. For taste and aftertaste, CF bread scored the highest and OF bread was the lowest. The cleaner aftertaste of CF bread may have contributed to its higher acceptance. Overall acceptability followed the same trend, where CF bread ranked the highest, OF bread was the lowest, with a

significant difference between those two. CF bread's strong score across multiple attributes suggested that it was the most appealing keto bread to panellists, while OF bread was the least preferred.

CONCLUSION

This study compared the shelf-life, quality attributes, and sensory acceptance of four keto bread formulations with wheat bread. AF bread showed the best microbial stability, while OF bread maintained the most stable pH, indicating both as strong options for shelf-life. AF and OF breads achieved the highest absolute loaf volumes, with OF also having the highest moisture content. AF bread had the softest texture, and OF bread's firmness was closest to wheat bread. CF bread had the lightest crumb colour and was most preferred in sensory evaluation, scoring highest in taste, aftertaste, colour, and overall acceptability. Overall, each flour demonstrated specific strengths, but no single formulation excelled in all aspects. Future research could focus on combining these flours to develop a keto bread with balanced sensory appeal, structural quality, and extended shelf-life.

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NEGERI SEMBILAN INTERNATIONAL EXPOSITION

RSST011 - ANALYSIS OF VEGETATIVE COMMUNITY STRUCTURE AND DIVERSITY OF UiTM KUALA PILAH FOREST

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ABSTRACT

Secondary tropical forests are critical for biodiversity conservation and ecological resilience in Malaysia, yet their structural complexity and recovery potential remain under documented. A lack of detailed data on community composition and forest dynamic limits effective monitoring and sustainable management. This study aims to evaluate the vegetative community structure and diversity of the UiTM Kuala Pilah Forest, a secondary lowland dipterocarp forest. Using stratified random sampling, a 50m x 10m plot was established and subdivided into five 10m x10m subplots. Vegetation data were collected for all trees with a diameter at breast height (DBH) ≥ 10cm. A total of 27 individual trees were recorded, representing 17 genera. Key structural parameters analysed, including genus frequency, basal area, size class distribution, Importance Value Index (IVI), and species diversity using Shannon-Weiner Index and Simpson's Index. Results show that *Shorea* sp. and *Dysoxylum* sp. are the most frequent genera (60%) and share the highest relative density (0.0080 indiv/m²). *Shorea* sp. recorded the highest IVI (44.40), suggesting ecological dominance, while *Cinnamomum* sp. exhibited structural dominance with the largest basal area (0.2068 m²). tree size class distribution showed dominance in the 10.0-14.9 cm class (n=12), forming a reverse-J curve indicative of active regeneration. The Shannon-Weiner Index value of H'= 2.80 reflects moderate to high diversity consistent with other secondary dipterocarp forests, while Simpson's Index (1-D= 0.894) shows high heterogeneity and low dominance among genera. These findings suggest that the UiTM Kuala Pilah Forest supports a structurally heterogeneous and ecologically functional community, highlighting its importance in biodiversity conservation and forest recovery assessment.

Keywords – Vegetative structure, species diversity, lowland dipterocarp forest, basal area, regeneration

INTRODUCTION

Tropical rainforests are among the most biodiverse and ecologically significant ecosystems, sustaining about 60% of global biodiversity (Foo & Numata, 2019; Laurance et al., 2012). Lowland dipterocarp rainforests, dominant in Malaysia, are characterized by emergent trees, multiple canopy layers, and exceptional species diversity (Ariff et al., 2022). Despite their ecological importance, these forests face rapid degradation from logging, agricultural expansion, and habitat fragmentation, particularly in Southeast Asia

(Botterill-James et al., 2024). Between 2005 and 2015, Malaysia contributed 16.6% of forest area loss and 17.4% of aboveground carbon stock loss in the region (Estoque et al., 2019). Even protected forests face indirect threats. For example, Endau-Rompin National Park maintained >97% forest cover, but surrounding buffer zones suffered severe deforestation due to oil palm expansion, reducing ecological connectivity ("leakage effect") (Foo & Numata, 2019).

This highlights the need for conservation strategies that extend beyond formal protection boundaries. The UiTM Kuala Pilah Forest Reserve, a secondary lowland dipterocarp forest in Negeri Sembilan under UiTM management, is under-researched despite its potential as an ecological buffer and research site. The absence of baseline data on species composition, diversity, and vegetative structure hinders evaluation of forest health, monitoring of changes, and informed management decisions. This study provides essential baseline data on the vegetation community structure and diversity of UiTM Kuala Pilah Forest to support ecological monitoring, comparisons with other forests, and informed conservation planning.

OBJECTIVE

The objectives of this study are:

i. To determine the community structure of vegetation in UiTM Kuala Pilah Forest.
ii. To determine the diversity indices of vegetation in UiTM Kuala Pilah Forest.

METHODOLOGY

The study was conducted in UiTM Kuala Pilah Forest, Negeri Sembilan, Malaysia (2.7890° N, 102.2180° E), a 405.41 ha secondary lowland dipterocarp forest formerly part of Pelangai Forest Reserve (Abdullah & Azmir, 2021). The site experiences tropical rainforest conditions with temperatures of 23–32°C and year-round rainfall (Hazir et al., 2019).

A 50 m × 10 m plot was established in the lowland area using stratified random sampling and subdivided into five 10 m × 10 m subplots for systematic data collection. All trees with DBH ≥ 10 cm were measured and identified to genus level using standard botanical references (Whitmore, 1972) and field guides. Unidentified or rare specimens were collected as voucher samples, tagged, pressed, dried, and authenticated.

Data analysis included calculating Shannon-Wiener Diversity Index (H′) and Simpson's Index (1-D) to assess species diversity and categorizing diversity levels based on Fernando (1998) and Baliton et al. (2020). Vegetative parameters such as species density, relative density, frequency, relative frequency, basal area, relative dominance, and Importance Value Index (IVI) were determined using established formulas (Curtis & McIntosh, 1951; Yeom & Kim, 2011).

RESULTS AND DISCUSSION

A total of 27 individual trees from 17 genera were recorded across five sample plots, representing a moderately diverse lowland dipterocarp forest community at early to mid-

successional stages. *Shorea* and *Dysoxylum* were the most frequent genera (60% occurrence), followed by *Syzygium*, *Litsea*, and *Palaquium* (40%). Less frequent genera such as *Xylopia*, *Mallotus*, and *Scaphium* suggest microhabitat specialization and spatial heterogeneity.

The DBH range (10–51.3 cm) indicated a multi-aged structure with both regenerating understory and mature canopy trees. *Cinnamomum* contributed the highest basal area (0.2068 m²) despite low frequency, demonstrating that dominance can be influenced by individual tree size. Size-class distribution followed a reverse-J pattern, with most individuals in the smallest class (10.0–14.9 cm), indicating active regeneration. The absence of certain intermediate classes suggests possible past disturbances or natural mortality. Species density was highest for *Shorea* and *Dysoxylum* (0.0080 indiv/m²), reflecting their structural and ecological prominence. Importance Value Index (IVI) analysis confirmed *Shorea* as the dominant genus (IVI = 44.40), followed by *Dysoxylum* (34.98) and *Cinnamomum* (30.89).

The Shannon-Wiener Index (H′= 2.802) indicated moderate to high diversity, comparable to other secondary lowland dipterocarp forests but lower than pristine sites such as Pasoh and Bukit Panchor. High index of heterogeneity and low dominance were demonstrated by the Simpson's Index (1-D = 0.894) of the forest community. A combination of these metrics implies that UiTM Kuala Pilah Forest is a relatively stable and well-balanced community of vegetation. Dominant genera played key ecological roles: *Shorea* in canopy structure and carbon storage; *Dysoxylum* in mid-storey stratification and seed dispersal; and *Cinnamomum* as an emergent species influencing microclimate and nutrient cycling. Genera like *Xylopia*, *Palaquium*, and *Syzygium* contributed to fruit production, vertical diversity, and shade-tolerant understory layers, supporting biodiversity and long-term forest resilience.

Table 1: Summary of vegetative structure parameters and Importance Value Index (IVI) of tree genera in UiTM Kuala Pilah forest

Genus Name	No. of Individuals	Species Density (indiv/m²)	Frequency (%)	Total Basal Area (m²)	Relative Dominance (%)	IVI Value
Shorea	4	0.0016	60	0.14565	15.95081	44.40198
Dysoxylum	4	0.0016	60	0.05964	6.531453	34.98262
Syzygium	3	0.0012	40	0.03427	3.753066	23.95509
Diospyrus	2	0.0008	20	0.03324	3.640266	15.59313
Dyera	2	0.0008	20	0.01705	1.867224	13.82009
Palaqium	2	0.0008	40	0.02389	2.616305	19.11462
Cinnamomum	1	0.0004	20	0.20677	22.64434	30.8935
Dillenia	1	0.0004	20	0.00894	0.979061	9.22822
Litsea	2	0.0008	40	0.0379	4.150605	16.94522
Endospermum	1	0.0004	20	0.00785	0.85969	9.108849
Xylopia	1	0.0004	20	0.10519	11.51984	19.769

Scaphium	1	0.0004	20	0.04104	4.49448	12.74364
Lithocarpus	1	0.0004	20	0.09931	10.8759	19.12506
Mallotus	1	0.0004	20	0.08301	9.09081	17.33997
Madhuca	1	0.0004	20	0.00937	1.026152	9.275311
Total	**27**			**0.86829**		

CONCLUSION

UiTM Kuala Pilah Forest demonstrates the structural and compositional attributes of a functioning lowland dipterocarp ecosystem, with evidence of active regeneration and ecological stability. The dominance of *Shorea* and the presence of varied DBH classes reflect healthy successional processes typical of such forests in Peninsular Malaysia. The combination of Shannon-Wiener and Simpson's indices emphasized that the forest exhibits resilience and ecological stability. Despite the limited sampling area and genus-level identification, the findings highlight the forest's ecological value for biodiversity conservation, carbon storage, and habitat provision. Expanding the sampling scope and conducting species-level identification in future studies would provide a more comprehensive understanding of its biodiversity and ecological dynamics.

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NEGERI SEMBILAN INTERNATIONAL EXPOSITION

RSST012 - COPROLOGICAL AND MOLECULAR INVESTIGATION OF ANIMAL PARASITE IN COW STOOL IN KUALA PILAH, NEGERI SEMBILAN

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ABSTRACT

Animal parasites is one of the significant threat to cattle productivity and public health due to their potential zoonotic risks. This study investigated the presence of *Toxocara* spp., *Cryptosporidium* spp., and *Fasciola* spp. in cattle from three farms in Kuala Pilah, Negeri Sembilan, using both coprological and molecular methods. A total of 30 faecal samples were examined through direct smear, formalin-ether sedimentation and trichrome staining for coprological analysis. Additionally, Polymerase Chain Reaction (PCR) amplification was performed using each parasite-specific primers to detect the DNA. Coprological results revealed *Toxocara* spp. (40%), *Cryptosporidium* spp. (33.33%), and unidentified animal parasites (13.33%), with no *Fasciola* spp. eggs observed. However, PCR did not yield amplification of all the targeted parasite DNA, which may have been due to low infection intensity, the presence of PCR inhibitors, or limitations in primer sensitivity. Interviews with farm managers revealed that deworming practices were inconsistent and management systems varied across farms, including both free grazing and confined feeding conditions, which may contribute to parasite transmission. These findings indicate a possible low prevalence or subclinical fascioliasis among cattle in the study area. To improve detection accuracy, future studies should incorporate validated primers, synthetic DNA as positive controls, and PCR additives. Regular deworming and improved farm hygiene practices are also recommended to manage parasitic risks more effectively.

Keywords – animal parasites, Toxocara spp., Cryptosporidium spp., Fasciola spp., ITS2 region

INTRODUCTION

Animal parasitic infections in cattle are a persistent challenge to livestock productivity and public health. Gastrointestinal parasites such as *Toxocara* spp., *Cryptosporidium* spp., and *Fasciola* spp. cause significant economic losses as well as possible zoonotic transmission. These parasites can reduce milk production, hinder growth and put animals at risk for various illnesses (Caravedo & Cabada, 2020). The prevalence of parasites can be directly impacted by the significant variations in farm management practices in Malaysia such as grazing systems, hygiene routines and deworming schedules. *Toxocara* spp. mostly infect carnivores but also can be found in ruminants and act as carriers during the parasite life cycle which posing risks of visceral or ocular larva migrans in humans (Centers for Disease

Control and Prevention, 2019a). *Cryptosporidium* spp. is an apicomplexan protozoan which causes cryptosporidiosis in calves and poses health threats to immunocompromised individuals (Centers for Disease Control and Prevention, 2019c. While *Fasciola* spp., are important veterinary and medical trematodes with *F.hepatica* and *F.gigantica* both reported in Southeast Asia, including Malaysia (Fürst et al., 2012).

Until these days, limited reports have been recorded regarding animal parasites in Negeri Sembilan, despite numerous studies being conducted in other states across Malaysia. Hence, the risk of parasitic infection in this state remains unknown. This research aims to identify research gaps on the identification and occurrence of parasitic disease in Negeri Sembilan, utilising cross-sectional surveys from several cattle farm. A coprological examination detects parasite eggs in stool samples observed under the microscope by using three different method which is direct smear, formalin-ether sedimentation and trichrome staining to enhance the detection and identification of parasitic organisms (Thakre et al., 2016). Molecular techniques like the nested polymerase chain reaction (PCR) are also used to target the internal transcribed spacer (ITS) of the gene since they have a higher sensitivity for identifying the parasite gene (Verweij & Stensvold, 2014). This research will help farmers and policymakers develop targeted control strategies, such as improved pasture management, snail control initiatives, and deworming methods, which will lessen the disease's impact by identifying high-risk areas and infection trends. In the end, it can give researchers and practitioners information about the parasitic threat in Negeri Sembilan's cow farms.

OBJECTIVE

This study aims to investigate the occurrence of parasitic infections in Kuala Pilah, Negeri Sembilan. The first objective is to carry out coprological examinations of cows' faeces to detect parasites eggs. Second objective is to perform stool DNA extraction and carry out polyerase chain reaction (PCR) to detect parasites gene in stool samples.

METHODOLOGY

30 stool samples were taken from three selected farms early in the morning. To detect parasite eggs based on morphological features, coprological examination was carried out using the direct-smear and sedimentation method. Trichrome staining was used to improve the visualization of parasite structures and promote protozoan identification (Centers for Disease Control and Prevention, 2019b). To improve the sensitivity and specificity for identifying parasite infections, molecular detection was conducted using PCR amplification that targeted the 5.8S rDNA and ITS2 regions and gel electrophoresis was utilized to verify product size (Verweij & Stensvold, 2014). The recorded data were analysed where the occurrence of parasite infestation in cattle using coprological and molecular methods calculated as percentage value. The overall occurrence (in %) at the animal level were calculated by dividing the total number of cattle.

RESULTS AND DISCUSSION

Based on the coprological result, *Toxocara* spp. was the most prevalent parasite, present in 40% (12/30) of the samples, followed by *Cryptosporidium* spp. in 33.33% (10/30) of samples (Table 1 and 2). Four samples (13.33%) contained unidentified parasite eggs that

could not be classified due to morphological complexity (Table 1 and 2). The presence of these parasites, especially zoonotic species such as *Toxocara* and *Cryptosporidium*, underscores their potential impact on animal health, farm productivity, and public health. This study highlights the need for regular parasitological monitoring, improved farm management, and further taxonomic or molecular analysis to identify other potentially important animal parasites.

Table 1: Coprological findings of parasite species found in 3 farms

Species	***Toxocara* spp.**	***Cryptosporidium* spp.**	**Other animal parasite**
Image under 100x magnification			

Table 2: Number of parasite species found in 3 farms

Farm/Parasite	***Fasciola* spp.**	***Toxocara* spp.**	***Cryptosporidium* spp.**	**Animal parasite**
Farm A	0/10	4/10	6/10	0/10
Farm B	0/4	1/4	1/4	0/4
Farm C	0/16	7/16	3/16	4/16
Total	0/30	12/30	10/30	4/30

According to molecular findings, PCR amplification targeting the universal 16S rRNA gene of *Eubacteria* confirmed good DNA extraction quality and optimal PCR conditions (Hong et al., 2024). However, amplification for *Fasciola* spp. (expected size: 1000 bp) failed despite repeated standard and nested PCR attempts, suggesting parasite absence or low parasite load in the sampled cattle (data not shown). For *Cryptosporidium* spp., amplification of a 655 bp fragment produced visible bands, but identical amplification occurred in negative controls, indicating primer contamination and made the results unreliable. These molecular results were consistent with coprological observations for *Fasciola* spp. but inconclusive for *Cryptosporidium* spp., highlighting the need for validated molecular protocols to ensure accurate parasite detection.

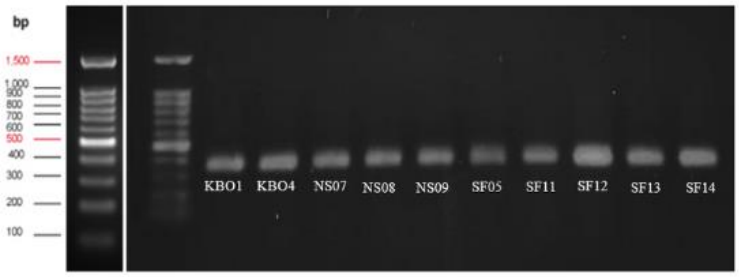

Figure 1: Amplified PCR product of the *Eubacteria* observed on gel electrophoresis

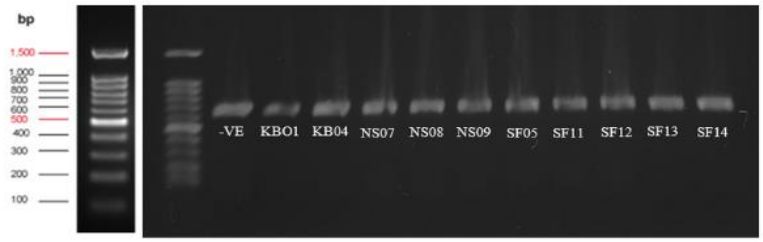

Figure 2: Amplified PCR product of the *Cryptosporidium* spp. observed on gel electrophoresis

CONCLUSION

In conclusion, microscopic analysis revealed various gastrointestinal parasites, with 40% of samples positive for *Toxocara* spp., 33.33% for *Cryptosporidium* spp., and 13.33% for other unidentified species. PCR results did not detect *Fasciola* spp. DNA, but successful amplification of *Eubacteria* DNA confirmed the reliability of the extraction and reagents, suggesting a true absence rather than a technical error. These findings indicate that cattle in the area continue to be exposed to parasitic infections, underscoring the need for routine surveillance, improved diagnostic tools, and regular deworming programs. Enhancing molecular detection through the use of positive controls, PCR additives, and validated primers will further strengthen parasite monitoring and control strategies in livestock across Malaysia.

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RSST013 - ADVANCING AI-READY TEACHER EDUCATION: INTEGRATION OF GENERATIVE AI

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ABSTRACT

The integration of Generative Artificial Intelligence (GenAI) into teacher education holds significant potential to enhance academic outcomes, foster engagement, and strengthen communication between educators and learners. This study examines the perceptions of trainee teachers on the integration of Generative AI at the Institute of Teacher Education, Technical Education Campus (IPGKPT). Anchored within global and national policy frameworks including the OECD Learning Compass 2030, UN Sustainable Development Goal 4, Malaysia's Digital Education Policy 2023–2030, and Malaysia TVET Policy 2030 as the research positions GenAI as a catalyst for educational transformation. Employing a descriptive quantitative design, data were collected from a stratified cohort of Bachelor of Teaching (PISMP) trainee teachers via a structured questionnaire adapted from validated instruments and demonstrating high reliability (Cronbach's $\alpha > 0.90$). Descriptive statistical analyses revealed strong positive perceptions of improvement and engagement ($M = 3.59$, $SD = 1.18$), barriers and challenges ($M = 3.37$, $SD = 1.03$) and communication and independence ($M = 3.12$, $SD = 1.02$). Nonetheless, notable concerns were identified, including ethical issues, fairness in assessment, infrastructural limitations, and the risk of diminishing the teacher's role. These findings highlight the need for targeted professional development, clear institutional guidelines, and equitable access to resources to ensure responsible GenAI integration. The study contributes empirical evidence to the growing discourse on AI readiness in teacher education, offering strategic recommendations aligned with Malaysia's national digital and TVET priorities.

Keywords – Generative AI, TVET, Trainee Teachers

INTRODUCTION

The integration of Generative AI (GenAI) into teacher education represents a transformative opportunity to enhance the pedagogical landscape. As educational institutions increasingly recognize the potential of AI technologies, there is a pressing need to prepare educators who are not only proficient in utilizing these tools but also equipped to navigate the ethical and practical challenges they present (Jain & Singh, 2023). By advancing AI-ready teacher education, we can foster a generation of educators capable of leveraging GenAI to create personalized learning experiences, promote student engagement, and facilitate innovative teaching practices. This integration requires a multifaceted approach, encompassing professional development, AI literacy, and the

establishment of supportive frameworks that empower teachers to harness the full potential of Generative AI in their classrooms (Merino-Campos, 2025).

The integration of Generative AI into teacher education offers significant opportunities for improvement and engagement by personalizing learning experiences and enhancing student motivation through tailored content (Nazaretsky et al., 2022). However, this integration is not without barriers and challenges, including the need for adequate training, ethical concerns regarding data privacy and algorithmic bias, and the risk of depersonalization in learning (Owoseni et al., 2024). Effective communication among stakeholders is essential to navigate these complexities, as it fosters collaboration and the sharing of best practices. Additionally, promoting independence among educators in utilizing AI tools empowers them to adapt these technologies to their unique teaching contexts, ultimately leading to innovative instructional strategies. Balancing these constructs is crucial for maximizing the benefits of Generative AI while addressing its challenges in teacher education (Zhang & Miao, 2024).

OBJECTIVE

The specific objective of this study is to examine the perceptions of trainee teachers at the Institute of Teacher Education, Technical Education Campus (IPGKPT) on the integration of Generative Artificial Intelligence (GenAI) tools into teacher education. The insights gained are crucial for identifying gaps in AI-related competencies, informing the development of targeted professional development programs, clear institutional guidelines, and equitable access to resources that align with technical and pedagogical needs. Furthermore, the findings will be valuable to policymakers, program designers, and lecturers in formulating strategies that support AI readiness in teacher education in line with national and global policy frameworks. In order to achieve the above objective, this paper attempts to answer the following research questions:

i. What is the level of improvement and engagement for GenAI tools in teacher education among trainee teachers at IPGKPT?
ii. What is the level of barriers and challenges for GenAI tools in teacher education among trainee teachers at IPGKPT?
iii. What is the level of communication and independence for GenAI tools in teacher education among trainee teachers at IPGKPT?

METHODOLOGY

This study employed a quantitative descriptive survey to examine the integration of Generative AI among 61 pre-service teachers from the Bachelor of Teaching Degree Program (PISMP), June 2022 intake, specialising in Design and Technology at the Institute of Teacher Education, Technical Education Campus (IPGKPT). The sample was determined using the Krejcie and Morgan (1970) framework and selected via simple random sampling. Data were collected through a structured, expert-validated questionnaire comprising 15 items across three constructs namely improvement and engagement, barriers and challenges, and communication and independence were administered via Google Forms for efficiency and data integrity. Pilot-tested with 30 respondents, the instrument demonstrated high reliability (Cronbach's $\alpha = 0.86–0.92$) and strong content validity. A 5-point Likert scale was used, with mean score interpretation following Tschannen-Moran and Gareis (2004). Data were analysed using descriptive

statistics (mean, SD) in SPSS v30. The systematic design, including pilot testing, expert review, and robust reliability assessment, ensured accurate, consistent, and contextually relevant findings to address the research objectives.

RESULTS AND DISCUSSION

Academic Improvement and Engagement for GenAI Tools in Teacher Education

Table 1 demonstrates the mean value and level of academic improvement and engagement for Gen AI Tools in teacher education at Institute of Teacher Education, Technical Education Campus (IPGKPT) is at a high level (M=3.59, SD=1.18). Based on Table 1 as shown below, the descriptive analysis found that the overall mean of academic improvement and engagement for Gen AI Tools in teacher education is at a high level.

Table 1: Academic Improvement and Engagement for GenAI Tools in Teacher Education

Item		Mean	SD	Level
B01	I believe that the use of Generative AI tools can significantly enhance students' academic performance and assessment outcomes.	3.33	1.29	Average
B02	Generative AI tools have the potential to make teaching and learning processes more engaging, interactive, and enjoyable for both tutors and students.	3.98	0.90	High
B03	The integration of Generative AI tools in teaching can positively influence students' motivation to participate actively in learning activities.	3.48	1.22	High
B04	Generative AI tools can support the facilitation of challenging lessons by providing adaptive explanations, examples, and scaffolding.	3.60	1.24	High
B05	The use of Generative AI tools enables tutors to effectively address diverse learners' needs and learning styles within the classroom.	3.60	1.20	High
B06	Integrating Generative AI tools into teaching practice can expand tutors' subject-matter knowledge and pedagogical resources.	3.56	1.22	High
		3.59	**1.18**	**High**

Barriers and Challenges for GenAI Tools in Teacher Education

Table 2 demonstrates the mean value and level of barriers and challenges for Gen AI Tools in teacher education at Institute of Teacher Education, Technical Education Campus (IPGKPT) is at a high level (M=3.37, SD=1.03). Based on Table 2 as shown below, the descriptive analysis found that the overall mean of barriers and challenges for Gen AI Tools in teacher education is at a high level.

Table 2: Barriers and Challenges for GenAI Tools in Teacher Education

Item		Mean	SD	Level
C07	My limited knowledge of the ethical implications of Generative AI use in education discourages me from integrating it into my teaching practice.	3.24	1.05	Average
C08	The lack of adequate technological infrastructure and resources limits my ability to effectively use Generative AI tools in teaching	3.23	1.05	Average
C09	The use of Generative AI tools may result in uniformity in student assessment, making it challenging to evaluate students fairly and accurately.	3.44	1.04	High
C10	The integration of Generative AI tools into teaching requires clear guidelines and institutional support to address fairness, ethics, and assessment integrity.	3.68	0.99	High
C11	The increasing independence of students using Generative AI tools may reduce their reliance on and appreciation for the tutor's expertise.	3.52	0.99	High
C12	Generative AI tools can facilitate new modes of interaction and communication between tutors and students, potentially enhancing engagement and collaboration.	3.11	1.07	Average
		3.37	**1.03**	**High**

Communication and Independence of using GenAI Tools in Teacher Education

Table 3 demonstrates the mean value and level of communication and independence of using Gen AI Tools in teacher education at Institute of Teacher Education, Technical Education Campus (IPGKPT) is at a high level (M=3.37, SD=1.03). Based on Table 3 as shown below, the descriptive analysis found that the overall mean of communication and independence of using Gen AI Tools in teacher education is at a average level.

Table 3: Communication and Independence of using GenAI Tool in Teacher Education

Item		Mean	SD	Level
D13	Generative AI tools can facilitate new forms of interaction and communication between tutors and students, enhancing engagement and collaboration in the learning process.	3.24	1.03	Average
D14	Tutors require targeted professional development to learn how to use Generative AI tools effectively and integrate them into the curriculum in alignment with pedagogical objectives.	3.08	1.04	Average
D15	The integration of Generative AI tools into teaching practices may alter or reduce the use of traditional instructional approaches that are valuable for student learning.	3.03	0.99	Average
		3.12	**1.02**	Average

CONCLUSION

In conclusion, the successful integration of Generative AI tools in teacher education hinges on a careful balance between leveraging their potential for enhancing engagement and learning outcomes while addressing the inherent barriers and challenges. By fostering effective communication among educators, administrators, and technology developers, and promoting independence in the use of AI tools, the educational landscape can be transformed to support innovative teaching practices. As educators navigate this evolving

terrain, it is essential to remain vigilant about ethical considerations and the need for ongoing professional development, ensuring that the benefits of Generative AI are realized without compromising the quality and personalization of the educational experience. Ultimately, embracing these advancements can lead to a more dynamic and responsive educational environment that meets the diverse needs of all learners.

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