



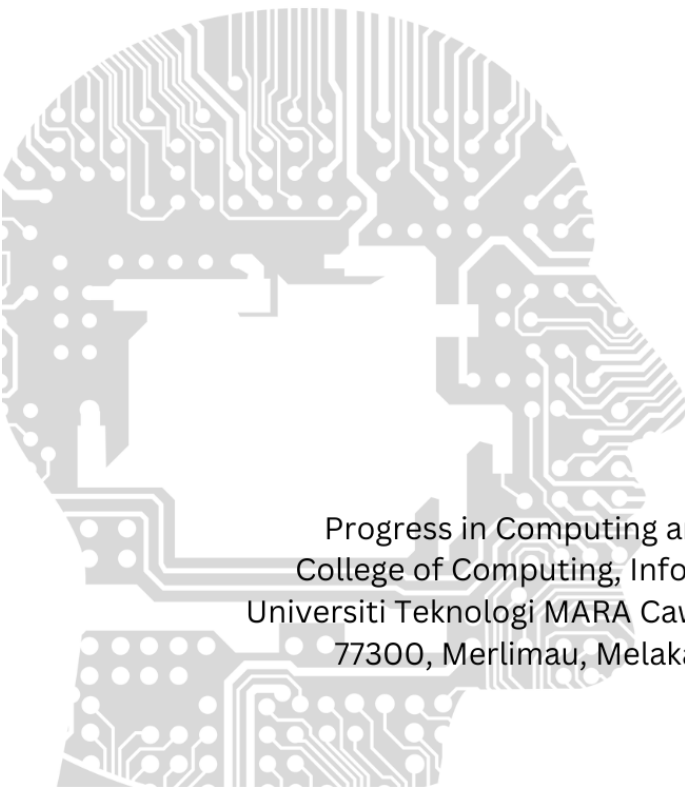
Cawangan Melaka

PCMJ

Progress in Computing and Mathematics Journal

volume 1

<https://fskmjebat.uitm.edu.my/pcmj/>



Progress in Computing and Mathematics Journal
College of Computing, Informatics, and Mathematics
Universiti Teknologi MARA Cawangan Melaka, Kampus Jasin
77300, Merlimau, Melaka Bandaraya Bersejarah

PCMJ

Progress in Computing and Mathematics Journal
volume 1



UNIVERSITI
TEKNOLOGI
MARA

Cawangan Melaka

Progress in Computing and Mathematics Journal (PCMJ)
College of Computing, Informatics, and Mathematics
Universiti Teknologi MARA Cawangan Melaka, Kampus Jasin
77300, Merlimau, Melaka Bandaraya Bersejarah

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior permission.

EDITORS

Ahmad Firdaus Ahmad Fadzil
Khyrina Airin Fariza Abu Samah
Raihana Md Saidi
Shahadan Saad
Sheik Badrul Hisham Jamil Azhar
Zainal Fikri Zamzuri
Siti Feirusz Ahmad Fesol
Salehah Hamzah
Raseeda Hamzah
Mohamad Asrol Arshad
Mohd Hafifi Mohd Supir
Nurul Hidayah Mat Zain
Syamsul Ariffin Yahaya
Edzreena Edza Odzaly

PCMJ

Progress in Computing and Mathematics Journal

volume 1

PREFACE

Welcome to the inaugural volume of the **Progress in Computing and Mathematics Journal (PCMJ)**, a publication proudly presented by the College of Computing, Informatics, and Mathematics at UiTM Cawangan Melaka.

This journal represents a significant step in our commitment to fostering a vibrant research culture, initially providing a crucial platform for our undergraduate students to showcase their intellectual curiosity, dedication to scholarly pursuit, and potential to contribute to the broader academic discourse in the fields of computing and mathematics. However, we envision PCMJ evolving into a beacon for researchers both nationally and internationally. We aspire to cultivate a space where groundbreaking research and innovative ideas converge, fostering collaboration and intellectual exchange among established scholars and emerging talents alike.

The manuscripts featured in this first volume, predominantly authored by our undergraduate students, are a testament to the hard work and dedication of these budding researchers, as well as the guidance and support provided by their faculty mentors. They cover a diverse range of topics, reflecting the breadth and depth of research interests within our college, and set the stage for the high-quality scholarship we aim to attract in future volumes.

As editors, we are honored to have played a role in bringing this journal to fruition. We extend our sincere gratitude to all the authors, reviewers, and members of the editorial board for their invaluable contributions. We also acknowledge the unwavering support of the college administration in making this initiative possible.

We hope that PCMJ will inspire future generations of students and researchers to embrace research and innovation, to push the boundaries of knowledge, and to make their mark on the world of computing and mathematics.

Editors

Progress in Computing and Mathematics Journal (PCMJ)
College of Computing, Informatics, and Mathematics
UiTM Cawangan Melaka

TABLE OF CONTENTS

LIST OF EDITORS	iii
PREFACE	iv
TABLE OF CONTENTS	v
SIMPLIFIED DRONE GAME FOR INITIAL REMEDIAL INTERVENTION FOR DYSPRAXIA AMONG KIDS	1
DEVELOPMENT OF STORAGE BOX WITH AUTOMATED AND REMOTE LOCK CONTROL SYSTEM IN WLAN ENVIRONMENT	16
COMPARATIVE ANALYSIS OF PASSWORD CRACKING TOOLS	29
SPORT FACILITIES FINDER USING GEOLOCATION	50
READ EASY AR: INTERACTIVE STORYBOOK FOR SLOW LEARNER	60
MATHMINDSET: GAME-BASED LEARNING TO REDUCE MATH ANXIETY	87
NETWORK PERFORMANCE ANALYSIS ON DIFFERENT ISP USING ONLINE CLASS PLATFORM ON DIFFERENT DEVICES.....	101
CIVIC HEROES; ENHANCING CIVIC AWARENESS THROUGH GAME-BASED LEARNING.....	115
ENHANCING COMMUNITY SQL INJECTION RULE IN INTRUSION DETECTION SYSTEM USING SNORT WITH EMAIL NOTIFICATIONS.....	124
LEARNING ABOUT MALAYSIA THROUGH GAME	138
STUDENT CHATROOM WITH PROFANITY FILTERING	150
ARCHITECTURE BBUILD AND DESIGN BUILDING THROUGH VIRTUAL REALITY	162
VEHICLE ACCIDENT ALERT SYSTEM USING GPS AND GSM	174
MARINE ODYSSEY: A NON-IMMERSIVE VIRTUAL REALITY GAME FOR MARINE LITTER AWARENESS.....	187
GAME BASED LEARNING FOR FIRE SAFETY AWARENESS AMONG PRIMARY SCHOOL CHILDREN.....	207
SIMULATING FLOOD DISASTER USING AUGMENTED REALITY APPLICATION	220
CRITICAL THINKER: VISUAL NOVEL GAME FOR BUILDING CRITICALTHINKING SKILLS	231
POPULAR MONSTER:.....	239
FIGURE SPRINTER: EDUCATIONAL ENDLESS RUNNING GAME TO LEARN 2D AND 3D SHAPE.....	252
AR MYDREAMHOUSE: AUGMENTED REALITY FOR CUSTOMISING HOUSE	265
RENTAL BIKE SERVICES WITH REAL TIME CHAT ASSISTANCE	308
IDOBI: IOT INTEGRATED SELF-SERVICE WASHING MACHINE RESERVATION SYSTEM WITH CODE BASED BOOKING TOKEN	321

TRADITIONAL POETRY OF UPPER SECONDARY STUDENTS VIA MOBILE APPLICATION	332
A MOBILE TECH HELPER RECOMMENDATIONS APPLICATION USING GEOLOCATION WITH AUTOMATED WHATSAPP MESSENGER.....	347
TURN-BASED ROLE-PLAYING GAME BASED ON MUSIC THEORY	370
FADTRACK: DEVELOPMENT OF VEHICLE TRACKING SYSTEM USING GPS	384
MENTALCARE: GAME-BASED LEARNING ON MENTAL HEALTH AWARENESS	397
HALAL INTEGRITY INSPECTOR:.....	411
MOBILE APPLICATION FOR REAL TIME BABY SIGN LANGUAGE RECOGNITION USING YOLOV8.....	434
TRAVEL TIME CONTEXT-BASED RECOMMENDATION SYSTEM USING CONTENT-BASED FILTERING	448
DETECTION SYSTEM OF DISEASE FROM TOMATO LEAF USING CONVOLUTIONAL NEURAL NETWORK	460
VIRTUAL REALITY (VR) FOR TEACHING AND LEARNING HUMAN ANATOMY IN SECONDARY SCHOOL.....	471
LEARNING KEDAH’S DIALECT VIA GAME-BASED LEARNING	490
AUTOMATED FACIAL PARALYSIS DETECTION USING DEEP LEARNING	504
ENHANCING CRIMINAL IDENTIFICATION: SVM-BASED FACE RECOGNITION WITH VGG ARCHITECTURE.....	517
WEB BASED PERSONALIZED UNIVERSITY TIMETABLE FOR UITM STUDENTS USING GENETIC ALGORITHM.....	528
SMART IQRA’ 2 MOBILE LEARNING APPLICATION	545
ANIMAL EXPLORER: A WALK IN THE JUNGLE.....	557
FOOD RECOMMENDATION SYSTEM FOR TYPE 2 DIABETES MELLITUS USING CONTENT-BASED FILTERING	569
WEB-BASED PERSONAL STUDY HELPER BASED ON LESSON PLAN USING GAMIFICATION	580
DIETARY SUPPLEMENT OF COLLABORATIVE RECOMMENDATION SYSTEM FOR ATHLETE AND FITNESS ENTHUSIAST.....	596
AUTOMATED HELMET AND PLATES NUMBER DETECTION USING DEEP LEARNING	611
VIRTUAL REALITY IN MATHEMATICAL LEARNING FOR SECONDARY SCHOOL.....	622
VIRTUAL REALITY (VR) IN CHEMISTRY LEARNING FOR SECONDARY SCHOOLS STUDENTS	634
GOLD PRICE PREDICTION USING LONG SHORT-TERM MEMORY APPROACH	651
ARTQUEST: A VIRTUAL REALITY ESCAPE ROOM FOR LEARNING ART HISTORY LESSONS.....	664
FIRE SURVIVAL: A FIRE SAFETY GAME USING GAME- BASED LEARNING.....	675
ANIMALAR: AN INTERACTIVE TOOL IN LEARNING EDUCATIONAL ANIMAL KINGDOM THROUGH AUGMENTED REALITY	690

ANIMAL EXPLORER: A WALK IN THE JUNGLE

Nurul Irdina binti Shahrizam

2021106691@student.uitm.edu.my

Siti Fatimah Mohd Rum

Fatimah418@uitm.edu.my

Article Info

Abstract

The Animal Explorer: A Walk in the Jungle, an interactive multimedia-based smartphone application tailored for elementary school students in standard 4,5 and 6, seeks to enhance science learning experiences. Specifically designed for portable and hand-held touch-controlled gadgets, the application addresses the challenges encountered by elementary students in comprehending the intricate components of the Classification of Animals. The project's primary focus is to assist students in successfully learning about classified animals in the vertebrates and invertebrates group, aiming to alleviate the difficulties associated with understanding this complex topic. The methodology used in this project is the ADDIE methodology. ADDIE methodology, divided into 5, which is analysis, design, development, implementation, and evaluation phases, ensures an efficient and planned development process for the interactive learning program. Based on the System Usability Scale (SUS) questionnaire in the survey, the application that has been developed is confirmed to be excellent with a 95.10% percentage of participants agreeing that the application is enjoyable, efficient, interactive, and user-friendly. In conclusion, the integration of the ADDIE method with interactive elements results in the creation of an effective and engaging educational tool, offering students a multimedia-rich learning experience that enhances overall success in science education at the elementary school level.

Received: February 2024

Accepted: August 2024

Available Online: October 2024

Keywords: ADDIE methodology, System Usability Scale (SUS), Classification of Animals, Science education, Elementary school students.

INTRODUCTION

In Malaysia's education system, particularly in science subjects for students in standards 4, 5, and 6, animal classification and anatomy are key topics (Cinici, 2018). This includes learning about vertebrates and invertebrates, as well as the internal structures of animals such as their skeletal, muscular, respiratory, and digestive systems (Sumintono, n.d.). Recognizing the need to modernize science education, there is a push to make learning more relevant and engaging for students, with the suggestion to develop educational applications like "Animal Explorers: A Walk in the Jungle". This multimedia-based mobile application aims to provide a new approach to learning science through interactive features and animations. It will focus

on two main modules: vertebrates (including fish, amphibians, mammals, reptiles, and birds) and invertebrates (such as sponges, worms, cnidarians, echinoderms, mollusks, and arthropods), with three sub-modules for each (Kundariati et al., 2020). Each module will offer detailed explanations of animal characteristics, habitats, behaviors, and reproductive methods, accompanied by 2D animations, videos, and images to enhance engagement.

The application's design will leverage multimedia elements such as text, graphics, audio, video, and animation to create an immersive learning experience. Additionally, interactive activities like quizzes and drag-and-drop exercises will be included to assess students' comprehension and deepen their understanding of the subject matter. Geared towards students aged 10 to 12 who are currently studying and interested in animals and science, this application aims to make learning about animals more enjoyable and accessible, ultimately fostering a greater interest and understanding of science among Malaysian schoolchildren (Broud, 2018).

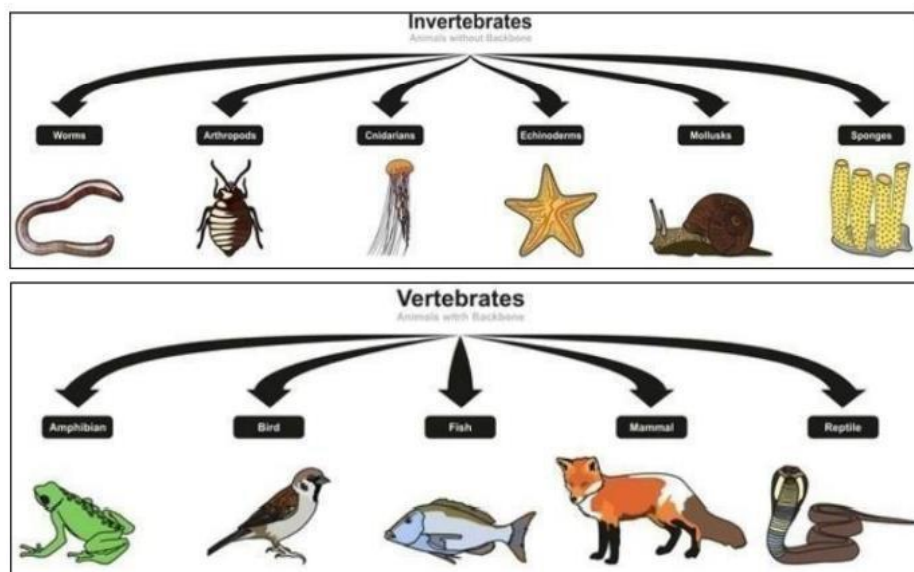


Figure 1: Types of Vertebrates and Invertebrates

LITERATURE REVIEW

Classification is the arrangement of object such as e.g. ideas or information into groups. Its goal is to make object simpler to recognize, describe, arrange, locate and study. Publications indicate that students may find it challenging to classify animals and other things despite the fact that categorization itself is designed to help people unify or clarify object they are interested in (Reiss & Tunnicliffe, 2018).

Animal classification is like sorting animals into groups based on their similarities and differences. In order to study and learn about the incredible variety of species that populate our world, scientists take these steps.

What is Animal Classification in Science?

Animal classification is crucial in biology, providing a systematic approach to understanding animal diversity. Taxonomy, the classification process, involves grouping animals based on shared characteristics and genetic links. This hierarchical system, from kingdom to phylum, helps scientists interpret evolutionary relationships and organize biological data for research and conservation efforts.

Technology Tools for E-Learning?

E-learning applications serve as virtual platforms tailored for educational purposes, accessible across devices like smartphones and tablets. They offer a range of educational materials, from text-based content to multimedia resources and interactive modules, including quizzes and games to engage learners actively.

Designed to be mobile-friendly, these apps provide flexibility and convenience, enabling anytime, anywhere access to educational content. Specifically developed for primary school students, apps like "Animal Explorer: A Walk in the Jungle" simplify complex topics such as animal classification, enhancing interest and understanding in online learning. Additionally, offline assessment capabilities make studying more accessible, as students can engage with the app across various devices without requiring an internet connection.

METHODOLOGY

The methodology that is suitable is ADDIE Methodology which contains 5 phases; analysis, design, development, implementation, and evaluation. These phases will be explained

in more detail to achieve good software for this project. Figure 2 shows the ADDIE methodology phases.

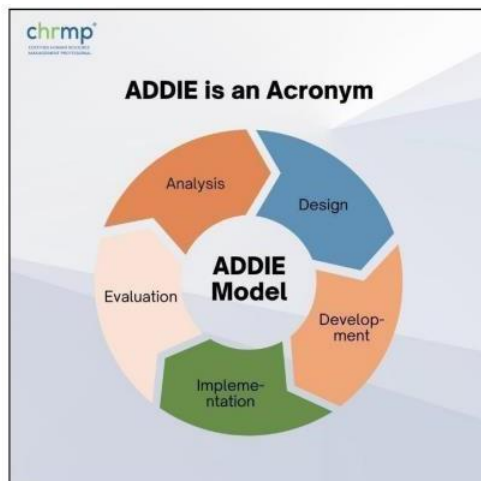


Figure 2: ADDIE Model

Analysis Phase

In the analysis phase of the ADDIE model for instructional design, the focus is on understanding the requirements and goals of the project. This includes identifying the problem statement, objectives, and content for an interactive multimedia-based mobile application aimed at teaching Animal Classification to children aged 10 to 12.

Design Phase

In the design phase of the "Animal Explorer: A Walk in the Jungle" Mobile Learning Application using the ADDIE model, the main focus is on creating a storyboard or mobile application interface. This step provides clear guidance and facilitates development by visualizing user interactions. Developing a flowchart and storyboard ensures that the design aligns with the project objectives and sets the stage for further development and implementation.

Development Phase

In the third phase of the ADDIE model, users actively participating in development provide faster input and solutions for confusing features. By examining and testing modifications before moving forward, faults are discovered sooner. This early feedback reduces time and

costs in the development phase by ensuring that consumer needs are addressed early on, resulting in a quicker and less expensive process.

Implementation Phase

During this phase, the "Animal Explorer: A Walk in the Jungle" application is developed according to the plans outlined in the development phase. Testing is conducted on the developed mobile application. Target users, specifically students, participate in testing the prototype to ensure its functionality and usability.

Evaluation Phase

In the evaluation phase, the "Animal Explorer: A Walk in the Jungle" application prototype is refined based on primary school standards 4, 5, and 6 feedback. Iterative adjustments are made until the application functions flawlessly and meets user satisfaction, ensuring its effectiveness.

DESIGN AND DEVELOPMENT

The design and development stages of the project matter most because that's when the process of creating educational mobile applications begins. To make sure that there are no problems, the flow needs to be properly planned and subjected to specific evaluations. The developer is responsible for analyzing the project's requirements, design, development, implementation, and its evaluation, as described in detail below.

Project Flowchart

The flow of this mobile app learning is just simple and easy to understand as shown in Figure 3 below.

- *Main Page:*
Users land on the main page upon opening the app.
- *Start:*
Users press "Start" to proceed.
- *Interface Selection:*
Users choose between "Let's learn!" or "Test your understanding".
- *Interface Selection:*
Users choose between "Let's learn!" or "Test your understanding".
- *Test Your Understanding:*

Users engage in three types of games: challenge (quiz), drag and drop, and guess game.

- *Repeat or Explore:*

Users can repeat the learning process or explore different topics as desired.

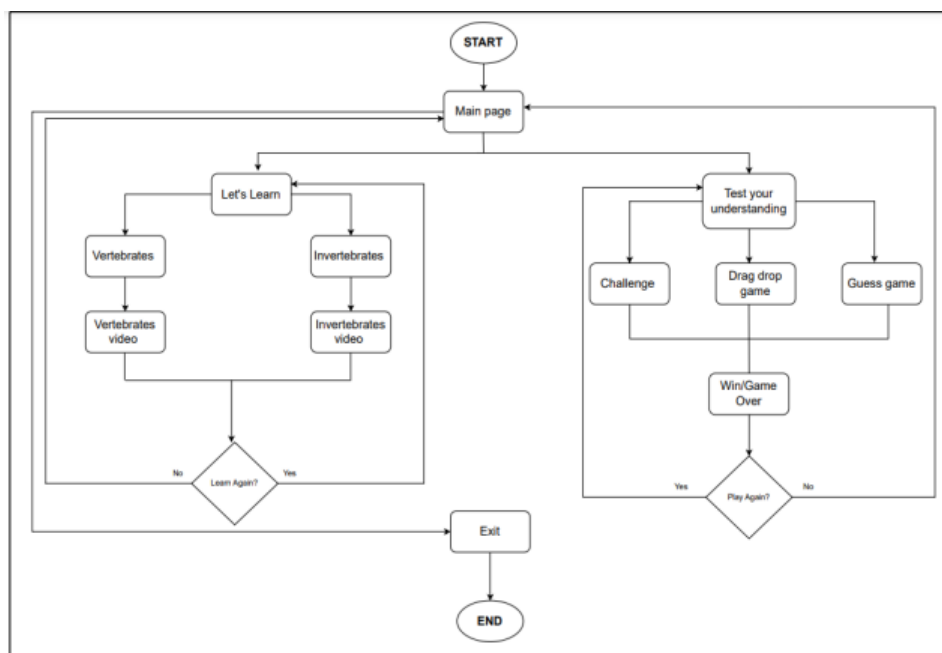


Figure 3. Flow of project

Application development

The Animal Explorer app uses books, YouTube videos, articles, and school syllabus to create its content. It's tested against real student standards 4, 5, and 6. Everything from background design to button creation, video animation, learning integration, and quiz design is carefully crafted for primary school students, ensuring a great learning experience.

Learning integration

The app enriches the user's learning experience by seamlessly integrating educational content and tools into its interface. Users can acquire new knowledge or skills while using the app for its main purpose. The learning materials are aligned with standards 4, 5, and 6 in science education, with textbooks serving as a key reference for creating video learning animations. See Figure 4 for an example of vertebrate learning within the app.

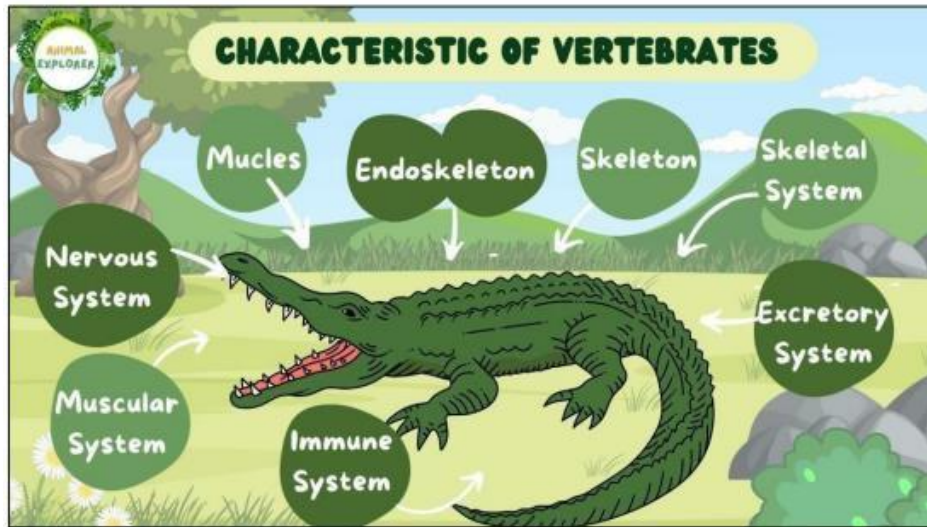


Figure 4. Learning Vertebrates

Learning Quiz

In a mobile learning context, a learning quiz involves including assessments within the app's educational content. These quizzes evaluate user understanding and may feature interactive formats like multiple-choice or true/false questions. They aim to reinforce learning, offer feedback, and measure progress in the science subject. Figures 5 illustrate examples of quiz learning within the application.



Figure 5. Quiz Learning

TESTING AND EVALUATION

Evaluation

User feedback is crucial for assessing whether the learning mobile app meets project objectives, particularly in terms of enjoyment. The System Usability Scale (SUS) questionnaire is employed to gauge user enjoyment. It comprises ten questions aimed at gathering feedback on the perceived usability of the system. Users rate their agreement or disagreement on a scale from strongly disagree to strongly agree, providing valuable insights into the app's usability and overall user experience.

System Usability Scale (SUS)

In table 1, the System Usability Scale (SUS) was chosen for the questionnaire. SUS focuses on efficiency, ease of use, and learnability, vital for learning contexts. Task success rates from participant surveys reinforce this choice. High success rates and positive feedback indicate an enjoyable user experience, validating the app's effectiveness for learning.

Code	Question
1	I think that I would like to use this application frequently
2	I found the application unnecessarily complex
3	I thought the application was easy to use
4	I think that I would need the support of a technical person to be able to use this application
5	I found the various functions in the application were well integrated
6	I thought there was too much inconsistency in this application
7	I would imagine that most people would learn to use this application very quickly
8	I found the system very cumbersome to use
9	I felt very confident using this application
10	I need to learn a lot of things before I could get going with this application

Table 1. SUS Questionnaire

In the table 1 above, there are the scoring system. Participants were told to pick the number that show their thought on each question in the System Usability Scale (SUS). This scale can get a feedback of how the application works from user. And table 2 below shows a SUS Scale Rating Score of the overall feedback from user.

Score	Information
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

Table 2. Scoring Information

Enjoyment Evaluation

The app was tested with 34 primary school students aged 10 to 12 at Sekolah Kebangsaan Merlimau 1. Feedback was collected through Google Forms (5 responses) and paper forms (29 responses). The focus was on usability, enjoyment, educational effectiveness, and engagement in learning about vertebrates and invertebrates. Observations included how well students interacted with the app, their comprehension, and overall engagement. This feedback will help refine the app to better meet the needs of its target audience. The iterative process ensures the app is informative, engaging, and user-friendly for students.

Respondent	Odd Question	Even Questions	RAW Calculation (SUS)	Final Score (SUS)
1	18	19	37	92.5
2	15	19	34	85
3	17	20	37	92.5
4	17	20	37	92.5
5	16	20	36	90
6	16	18	34	85
7	17	20	37	92.5
8	18	19	37	92.5
9	20	20	40	100
10	18	20	38	95
11	19	20	39	97.5
12	18	19	37	92.5
13	17	20	37	92.5
14	20	19	39	97.5
15	20	20	40	100
16	20	20	40	100
17	18	20	38	95
18	19	20	39	97.5
19	20	19	39	97.5
20	20	20	40	100
21	19	20	39	97.5
22	18	19	37	92.5
23	19	20	39	97.5
24	19	19	38	95
25	19	20	39	97.5
26	19	20	39	97.5
27	20	20	40	100
28	20	20	40	100
29	18	20	38	95
30	20	20	40	100
31	20	20	40	100
32	12	19	31	77.5
33	12	20	32	80
34	13	20	33	82.5
AVERAGE				94.10%

Table 3. Result Calculation (SUS)

SUS Score	Grade	Adjective Rating
94.10%	A	Excellent

Table 4. Result of (SUS) Scale

An average SUS Score of 94.10% that people find the system is effective and user friendly. 94.10% of respondents expressed agreement with the notion that the application provides an effective and user-friendly learning experience. This suggests get an Excellent which is grade A in (SUS) rating table in table 4, of consensus among the participants regarding the positive attributes of the application's educational features.

CONCLUSION AND RECOMMENDATION

Project Conclusion

"Animal Explorer: A Walk in the Jungle" is a learning application designed to make science education enjoyable. It offers a fun way for users, primarily students in standards 4, 5, and 6, to learn about vertebrates and invertebrates. The app provides comprehensive information on the characteristics, classification, and examples of these animal groups. It aligns with educational curricula, serving as an interactive supplement to classroom learning. By incorporating visual elements like images, videos, and interactive features, the app caters to diverse learning styles, making the learning experience engaging and effective. Users can study at their own pace, fostering a deeper understanding and appreciation for animals. Ultimately, the app aims to make science education more accessible and engaging for all learners.

Project Limitation

The Animal Explorer: A Walk in the Jungle application project has identified a notable limitation: exclusivity to Android users. The app is only available as an APK for Android devices, excluding iOS users. This decision limits accessibility to those with Android devices, such as smartphones and tablets, while individuals with iOS devices like iPhones or iPads are unable to access the educational content and features. This platform-specific restriction narrows the reach of the app, potentially excluding a significant portion of users who could benefit from the informative content and interactive features related to the study of vertebrates and invertebrates.

Another limitation of the Animal Explorer app could be insufficient content depth, potentially limiting its utility for users seeking advanced information. Additionally, staying current with evolving scientific knowledge might be challenging, leading to outdated content. Regular updates are essential to address these limitations and maintain the app's relevance as an educational tool.

Future Work

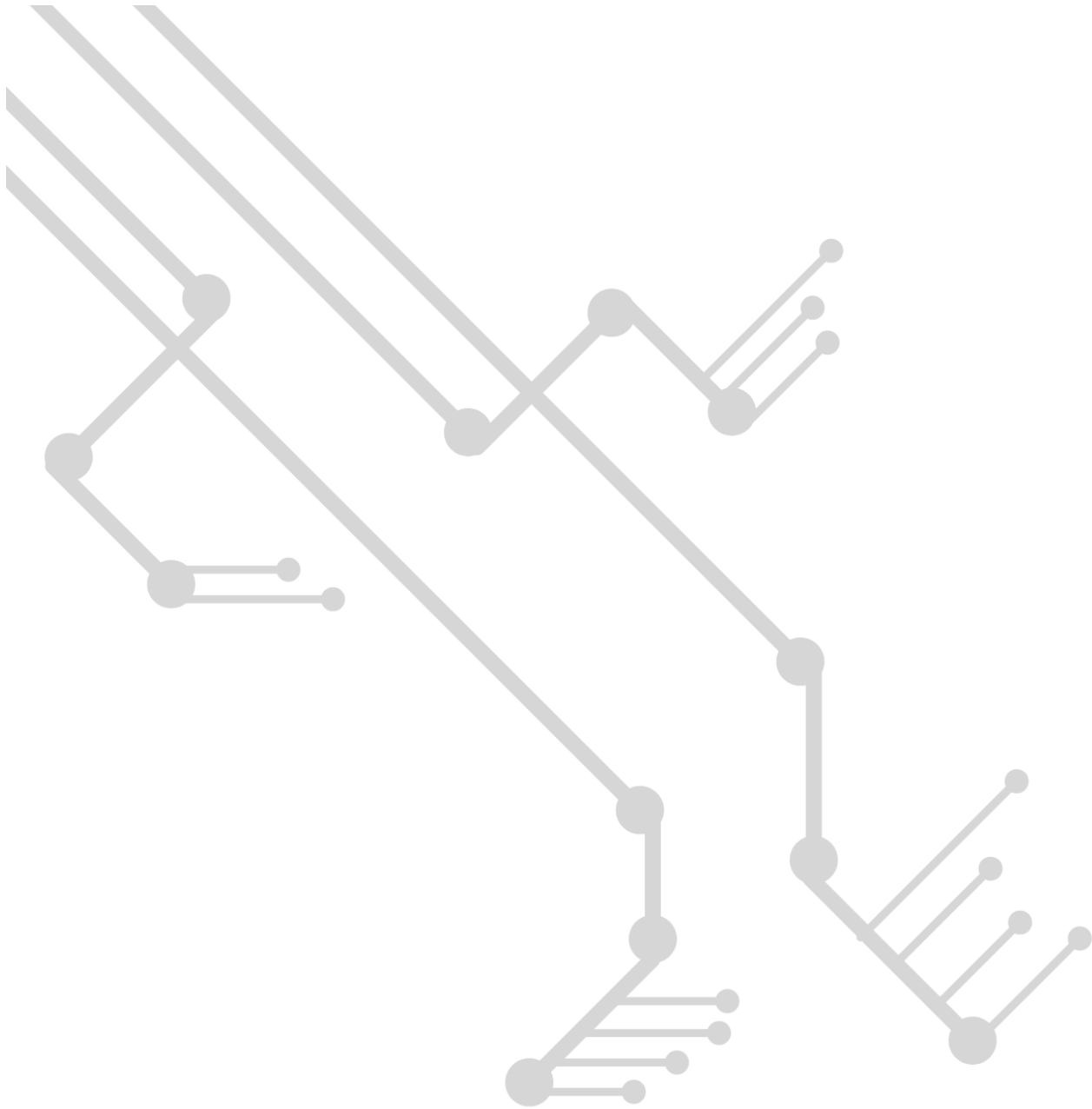
Based on project limitations, here are several recommendations for future improvement. Firstly, expanding compatibility to iOS devices would increase user accessibility. Secondly, regularly updating and enriching educational material would keep the app relevant. Implementing user feedback mechanisms can refine features and address specific needs. Lastly, partnering with educational institutions or subject matter experts can enhance credibility and provide access to latest research. Considering these recommendations can lead to more comprehensive and impactful educational experiences in future iterations of the app.

Summary

The Animal Explorer: A Walk in the Jungle is a popular tool for engaging primary school students in science education. Evaluation results show positive feedback, particularly for the "Test your understanding" game. However, the app has limitations, such as being available only for Android users and potential gaps in content depth and coverage. These limitations impact its success in teaching about vertebrates and invertebrates. To address these, future recommendations include expanding compatibility to iOS and regularly updating educational content to ensure relevance and value for users seeking advanced information.

REFERENCES

- Comparison of Websites and Mobile Applications for E-Learning. (n.d.). 2017 IACB, 2017 ICE & 2018 ICTE Proceedings . <https://core.ac.uk/download/pdf/288366729.pdf>
- Mahmud, S. N. D., Nasri, N. M., Samsudin, M. A., & Halim, L. (2018, May 15). Science teacher education in Malaysia: challenges and way forward. *Asia-Pacific Science Education*, 4(1).
- White, D. W. (2014). What is STEM education and why is it important? ResearchGate. https://www.researchgate.net/publication/264457053_What_is_STEM_education_and_why_is_it_important
- Koole, M. (2009). A model for framing mobile learning. ResearchGate. https://www.researchgate.net/publication/252714629_A_Model_for_Framing_Mobile_Learning
- Kaur, A., & Kaur, K. (2022). Systematic literature review of mobile application development and testing effort estimation. *Journal of King Saud University - Computer and Information Sciences*, 34(2), 1–15. <https://doi.org/10.1016/j.jksuci.2018.11.002>
- Titley, M. A., Snaddon, J. L., & Turner, E. C. (2017). Scientific research on animal biodiversity is systematically biased towards vertebrates and temperate regions. *PLOS ONE*, 12(12), e0189577. <https://doi.org/10.1371/journal.pone.0189577>
- Eisenhauer, N., & Hines, J. (2021). Invertebrate biodiversity and conservation. *Current Biology*, 31(19), R1214–R1218. <https://doi.org/10.1016/j.cub.2021.06.058>
- Kaur, A., & Kaur, K. (2022). Systematic literature review of mobile application development and testing effort estimation. *Journal of King Saud University - Computer and Information Sciences*, 34(2), 1–15. <https://doi.org/10.1016/j.jksuci.2018.11.002>
- DeSai, C. (2023, August 8). Anatomy, back, vertebral column. StatPearls - NCBI Bookshelf. <https://www.ncbi.nlm.nih.gov/books/NBK525969/>
- Dunton, A. D., Göpel, T., Ho, D. H., & Burggren, W. (2021). Form and Function of the Vertebrate and Invertebrate Blood-Brain Barriers. *International Journal of Molecular Sciences*, 22(22)
- Trinidad and Tobago. Ministry of Education. (2022, January 10). Primary school syllabus, Standard Four and Standard Five: Science. <https://uwispace.sta.uwi.edu/items/8813017e-e59a-4694-8f9b-4f4c346e32b3>
- White, D. W. (2014). What is STEM education and why is it important? ResearchGate. https://www.researchgate.net/publication/264457053_What_is_STEM_education_and_why_is_it_important



PCMJ

Progress in Computing and Mathematics Journal



UNIVERSITI
TEKNOLOGI
MARA

Cawangan Melaka

eISSN 3030-6728



9 773030 672004