COUNTING QUEST: ENGAGING MOBILE LEARNING WITH GAMIFICATION FOR KIDS

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This report is submitted in partial fulfilment of the requirements for the Bachelor of Computer Science (Interactive Media) with Honours.

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2023

DECLARATION

I hereby declare that this project report entitled

COUNTING QUEST: ENGAGING MOBILE LEARNING WITH GAMIFICATION FOR KIDS

is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT : _____ Date : 27/09/2023
(MUHAMMAD HAZIQ BIN ZAFRI)

I hereby declare that I have read this project report and found this project report is sufficient in term of the scope and quality for the award of Bachelor of Computer Science (Interactive Media) with Honours.

SUPERVISOR : _____ Date : 27/09/23
(PROF. DR. SAZILAH BINTI SALAM)

DEDICATION

I am truly grateful for the unwavering support and encouragement that I have received from everyone who has played a role in my journey of personal growth and success. The guidance and motivation provided by these individuals have been crucial in enabling me to reach where I am today, and for that, I am truly thankful.

In particular, I owe a special thanks to my beloved parents who have been a constant source of love and inspiration throughout my life. Their unwavering belief in me, coupled with their valuable advice and guidance, have been instrumental in shaping my character and helping me achieve my goals. I could not have reached this point in my life without their unwavering support and encouragement.

Likewise, I would also like to extend my gratitude to my respected supervisor, Prof Dr. Sazilah Salam who has provided me with the knowledge, skills, and tools necessary to succeed in my chosen field. Their mentorship, guidance, and encouragement have pushed me to reach new heights, and I am grateful for the time and effort they have invested in my education and development.

In addition, I would like to express my appreciation to all the friends, family members, and colleagues who have provided me with their support and encouragement along the way. Their belief in me has kept me going during difficult times, and I am grateful for the positive impact they have had on my life.

In conclusion, I cannot express enough gratitude to everyone who has motivated, pushed, and supported me in my journey so far. Their love, guidance, and care have been invaluable, and I will always be thankful for their contributions to my life.

ACKNOWLEDGEMENTS

In the name of Allah S.W.T, The Most Gracious, The Most Merciful. Pray and peace upon the Prophet Muhammad S.A.W.

Initially, I express my deep gratitude to Allah S.W.T. for providing me with the chance to undergo this learning process in a healthy and secure environment. Moreover, I want to extend my thanks to my supervisor, Prof. Sazilah Salam, who has been a great source of inspiration in completing my bachelor's degree project. I am truly grateful for her constant support and motivation, which encouraged me not to give up in the face of any challenges.

I would like to express my sincere appreciation and gratitude to the Faculty of Information and Communication Technology at Universiti Teknikal Malaysia Melaka (UTeM) for granting me the opportunity to pursue my studies.

ABSTRACT

This project aims to develop a mobile learning platform specifically designed for children. The platform will provide a range of educational resources in a fun and interactive way, with the goal of making learning engaging and accessible for young learners. The project will focus on creating a user-friendly interface that is easy for children to navigate, with features such as interactive quizzes, games, and videos. The mobile learning platform will be designed to cater to the needs of children in different age groups and learning levels. By providing a comprehensive and interactive learning experience, the project aims to promote a love for learning among children and equip them with the necessary knowledge and skills for their academic and personal development.

ABSTRAK

Projek ini bertujuan untuk mengembangkan platform pembelajaran dalam telefon yang direka khusus untuk kanak-kanak. Platform ini akan menyediakan pelbagai sumber pendidikan secara menyeronokkan dan interaktif, dengan matlamat untuk membuat pembelajaran menjadi menarik dan mudah diakses bagi pelajar muda. Projek ini akan memberi tumpuan kepada penciptaan antara muka mesra pengguna yang mudah untuk dikendalikan oleh kanak-kanak, dengan ciri-ciri seperti kuiz interaktif, permainan, dan video. Platform pembelajaran dalam talian ini akan direka khusus untuk memenuhi keperluan kanak-kanak dalam kumpulan umur dan tahap pembelajaran yang berbeza. Dengan menyediakan pengalaman pembelajaran yang komprehensif dan interaktif, projek ini bertujuan untuk mempromosikan kecintaan terhadap pembelajaran dalam kalangan kanak-kanak dan melengkapkan mereka dengan pengetahuan dan kemahiran yang diperlukan untuk perkembangan akademik dan personal mereka.

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app	**-**	**Application**
UTeM	**-**	**Universiti Teknikal Malaysia Melaka**

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CHAPTER 1: INTRODUCTION

1.1 Project Background

Interactive games are examples of how mobile learning has progressed over the years. With the proliferation of game platforms, mobile learning has also become more approachable. Because of lockdowns and social distancing measures implemented in response to the COVID-19 epidemic, schools and educational institutions around the world have been compelled to switch to online learning.

Mobile learning is a powerful building and transportation means that online education can be delivered at a lower cost than traditional tools because it offers a dynamic, interactive, and adaptable alternative to traditional classroom settings. As mobile learning has grown in popularity, more specialized platforms have emerged, such as those aimed towards young learners. Accessible 24/7, interactive classroom for kids of all ages and socioeconomic backgrounds These are 3 example kids mobile learning platform Khan Academy Kids, Duolingo Kids and Prodigy Math Game.

Gamification technique used to make learning more engaging and motivating. Gamification techniques use game-like elements, such as feedback and rewards, individual progress tracking and mini-quizzes or assessments to encourage users to participate in learning activities.

In sum, mobile learning underlines the significance of technology in enhancing students' educational outcomes and the requirement for alternative learning environments that are interesting, interactive, and adaptable.

1.2 Problem Statement

According to The Effects of Content Overload on Student Attention and Learning by Mayer and Moreno (2003), this study discovered that students who were exposed to a lot of information at once were more likely to become distracted and learn less than those who were exposed to it in smaller pieces. If a mobile learning platform offers a large amount of content that is not organized or presented in a manageable way, learners may feel overwhelmed and find it difficult to engage with the material. This can lead to a lack of motivation and interest in continuing to use the platform. Next, according to Bruning and Horn (2000), two decades of cognitive research have shown that "Learning to write is both a linguistic and a mental task that requires careful attention to the environment in order to build motivation and skill" means that that feedback has a definite impact on motivation. Learners may lose interest in mobile learning if they do not receive feedback or positive reinforcement for their efforts and successes. Without feedback, learners may feel unsure of their progress and become disengaged from the learning process. Positive reinforcement, on the other hand, can help learners feel motivated and encouraged to continue learning. By providing learners with feedback and positive reinforcement, mobile learning platforms can help learners stay engaged and motivated, leading to better retention of knowledge and improved learning outcomes.

1.3 Objectives

There are three goals that must be reached. These goals are:

1. To identify gamification techniques that can increase children's motivation in learning.
2. To develop mobile learning modules for children that apply the proposed gamification techniques.
3. To evaluate the learning effectiveness of the mobile learning modules in increasing children's learning motivation.

1.4 Project Scope

The educational and interactive platforms developed using Adobe Animate with a theme of education and technology are targeted towards children 4 and 5 years old.

1.5 Project Significance

This project provides the audience with relevant material on studies that is flexible, accessible, and engaging for learning purposes flexible, accessible, and engaging for learning purposes. It is anticipated that this project will provide children with the opportunity to learn at their own speed, allowing them to acquire fundamental knowledge and abilities before moving on to more challenging subject matter.

1.6 Conclusion

In conclusion, when the new project is fully implemented, it will certainly benefit students, parents, and instructors in the learning process, and this application will introduce innovative techniques.

With the help of gamification techniques, the purpose of this project is to develop a mobile educational environment for children. The successful completion of this project within the allotted amount of time is the outcome that is anticipated. In addition, there is the possibility that the project will solve existing problems by successfully completing objectives.

So, the next chapter will be covered are literature review and project methodology.

CHAPTER 2: LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

During the pandemic, mobile learning has become an increasingly prevalent mode of education. Keeping children interested in mobile learning can be a challenge for parents and teachers. Here, gamification techniques can play a crucial role in boosting children's motivation to learn.

Studies have shown that gamification techniques can increase children's learning motivation and engagement (Hanus & Fox, 2015; Seaborn & Fels, 2015). Gamification techniques include the use of game elements such as points, badges, and leaderboards to enhance the learning experience. According to Dicheva et al. (2015), gamification positively influences students' motivation, engagement, and learning outcomes. Furthermore, the use of gamification techniques in mobile learning can also enhance students' social interaction and collaboration (Hamari, Koivisto, & Sarsa, 2014).

In addition, the use of gamification techniques can also improve students' self-efficacy and self-regulation skills (Kapp, 2012). These skills are essential for students to become successful learners, and the use of gamification techniques can help develop these skills in a fun and engaging way.

This literature review seeks to investigate the impact of gamification on learning motivation in mobile learning for children. In addition, a product

methodology for mobile learning for children employing gamification techniques is proposed.

2.2 Domain

This domain of this project is mobile learning with interactive and educational genre. This mobile learning has been able to answer the puzzle, question, and game in an interactive manner thanks to the use of the gamification techniques. Interactive learning experiences are more immersive and interactive because they actively include the students. Before moving on to the next level, the students must answer the questions. To help the students, a guider will be questioned on how to answer the question.

2.3 Existing Mobile Learning

Below are examples of the mobile learning application that are Khan Academy Kids, Duolingo Kids, Prodigy Math Game, The Singing Walrus - English Songs for Kids and Numbers Song 1-10 Nursery Rhymes.

2.3.1 Khan Academy Kids

Khan Academy Kids is a free educational app for children aged 2 to 7 years old. It provides interactive activities that cover subjects such as math, reading, social-emotional development, and creative expression. The app adapts to the child's learning level and provides personalized recommendations. It also has fun activities, tracks progress, and promotes parental involvement. The application was designed with child development experts to ensure that the content is appropriate and aligned with best practices in early childhood education.

Khan Academy Kids uses adaptive learning strategies to individualize the learning experience for each child. According to a study by Hssina and Erritali (2019), students who used an adaptive learning system for mathematics instruction performed significantly better on a standardized math exam than students who did not use the system.

Khan Academy Kids uses gamification to create a stimulating and pleasurable learning environment. Elements of gamification, such as rewards, badges, and interactive features, can increase children's interest and motivation in learning activities (Plass et al., 2014).

Figure 2.1 Example 1 from Khan Academy Kids

Figure 2.2 Example 2 from Khan Academy Kids

2.3.2 Duolingo Kids

Duolingo Kids is a way for young people to learn a new language. It has a range of interactive and game-like lessons that kids can use to learn a language. The app has bright graphics, animated characters, and fun activities that are meant to make learning a language fun and interesting for young users.

Duolingo Kids is based on positive reward and feedback, which is one of its most important parts. The site gives children instant feedback, praising them for right answers and giving them advice or hints for wrong ones. Gamification techniques, such as rewards, leaderboards, and progress tracking, enhance motivation and engagement in language learning (Dicheva et al., 2015).

Duolingo Kids also has game-like features, such as getting virtual rewards, unlocking new levels, and collecting items. This helps keep young learners interested and motivated. The platform uses adaptive learning techniques that change the content and amount of difficulty depending on how well the child is doing. This makes sure that each child has a unique learning experience.

Duolingo Kids can be a helpful way to learn a language, but it's important to remember that it should be used as an addition to other ways of practising the language and talking with native speakers.

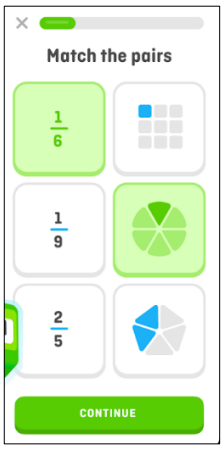


Figure 2.3 Example 1 from Duolingo Kids

Figure 2.4 Example 2 from Duolingo Kids

2.3.3 Prodigy Math Game

Prodigy Math Game is a famous mobile learning platform that helps students improve their math skills by making learning math more like a game. Students are interested in the game because it has things like rewards, badges, and keeping track of their progress, which encourages more participation and drive. According to Johns Hopkins University (2020) students in the present study were highly engaged in Prodigy's narrative and motivated to solve mathematics problems to advance in the game.

Adaptive learning techniques are used in Prodigy Math Game to make sure that the material and challenges are right for each student. This personalised method lets students learn at their own pace and get instruction that is right for them, which helps them learn better in the long run. One great thing about mobile learning tools like Prodigy Math Game is that they give students feedback right away. By getting immediate feedback on their answers, students can learn from their mistakes right away and make changes, which helps them understand math ideas better.

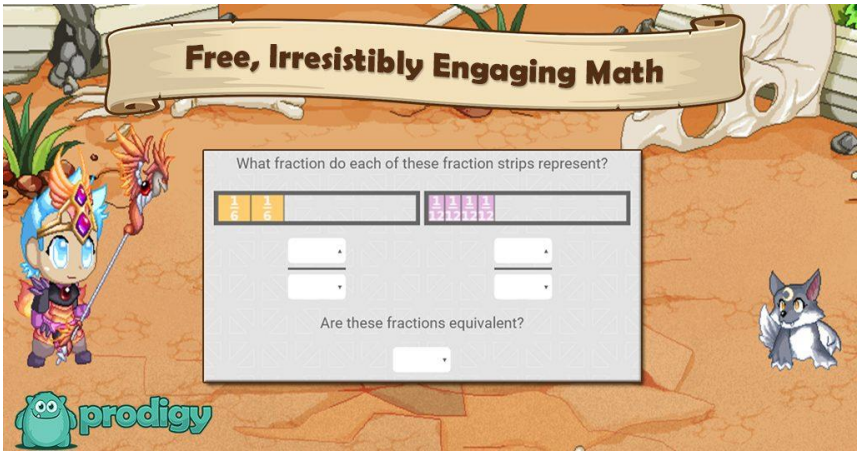


Figure 2.5 Example 1 from Prodigy Math Game

Figure 2.6 Example 2 from Prodigy Math Game

2.3.4 The Singing Walrus - English Songs for Kids

"The Singing Walrus - English Songs for Kids Funky Counting Song | Numbers 1-10" is a fun and catchy educational song made by The Singing Walrus, a famous YouTube channel that makes entertaining and educational videos for kids. The lively and upbeat tune of the song grabs the attention of young learners right away. This makes learning the numbers from 1 to 10 fun and enjoyable. With its catchy tune and regular words, this song makes it easy for kids to remember the order of the numbers. The video that goes with it adds another layer of visual support with bright, moving pictures of numbers, animals, and items. These pictures help people connect numbers with the right amounts, which makes learning easier.

Through call-and-response parts, the song also gets kids to join in by having them count along and repeat the numbers. This engaging part keeps kids' attention and gets them involved in learning. By singing the numbers several times, the song helps children learn the names of the numbers and get better at recognising them. Furthermore, the song presents diverse items and creatures connected with each number, broadening children's vocabulary and boosting language development. The song accommodates to many learning styles and preferences by incorporating auditory, visual, and kinaesthetic features. It also encourages cultural acceptance by using characters and elements from different countries. This helps young learners become more aware of and appreciative of the world. Overall, "The Singing Walrus - English Songs For Kids Funky Counting Song | Numbers 1-10" is a well-made teaching resource that uses music, visuals, and interactivity to keep kids interested and help them learn numbers early on.

Figure 2.7 Example 1 from The Singing Walrus - English Songs for Kids

Figure 2.8 Example 2 from The Singing Walrus - English Songs for Kids

2.3.5 Numbers Song 1-10 Nursery Rhymes

Numbers Song 1-10 Nursery Rhymes discover a delightful array of videos tailored to young children's educational needs. These videos are thoughtfully designed to transform the process of learning numbers from 1 to 10 into an engaging and enjoyable adventure. Typically featuring catchy songs set to colorful animations, these videos captivate children's attention and foster a love for learning. Through repetition and interactive visuals, they create an ideal environment for grasping numerical concepts. By incorporating music, vibrant visuals, and pedagogical repetition, these nursery rhymes play a vital role in making number learning both fun and effective, helping young learners build a strong foundation in numeracy while having a great time.

Figure 2.9 Example 1 from Numbers Song 1-10 Nursery Rhymes

Figure 2.10 Example 2 from Numbers Song 1-10 Nursery Rhymes

2.4 Existing Gamification Technique

Gamification techniques in mobile learning involve incorporating game elements such as points, rewards, badges, leaderboards, storytelling, challenges, immediate feedback, and social collaboration to boost learner engagement and motivation. These techniques aim to create an enjoyable and interactive learning experience, encouraging learners to feel accomplished, competitive, and connected with their peers, ultimately resulting in enhanced learning outcomes.

According to the journal Mapping learning and game mechanics for serious game analysis (Arnab et al., 2015), gamification techniques have demonstrated great

potential for developing engaging and immersive learning environments for children. Children's attention is captured and their interest in educational activities is maintained by the incorporation of interactive game mechanics, compelling narrative elements, and multimedia content. This increased engagement facilitates deeper learning and retention of information.

2.4.1 Gamification techniques in Khan Academy Kids

Khan Academy Kids provides interactive learning exercises for young children. Khan Academy Kids courses use these gamification methods:

i. Collectible Items: Khan Academy Kids can earn virtual stickers, cash, and badges for completing activities and meeting learning goals. Students can put these objects in a virtual bag or treasure chest to feel accomplished and motivated to learn.

ii. Avatar Customization: Khan Academy Kids may let students personalize their avatars with different personalities, clothing, and accessories. This tool lets students build their own avatars, which can boost self-confidence and make learning more fun.

iii. Levelling Up: Khan Academy Kids may use a levelling up system where students can advance as they complete activities or reach learning goals. Students are motivated to progress by unlocking additional content and levels.

iv. Progress Tracking: Khan Academy Kids lets students track their progress and completion for numerous activities and topics. Progress bars or stars can indicate students how much they've accomplished and how near they are to reaching a goal, motivating them.

v. Mini-games and Challenges: Khan Academy Kids may incorporate mini-games or challenges to make learning more fun. Games and challenges

relevant to the learning subject engage and motivate students to practice and apply their skills.

vi. Rewards for Milestones: Khan Academy Kids may offer rewards for completing a set number of exercises, mastering a topic, or signing in consistently. Virtual objects, badges, and diplomas can motivate kids to learn and succeed.

vii. Comments and Encouragement: Khan Academy Kids can provide students comments and encouragement. This can include compliments, animations, or music when students answer questions properly or accomplish activities, motivating them to continue.

viii. Social Features: Khan Academy Kids may incorporate social features like a virtual classroom or chat option to help students collaborate and learn from each other. This encourages community, engagement, and competition, making learning more fun and participatory.

2.4.2 Gamification Techniques in Duolingo Kids

The language-learning platform for children, Duolingo Kids, integrates game-based learning to enhance the learning experience. This section examines the gamification techniques utilized by Duolingo Kids and their impact on the language acquisition of children.

i. Tracking Progress and Rewards: Duolingo Kids monitors children's progress and rewards them with virtual currency and badges for completing courses. This provides students with a sense of accomplishment and encourages them to continue their education.

ii. Unlocking Levels and Content: As children complete lessons, they advance through various levels and access new content. This sense of advancement and access to new materials keeps children interested in and enthusiastic about learning.

iii. Interactive Challenges and Mini-Games: Duolingo Kids contains mini-games and interactive challenges that make language learning more entertaining. These games encourage children to practice their language abilities in an entertaining manner.

iv. Personalized Learning: Duolingo Kids customizes the learning experience based on the progress and preferences of each individual. Adaptive algorithms provide a personalized learning path by adjusting the level of difficulty to match the child's abilities.

v. Social Elements: The social features of Duolingo Kids include leaderboards and virtual classrooms. Children can engage in healthy competition with their peers, monitor their rankings, and collaborate with others, fostering a sense of community and promoting healthy competition.

2.4.3 Gamification Technique in Prodigy Math Game

The Prodigy Math Game uses gamification techniques to make learning mathematics enjoyable for children. This section examines the Prodigy arithmetic Game's gamification features and their impact on children's arithmetic learning.

i. Adventure-Based Gameplay: Math education is presented as an adventure in Prodigy Math Game, with children navigating a virtual world, accomplishing quests, and engaging in battles. This engaging game encourages children to advance and master math abilities.

ii. In-Game Rewards and Achievements: Children earn virtual currency, items, and experience points by completing arithmetic challenges and problems. These incentives provide a feeling of accomplishment and encourage continued engagement with mathematical concepts.

iii. Personalized Learning Paths: Prodigy arithmetic Game adapts the level of difficulty and the content to each child's arithmetic skills. This individualized approach promotes individualized learning experiences by ensuring that children are appropriately challenged.

iv. Math-Based Battles: Children engage in math-based conflicts by strategically solving math problems. This interactive element adds competition and excitement to math education, making it more pleasurable and engaging.

v. Peer Interaction and Leaderboards: The leaderboards and multiplayer features of Prodigy Math Game enable children to compete with their peers and track their rankings. This social aspect encourages learners' collaboration, communication, and motivation.

2.4.4 Comparison Gamification Techniques

Table 2.1 Comparison gamification technique

Gamification Technique	Duolingo Kids	Prodigy Math Game	Khan Academy Kids
Points and Rewards	Duolingo Kids rewards lessons and assignments with points. Points unlock levels and virtual stuff.	In Prodigy Math Game, badges and virtual currency may be used to customize avatars and unlock new features, motivating students.	Khan Academy Kids rewards with virtual stickers and trinkets. Kids can personalize their virtual classroom with badges and stickers.
Progress Tracking	Duolingo Kids tracks kids' levels and gives feedback on completed assignments. Parents can track their child's progress.	Prodigy Math Game tracks student math progress. A thorough analysis shows strengths and weaknesses.	Khan Academy Kids customizes learning paths and tracks skills. Reports show parents their child's growth.
Challenges and Competitions	Duolingo Kids lets kids compete with friends and family in tasks and points.	Prodigy Math Game lets kids compete in real-time math fights.	Khan Academy Kids offers collaborative challenges to get kids working together. They can also compete with friends.
Avatars and Customization	Duolingo Kids lets kids design and dress their own avatar.	Kids can dress their avatars in Prodigy Math Game.	Khan Academy Kids lets kids customise their virtual classroom with beautiful, colourful avatars.

Interactive Learning	Duolingo Kids makes language learning enjoyable with animations, voice interactions, and puzzles.	Prodigy Math Game makes math fun with fights, quizzes, and challenges.	Khan Academy Kids engages students with games, movies, and quizzes.

2.5 Project Methodology

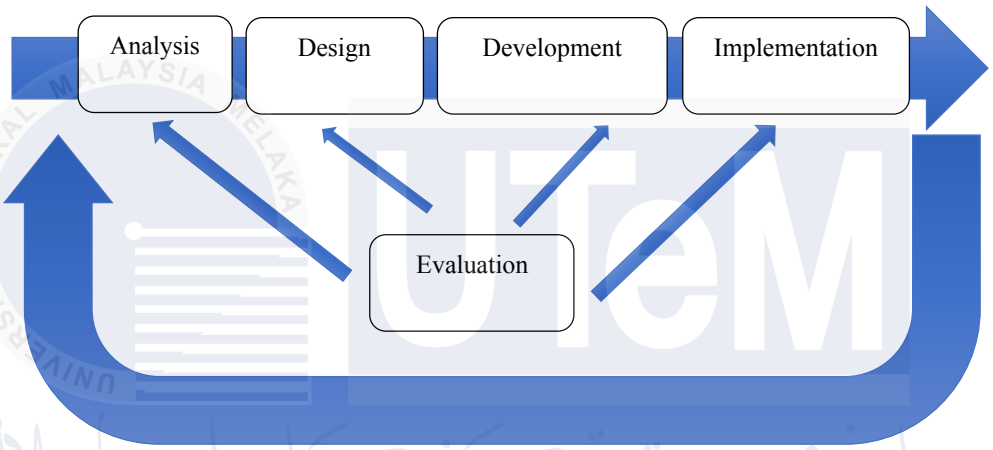


Figure 2.11 ADDIE model

- **Analysis**

In the Analysis phase of the ADDIE model, information is gathered and analysed to determine the needs of the target audience and the training program's learning objectives. This phase entails conducting a needs assessment, analysing audience characteristics, reviewing existing instructional materials, and taking contextual factors such as the learning environment and available resources into account. The analysis phase serves as the foundation for the subsequent phases of the ADDIE model.

- **Design**

In this phase, the primary objective is to identify and comprehend the problems that are related to the project's causes and effects. People must also comprehend the

constraints that limit the solution. There are numerous techniques used in analysis, including interviews, questionnaires, observation, reading materials, and supervisor-led focus group discussions.

- **Development**

In this phase, the production will commence with formative evaluation and revision. The authoring and production process will utilise the storyboard developed during the design phase. This development phase will produce the actual project plans and materials.

- **Implementation**

The proposal will be implemented. It involves integrating the learning solution into the actual business environment. Many evaluations will be conducted during this phase.

- **Evaluation**

Evaluate the plan at all levels for the subsequent implementation and ensure that the materials have met the intended objectives. It is the process of measuring the effectiveness and efficiency of the learning in accordance with the specified business objectives; it occurs in each phase of the ADDIE model and at the conclusion of the project. In this phase, the testing exercise will be carried out to obtain user feedback.

2.6 Instructional Design

- **Educational Goals**

i. Development of counting numbers skills.
ii. Provide numerous motivations to learning.

- **Course Map / Flowchart**

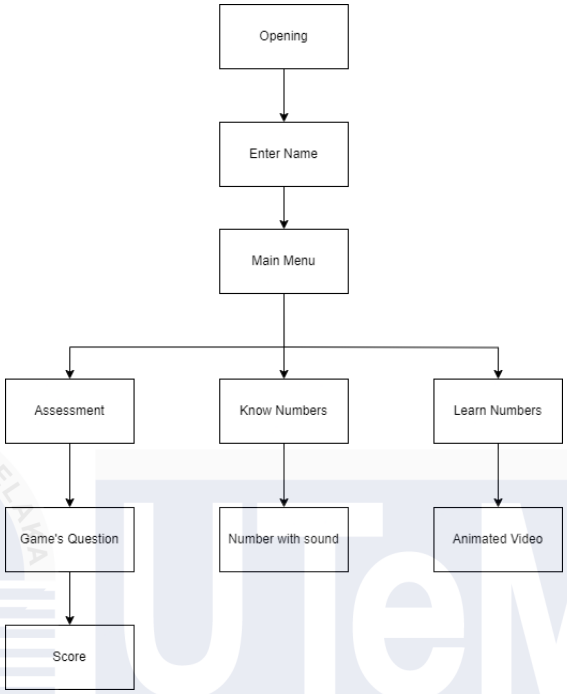


Figure 2.12 Flowchart

- **Detailed Course Content**

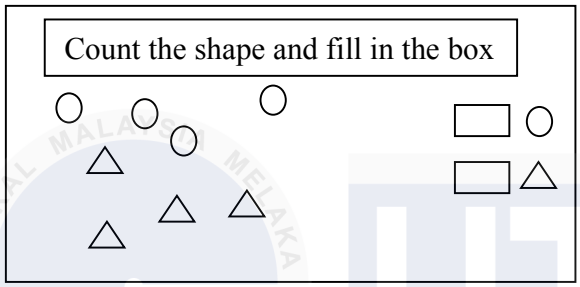
This online course is intended to provide children with strategies for engaging children in Mathematics via mobile learning employing gamification techniques. The course will cover the principles of gamification, and how to incorporate these techniques into mobile learning to increase children's motivation and engagement.

i. Video count the numbers 1 to 10 three times and each time will count faster.
ii. There is a board contain number and each number has sound. Users need to click next button to go next number or previous button to previous number.
iii. There is leaderboard to see whose got highest mark answering assessment.

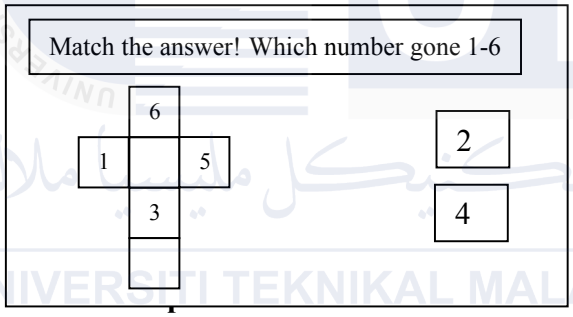
- **Test Questions**

The application also includes an assessment to aid children in learning how to count. It is a test to determine if they have retained the material. Below are the assessments for this application.

i. Assessment 1 & 2



ii. Assessment 3



In this mobile learning course, the colour chosen is appropriate for children. The colour should complement the developed and intended product. The users are children with special needs, so colours with high contrast can help them see and read more readily. Since the application is about mobile learning, the setting, questions, and characters are geared towards children. The icons are used to navigate the system and are represented by images or text. The icon should be simple to comprehend and should not cause user confusion. The text, graphics, and animation are undoubtedly straightforward and simple to comprehend.

2.7 Project Requirements

Project requirements including software and hardware used in this project. Each requirement is listed and explained next.

2.7.1 Software Requirements

i. Google Forms

This Google service can be used to construct an online survey or questionnaire, which can then be used to collect customer specifications. Graphs will be utilised to illustrate the collected data.

ii. Microsoft Word

Reports and documentation are created in this programme to serve as guidelines and future guides for this undertaking.

iii. Adobe Animate

Adobe Animate is a computer animation and multimedia authoring application created by Adobe Systems. Its primary use is the creation of vector graphics and animation for usage in film, television, the online, and video games. Users can export their finished animations and interactive projects to many file types, including HTML5 Canvas, WebGL, Flash/Adobe AIR, and more. Vector drawing tools, timeline-based animation support, motion graphics, and interaction are just some of the many features offered by Adobe Animate. Many people in the multimedia industry rely on it, including animators, web designers, game developers, and others.

iv. Samsung Notes

This app used for making storyboard and some note taking for this project.

v. Adobe Illustrator

Illustrator edits vectors. It helps artists, illustrators, and graphic designers create and modify scalable, high-quality artwork. Illustrator lets users create accurate paths, shapes, and freehand designs. Typography includes editing, font selection, and text flow management. The software adds colours,

gradients, and patterns. Layers, groups, effects, and filters enable stunning artwork. Illustrator exports multiple formats and works with Adobe Creative Cloud apps. Illustrator helps designers and artists create.

vi. Adobe Premiere Pro

Adobe Premiere Pro is a professional video editing software used by filmmakers and content creators. It offers a comprehensive set of tools for trimming, rearranging, and editing video clips on a timeline-based interface. With multi-camera editing, users can sync and edit footage from multiple cameras. The software includes a wide range of effects and transitions, along with integration with other Adobe Creative Cloud applications. It supports collaboration and seamless sharing of projects. Premiere Pro allows users to export videos in various formats, making it a powerful tool for creating high-quality videos for different platforms.

vii. Audacity

Audacity is used for sound editing. The sound of character, background sound can be edited in Audacity. Furthermore, this application also can add special effect.

2.7.2 Hardware Requirements

i. Computer

The above programmes have specific hardware needs. This is done to guarantee that there will be no technical issues, such as crashes, during the development of the programme.

- Microsoft Windows 10/11 64-bits
- CPU (at least Intel i3 8th Generation)
- 8 GB RAM
- At least 50GB HDD space
- At least NVDIA GeForce MX Series

2.8 Conclusion

Gamification can motivate youngsters to learn math, according to the research review. Gamified mobile learning provides benefits, best practises, and instructional design concepts, but more research is needed.

Gamification give a foundation for researching kids' learning. The chosen research design, data gathering methods, and data analysis methods will enable a systematic study of gamified e-effects learning's on children's learning motivation. Yet, practical factors may require research revisions.

Overall, the literature review and methodology sections provide a strong foundation for the upcoming research, and the findings of this study may contribute to the fields of mobile learning, gamification by providing valuable insights and recommendations for educators, researchers, and practitioners interested in improving online learning motivation among children.

The following section examines the project analysis, identifying the problem analysis and requirements analysis.

CHAPTER 3: ANALYSIS

3.0 Introduction

Analysis is the process of scrutinising, evaluating, and interpreting information or data for the purpose of gaining deeper insights and comprehension. It is an essential skill used in numerous disciplines, including business, science, and research, among others. Analysis facilitates informed decision-making, problem-solving, and the identification of opportunities. It may employ quantitative or qualitative techniques and may be deductive or inductive. Effective analysis requires the ability to think critically and solve problems. In this context, analysis can be applied to numerous domains, thereby contributing to the advancement of knowledge in numerous disciplines.

3.1 Current Scenario Analysis

The present scenario analysis involves examining the complete project to determine the concept for the children's mobile learning. Observation, interviews, readings, and surveys have all been used to investigate the issue as well.

3.1.1 Comparison of Existing System

The existing system has both assets and weaknesses, such as in its audio and user interfaces. Table 3.1 compares the current system to the proposed solution:

Table 3.1 Comparison Existing System

Aspect	Duolingo	Prodigy Math Game	Khan Academy
Interactive Elements	Interactive language lessons, quizzes, speaking exercises.	Interactive math battles, problem-solving challenges.	Interactive lessons, quizzes, activities across various subjects.
Types of Visualization	Text, images, audio, simple animations.	Colorful characters, fantasy-themed environments.	Varied visuals, diagrams, illustrations, interactive graphics.
Interface	User-friendly, intuitive interface, mobile and web platforms.	Engaging interface with character avatars, intuitive controls.	User-friendly interface, easy navigation, mobile and web platforms.
Sound	Pronunciation exercises, audio prompts.	Sound effects, background music, audio cues.	Audio instructions, voiceovers, sound effects.
Scope	Language learning (Spanish, French, etc.).	Math learning (various math concepts).	Comprehensive subjects (Math, Science, Reading, etc.).
Language Support	Multiple languages available.	English, with plans for more languages.	English, with plans for more languages.
Strengths	Gamified language learning, bite-sized lessons, mobile accessibility.	Engaging math battles, adaptive learning, immersive gameplay.	Comprehensive educational content, adaptive learning, extensive resources.
Limitations	Limited focus on language learning, may lack depth in advanced topics.	Primarily focused on math, limited subject coverage beyond math.	Limited interactivity in certain subjects, may require internet access for full functionality.

3.2 Requirement Analysis

The analysis of requirements includes functional and non-functional requirements, as well as development and runtime requirements. The functional and non-functional requirements will define the project's functionalities, characteristics, features, and attributes. In the meantime, the development and runtime requirements will define in detail the required resources (hardware and software) and delivery platform.

3.2.1 Need Analysis

Mobile learning is the exciting discipline of enhancing the learning experience using mobile technologies. The objective of the mobile learning initiative is to provide industry-relevant curriculum in an innovative, cutting-edge manner. Students participating in this innovative new programme will have access to learning materials, fellow students, and instructors at any time and from any location. This is a significant additional learning aid to support learning outside the classroom.

By delivering training and communication that is genuinely just-in-time, just-enough, and just-as-needed, mobile technology is being used to increase profitability and reduce costs. Viewers and learners can access the content they require wherever they are, whenever they have a moment, and then promptly return to their jobs to perform them more efficiently, effectively, or safely. In terms of hardware, they are inexpensive compared to the total cost of a PC. However, the content of the learning should consider the screen size, storage capacity, and power limitations of the mobile device. Understanding the limitations of the user interface is also essential. Mobile devices have small displays, inadequate input methods, and limited battery life.

3.2.2 User Analysis

The target audience for this application is kids in grades 4 and 5. The user must have access to mobile applications. Users must also understand and be able to use mobile phones to perform all necessary interactions within the mobile application. This mobile application can educate users on a counting topics.

Educators and parents can use this application to enhance their children's understanding of this topic. It is a fantastic way for parents to discuss the topic with their children. It is a straightforward method for instructors to engage young students in an activity that will aid in their learning and processing of counting information.

3.2.3 Technical Analysis

Adobe animate is the program that can be used to make this kind of mobile learning. Before exporting the content, make sure that the hardware and apps used meet Adobe Animate's system requirements. This means you need an operating system that works with it, enough RAM and file space, and a graphics card that supports OpenGL 2.0 or higher.

When using Adobe Animate to make mobile learning content, it's important to think about the file size and loading time of the content and make sure it's compatible with the platform that will be used to send it.

After exporting the content, it's important to test it on the site where it will be delivered to make sure it works as planned and can be reached by the intended audience. This could mean testing the material on different web browsers and making sure it works on different screen sizes and resolutions.

3.2.4 Resource Analysis

The most references syllabus is taken from websites and books. The resources used as below:

i. Kohwai, & Yong. (2021). *Smart Series Matematik* (Vol. 3).
ii. Chalida Sawatrung. (n.d). Counting Fruits from 1 to 10.

3.2.5 Requirement Gathering

The requirement's gathering procedure is the most important part of transferring and organising data. Distribution of a content verification form is used for requirements collection.

.

i. Research on internet and books

Research is an additional method of information collection. Research can be conducted in two distinct methods. The first is through the Internet and online resources, and the second is through printed media such as a book. For this endeavour, internet information has been gathered so that the developer is aware of the prevalent learning and teaching disabilities.

Some printed materials, such as books, aid the developer in gathering information for this project and this thesis. Online sources are less reliable than printed sources.

3.2.6 Functional Requirement

The term "functional requirements" is used to describe the characteristics that a system or product must have to provide its intended function. They outline the inputs, procedures, and expected outcomes of the system.

i. Animation – learning will be enhanced with animation so that students appear more engaged.

ii. Text - The visuals used in mobile learning are supported and clarified by textual explanations and descriptions. The size, style, and colour of the typeface all contribute to its legibility.

iii. Audio - In order to fully grasp a mobile learning exercise, a voice over is essential. Due to the potential for misunderstanding, voice-over narration needs to be handled with care.

iv. Images and graphic - Every single multimedia programme out there is extremely picky about the colours and images they employ. It is crucial to use appropriate visuals with the proper colour scheme.

v. Background Music - The tunes in the background will set a cheerful and instructive tone for the classroom. The tunes you play should be appropriate for the setting.

vi. Navigation - In order to move from one page to another, mobile learning will make use of navigation.

3.2.7 Non-Functional Requirement

Non-functional requirements are essential for guaranteeing that the system or product fulfils the desired level of performance, reliability, security, and other quality attributes. It guides the design, development, and testing processes to ensure that the mobile learning is constructed and delivered with the desired non-functional characteristics.

i. User friendly – The mobile learning platforms have intuitive UI. This is due to the fact that the pages can always be referenced. This textual tutorial is meant to aid the user in navigating the software.

ii. Reliable - This programme has been tested to run thousands of times without crashing or freezing.

iii. Usability - The user can just type in the correct response. It displays correctly when the user presses the keyboard.

Consistency - The uniformity of the application's user interfaces facilitates full immersion in the experience.

3.2.8 Software Requirement

A list of the software programmes that must be built in order to construct the system is referred to as a software requirement.

i. Adobe Animate

Adobe Animate is a computer animation and multimedia authoring tool that was made by Adobe Systems. It is used to make vector graphics and animation, websites, video games, and other types of multimedia. It can make animations and interactive content in different formats, like HTML5 Canvas, WebGL, Flash/Adobe AIR, and others, with this tool. Adobe Animate has a lot of different features, such as vector drawing tools, support for timeline-based cartoons, motion graphics, and interactivity.

ii. Adobe Illustrator

Adobe Illustrator is a program for editing vector graphics that is used to make illustrations, designs, and other artwork with a focus on clean lines and pictures that can be resized. It is used for images editing.

iii. Audacity

With features such as effects, noise reduction, and equalization, Audacity permits users to record, edit, and mix audio recordings. It supports numerous

file formats, including WAV, AIFF, MP3, and OGG, and offers features such as multi-track editing and 16-bit, 24-bit, and 32-bit sample format support. The backdrop sound will be edited in audacity.

iv. Microsoft Excel

The software that helps developers prepares project schedule and milestone as guidance.

3.2.9 Hardware Requirement

A list of the hardware devices that must be built in order to construct the system is referred to as a hardware requirement.

i. Laptop

Will be used to access the software listed and for system development.

ii. Operating System

Microsoft Windows 11 Home Single Language 64-bit Operating system, x64-based processor

iii. Computer Processor

Intel Core i5-8265U CPU @ 1.6GHz, 8th Gen

iv. Installed Memory

24.00 GB Memory (RAM)

v. Graphics Card

NVIDIA GeForce GTX 1050 with 4GB VRAM

3.3 Project Schedule and Milestone

The utilisation of Gantt Charts is one of the most effective methods for visually representing progress over time. The Gantt Chart will be utilised to document the progression of each stage from initiation to completion. The primary objective of utilising a Gantt Chart is to ensure that the advancement of a project remains aligned with its intended trajectory. Figure 3.1 depicts the Gantt Chart employed throughout the project development phase to ensure adherence to the designated time range.

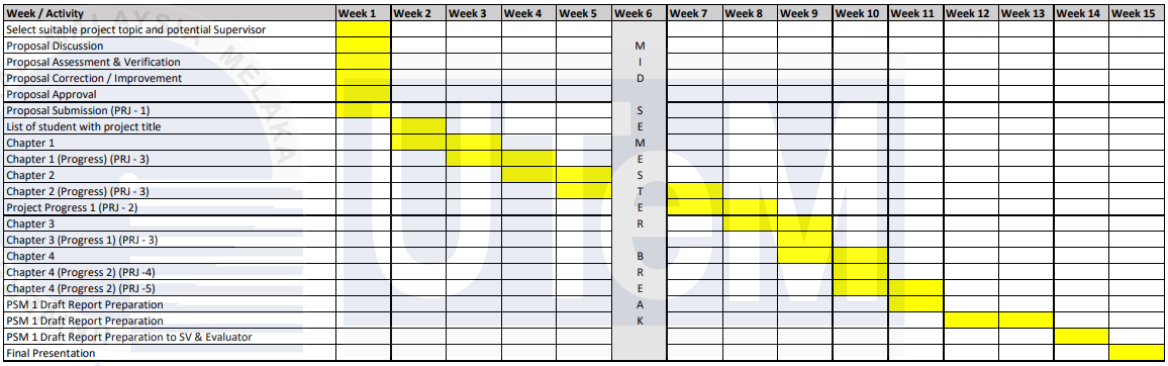


Figure 3.1 Project Schedule and Milestone

3.4 Conclusion

As a conclusion, this chapter will be split into analysis stages, which include problem analysis and requirement analysis. In the first part problem analysis, a tool creator needs to look at the different ways that teachers and students can give information. Some of the things that have been done to figure out the problem are observation, study, and interviews. For requirement analysis, it will describe how the project works and how it doesn't work, as well as what hardware and software are needed to make sure the project runs easily. The last thing it will describe is the run-time requirements that are needed for the project to run.

The next chapter is all about the design phase, which is called the design step. The process included making a storyboard and designing the tools.

CHAPTER 4: DESIGN

4.1 Introduction

This chapter describes the results of both the preliminary design analysis and the comprehensive design. Additionally, this chapter will illustrate the system's architecture, interface design, and navigation design.

The system or application design sequence leading to the application will be described in the system architecture. It will also exhibit the entire creation process for mobile learning. This architecture will also facilitate interaction between applications and users.

It will demonstrate how interfaces navigate or interact with one another in the navigation design. In this section, rudimentary application interfaces are navigated.

4.2 System Architecture

Figure 4.1 illustrates how this application operates, from user input selection to output result. Students are first introduced to a welcome screen. This application's main menu contains four submenus: learn number, know number, assessment, and leaderboard. Each submenu contains content that can provide the student with a straightforward explanation in an interactive manner. Once the user has selected the

data, it is presented on the appropriate interface and is referred to as output. The user will then interact with the application via mobile application.

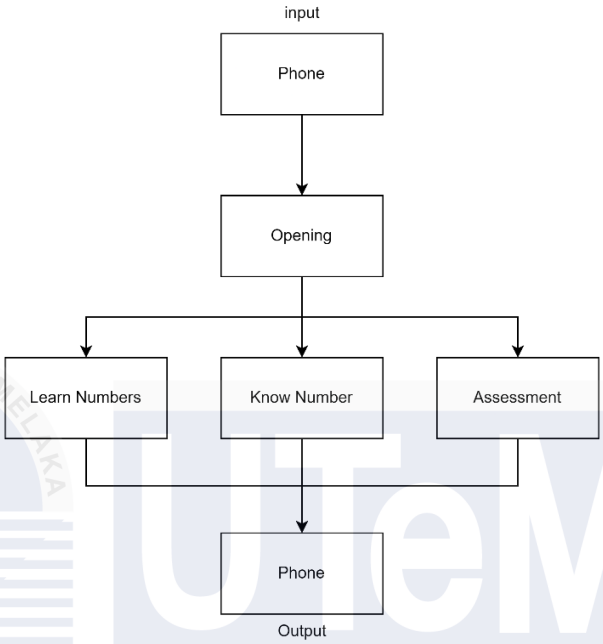


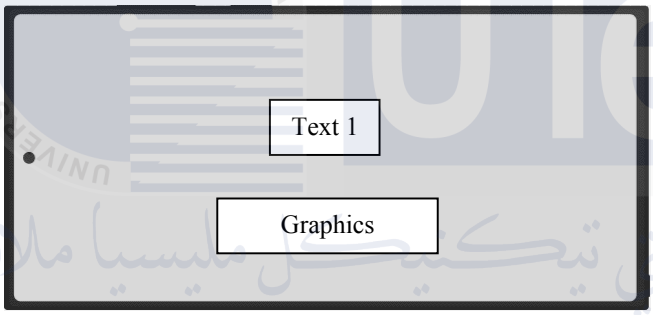
Figure 4.1 System Architecture of Application

4.3 Preliminary Design

This phase details how the application's content is organized. It contains all multimedia components, including text, audio, animation, and visuals. The storyboard will be used to visualize the entirety of the project's design. If the storyboard has been completed, the next phase will be implementation. The table depicts the general storyboard design process planning.

4.3.1 Storyboard Design

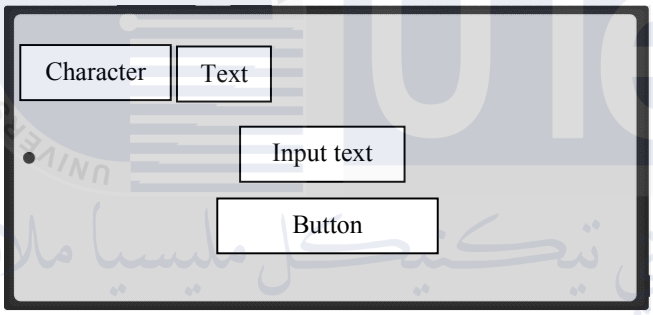
The storyboard will indicate where navigations, visuals, and text will be, as well as provide information about the next and previous scene. Each storyboard layout is determined by the contents. The design must be appropriate and representative of the content. The design of storyboards for this application is explained subsequently.

<table>
<tr><td>Subject</td><td>Mobile Learning</td><td>Scene Name</td><td>Opening</td></tr>
<tr><td>Project</td><td>Counting Quest: Engaging Mobile Learning with Gamification for Kids</td><td>Description</td><td>Scene Opening</td></tr>
<tr><td colspan="2" rowspan="2"> 
</td><td colspan="2">Action
• This page then automatically enter scene ask user to enter name.</td></tr>
<tr><td colspan="2">Graphic
• Graphics including background wallpaper, images of character and other images.

Animation
• Animation text, loading bar, character.

Text
T1 – “Welcome, Let’s Learn Together”</td></tr>
</table>

Figure 4.2 Storyboard for Opening

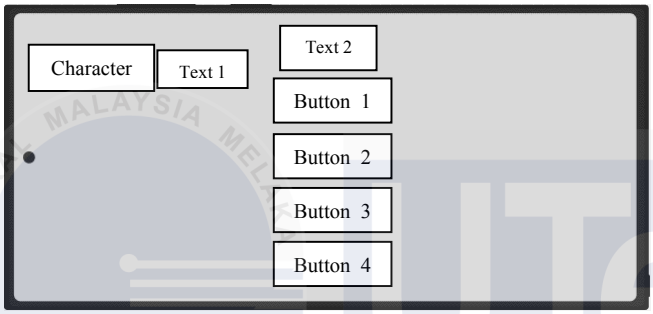
<table>
<tr><td>Subject</td><td>Mobile Learning</td><td>Scene Name</td><td>Enter Name</td></tr>
<tr><td>Project</td><td>Counting Quest: Engaging Mobile Learning with Gamification for Kids</td><td>Description</td><td>Scene for enter name</td></tr>
<tr><td colspan="2" rowspan="2"> 
</td><td colspan="2">Action
• This page ask user to enter name.</td></tr>
<tr><td colspan="2">Graphic
• Graphics including character, background wallpaper.

Button
• Button for submit name.

Animation
• Animation character ask user to enter name.

Text
T1 – “Please enter your name”</td></tr>
</table>

Figure 4.3 Storyboard for Enter Name

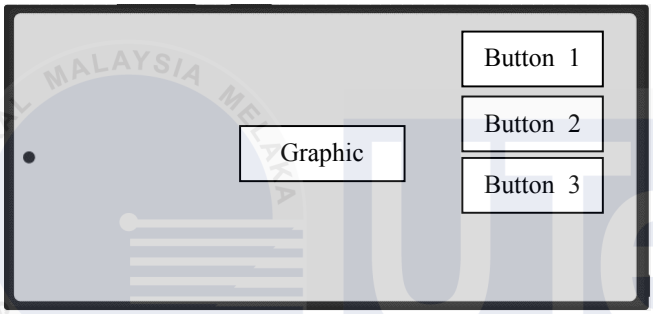
<table>
<tr><td>Subject</td><td>Mobile Learning</td><td>Scene Name</td><td>Enter Name</td></tr>
<tr><td>Project</td><td>Counting Quest: Engaging Mobile Learning with Gamification for Kids</td><td>Description</td><td>Scene for enter name</td></tr>
<tr><td colspan="2" rowspan="2"> 
</td><td colspan="2">Action
• This page ask user to choose the menu.</td></tr>
<tr><td colspan="2">Graphic
• Graphics including character, background wallpaper.

Button
• Button 1 to enter Learn Number.
• Button 2 to enter Know Number
• Button 3 to enter Assessment.
• Button 4 to exit the application.

Animation
• Animation character ask user to choose menu.

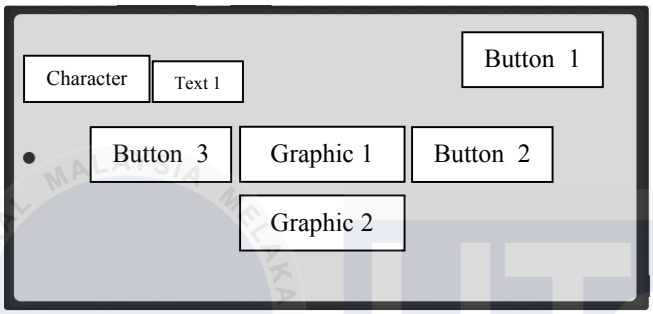
Text
T1 – “Please choose menu”.
T2 – “Menu”.</td></tr>
</table>

Figure 4.4 Storyboard for Menu

<table>
<tr><td>Subject</td><td>Mobile Learning</td><td>Scene Name</td><td>Learn Number</td></tr>
<tr><td>Project</td><td>Counting Quest: Engaging Mobile Learning with Gamification for Kids</td><td>Description</td><td>Scene for learn Number</td></tr>
<tr><td colspan="2" rowspan="2"> 
</td><td colspan="2">Action
• Video begins when entering page.</td></tr>
<tr><td colspan="2">Graphic
• Graphics including video, background wallpaper.

Button
• Button 1 to back to main menu.
• Button 2 to replay the video.
• Button 3 to pause or resume the video.</td></tr>
</table>

Figure 4.5 Storyboard for Learn Number

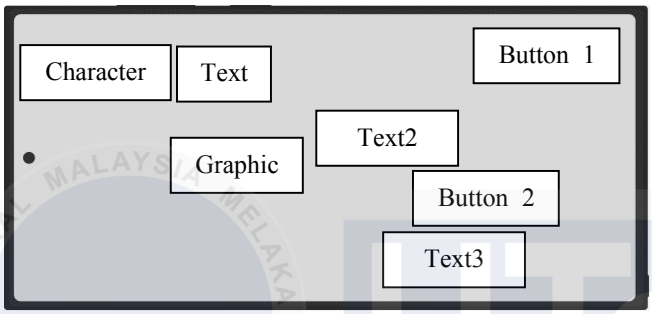
<table>
<tr><td>Subject</td><td>Mobile Learning</td><td>Scene Name</td><td>Know Number</td></tr>
<tr><td>Project</td><td>Counting Quest: Engaging Mobile Learning with Gamification for Kids</td><td>Description</td><td>Scene for Know the Number</td></tr>
<tr><td colspan="2" rowspan="2"> 
</td><td colspan="2">Action
• Sound begins when entering page.</td></tr>
<tr><td colspan="2">Graphic
• Graphics including character background wallpaper.

Button
• Button 1 to back to main menu.
• Button 2 to go next number.
• Button 3 to go previous number.

Animation
• Animation character ask user to click button.

Text
• Text 1 – “Click next and previous button to play”.</td></tr>
</table>

Figure 4.6 Storyboard for Know Number

<table>
<tr><td>Subject</td><td>Mobile Learning</td><td>Scene Name</td><td>Assessment 1 & 2</td></tr>
<tr><td>Project</td><td>Counting Quest: Engaging Mobile Learning with Gamification for Kids</td><td>Description</td><td>Scene for Assessment</td></tr>
<tr><td colspan="2" rowspan="3"> 
</td><td colspan="2">Action
• Music begins when entering page followed by graphic, text.
• This page ask user to enter name.</td></tr>
<tr><td colspan="2">Graphic
• Graphics including character, background wallpaper.

Button
• Button 1 to go menu.
• Button 2 to submit answer.

Animation
• Animation character ask user to enter answers.

Text
T1 – “Please choose the answer”.
T2 – “Answers”.
T3 – “Score”.</td></tr>
</table>

Figure 4.7 Storyboard for Assessment 1 , 2 & 3

<table>
<tr><td>Subject</td><td>Mobile Learning</td><td>Scene Name</td><td>Learn Number</td></tr>
<tr><td>Project</td><td>Counting Quest: Engaging Mobile Learning with Gamification for Kids</td><td>Description</td><td>Scene 1 for Animation Learn Number</td></tr>
<tr><td colspan="2" rowspan="2"> 
</td><td colspan="2">Description
• Number fell out from above with animation.
• There is voice over told “count the number from 1 to 10”.</td></tr>
<tr><td colspan="2">Background Sound
• bass-loops-003-with-drums-long-loop-120-bpm-24371
Duration
• 4 seconds</td></tr>
</table>

Figure 4.8 Example Storyboard for Animation Learn Number Scene 1

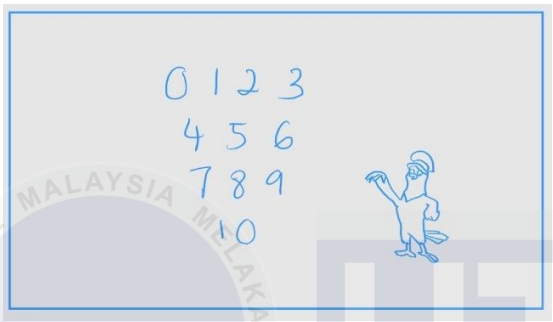
<table>
<tr><td>Subject</td><td>Mobile Learning</td><td>Scene Name</td><td>Learn Number</td></tr>
<tr><td>Project</td><td>Counting Quest: Engaging Mobile Learning with Gamification for Kids</td><td>Description</td><td>Scene 2 for Animation Learn Number</td></tr>
<tr><td colspan="2" rowspan="2"> 
</td><td colspan="2">Description
• There is a character explains the activities.
• There is voice over told “Greeting kids, let’s start 1 and count to 10 shall we. We started slowly and workout to fast ten counts”.</td></tr>
<tr><td colspan="2">Background Sound
• bass-loops-003-with-drums-long-loop-120-bpm-24371
Duration
• 7 seconds</td></tr>
</table>

Figure 4.9 Example Storyboard for Animation Learn Number Scene 2

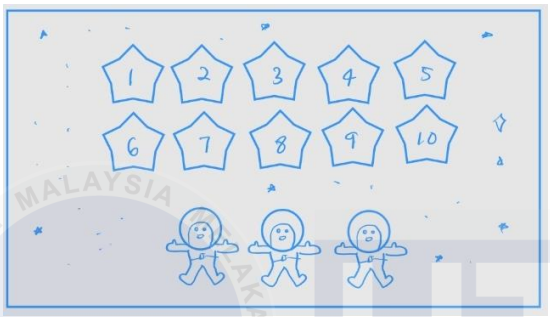
<table>
<tr><td>Subject</td><td>Mobile Learning</td><td>Scene Name</td><td>Learn Number</td></tr>
<tr><td>Project</td><td>Counting Quest: Engaging Mobile Learning with Gamification for Kids</td><td>Description</td><td>Scene 3 for Animation Learn Number</td></tr>
<tr><td colspan="2" rowspan="2"> 
</td><td colspan="2">Description
• There are characters explains the activities.
• There is voice over told “You can depend on me. Just keep on counting, come on let’s do a great count from one to ten. 1,2,3,4,5,6,7,8,9,10”.</td></tr>
<tr><td colspan="2">Background Sound
• bass-loops-003-with-drums-long-loop-120-bpm-24371
Duration
• 16 seconds</td></tr>
</table>

Figure 4.10 Example Storyboard for Animation Learn Number Scene 3

<table>
<tr><td>Subject</td><td>Mobile Learning</td><td>Scene Name</td><td>Learn Number</td></tr>
<tr><td>Project</td><td>Counting Quest: Engaging Mobile Learning with Gamification for Kids</td><td>Description</td><td>Scene 4 for Animation Learn Number</td></tr>
<tr><td colspan="2" rowspan="2">  </td><td colspan="2">Description
• There is a character explains the activities.
• There is voice over told “Excellent work kids, please count more quickly”.</td></tr>
<tr><td colspan="2">Background Sound
• bass-loops-003-with-drums-long-loop-120-bpm-24371
Duration
• 3 seconds</td></tr>
</table>

Figure 4.11 Example Storyboard for Animation Learn Number Scene 4

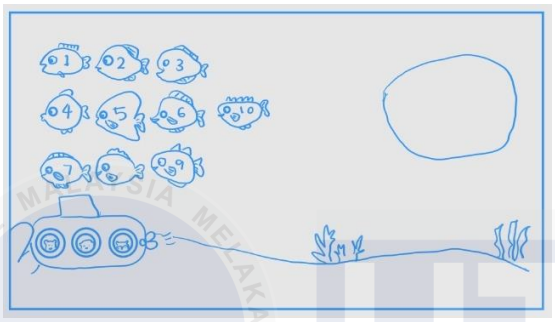
<table>
<tr><td>Subject</td><td>Mobile Learning</td><td>Scene Name</td><td>Learn Number</td></tr>
<tr><td>Project</td><td>Counting Quest: Engaging Mobile Learning with Gamification for Kids</td><td>Description</td><td>Scene 5 for Animation Learn Number</td></tr>
<tr><td colspan="2" rowspan="2">  </td><td colspan="2">Description
• There are characters explains the activities.
• There is voice over told “Let’s do a great, great, great shall we. 1,2,3,4,5,6,7,8,9,10”.</td></tr>
<tr><td colspan="2">Background Sound
• bass-loops-003-with-drums-long-loop-120-bpm-24371
Duration
• 12 seconds</td></tr>
</table>

Figure 4.12 Example Storyboard for Animation Learn Number Scene 5

<table>
<tr><td>Subject</td><td>Mobile Learning</td><td>Scene Name</td><td>Learn Number</td></tr>
<tr><td>Project</td><td>Counting Quest: Engaging Mobile Learning with Gamification for Kids</td><td>Description</td><td>Scene 6 for Animation Learn Number</td></tr>
<tr><td colspan="2" rowspan="2">  </td><td colspan="2">Description
• There is a character explains the activities.
• There is voice over told “Outstanding, recounting but this time more quickly”.</td></tr>
<tr><td colspan="2">Background Sound
• bass-loops-003-with-drums-long-loop-120-bpm-24371
Duration
• 3 seconds</td></tr>
</table>

Figure 4.13 Example Storyboard for Animation Learn Number Scene 6

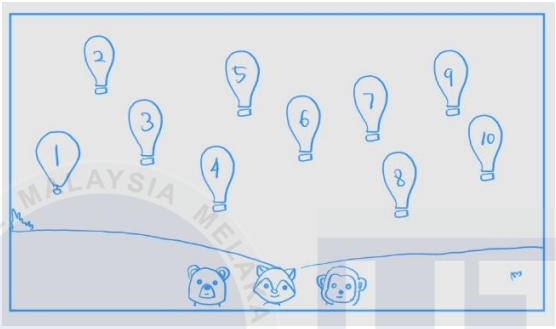
<table>
<tr><td>Subject</td><td>Mobile Learning</td><td>Scene Name</td><td>Learn Number</td></tr>
<tr><td>Project</td><td>Counting Quest: Engaging Mobile Learning with Gamification for Kids</td><td>Description</td><td>Scene 7 for Animation Learn Number</td></tr>
<tr><td colspan="2" rowspan="2">  </td><td colspan="2">Description
There are characters explains the activities.
There is voice over told “Let’s do a great, great, great shall we. 1,2,3,4,5,6,7,8,9,10”.</td></tr>
<tr><td colspan="2">Background Sound
bass-loops-003-with-drums-long-loop-120-bpm-24371
Duration
11 seconds</td></tr>
</table>

Figure 4.14 Example Storyboard for Animation Learn Number Scene 7

4.4 User Interface Design

User interface design is the process of making digital items or systems' interfaces look good and be easy to use. It means making a user interface that not only looks good but also lets people use the software or gear well. The main goal of user interface design is to give the target audience an easy-to-use and interesting experience that meets their wants and expectations.

The visual design, layout and information architecture, navigation, interaction design, responsiveness, accessibility, and usability tests are all important parts of user interface design. Visual design is the process of choosing colours, fonts, icons, and other graphic elements to make an interface that looks good and makes sense. Layout and information design are all about putting things together in a way that makes it easy for people to understand the structure and find what they are looking

for. Navigation design makes sure that menus, buttons, and links make it easy for users to move around the screen.

Designing interactive tools and giving users feedback on what they do is part of interaction design. Responsiveness makes sure that the interface can be used on a variety of devices with different screen sizes. Accessibility means making sure that the system can be used by people with disabilities. Usability testing includes getting feedback from users and changing the design based on how they use it. By taking these things into account and making interfaces with the user in mind, designers can improve the general user experience and get people more involved.

i. Navigation Design

Good navigation design prioritises organisation over graphics. Even though artistic graphics can make the navigation look better, your main goal should be to make it easy for kids to find their way in and out of any part of the app you make. The navigation design shows how the different types of navigation settings work in Counting Quest: Engaging Mobile Learning with Gamification for Kids. Navigation design also helps the creator make sure that the system's flow is easy to control. The kids need to know how to use the directions on the apps so that they don't get lost while using them. It's important to build it right because that will show how user-friendly it is. The menu for this app is shown in the pictures below.

- Navigation Flow

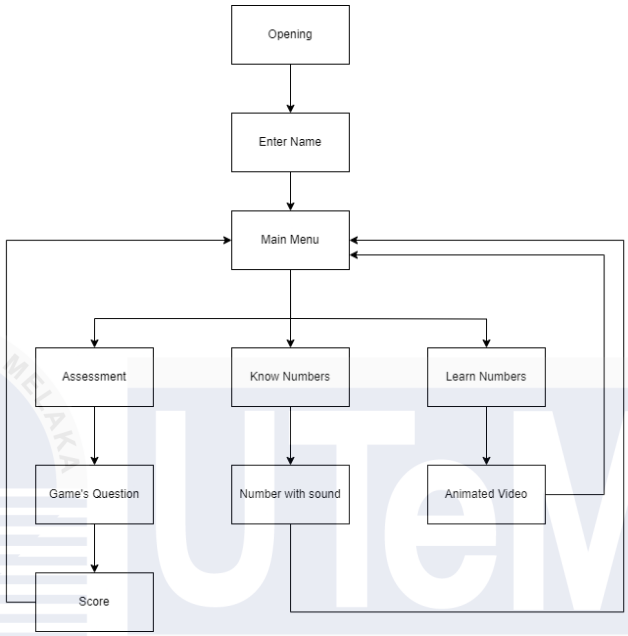


Figure 4.15 Navigation flow

ii. Input Design

The phone's keyboard is used to enter information into this app. For instance, to input number in the answer or type the name.

iii. Output Design

This programme also needs an output design, which will include text, graphics, audio, music, and animation. For the programme to be shown, it needs a smartphone so that the output can be seen.

Table 4.1 Result application interaction with user input

Subject	Medium	Output
Select option/ choice	Screen	Visualize text, graphic and audio
Voice	Screen and Audio	Audio
Animated	Screen	Visualize Animation
Perform result for user answer	Text	Visualize text and Audio

1. Text

Text will be one of the parts of this application. Users will be able to understand what the app is about because text is used to share information. This app has a lot of text, such as learning explanations on the buttons, images, and the app title.

2. Graphics

A computer-made picture is called a "graphic." A good application will have images that help the user understand the information it contains. This is very different from the traditional paper-based picture, which needed the artistry, creativity, and steady hand of the person drawing it to show what they were thinking. When a picture is made this way, it is called a "bitmap," and each field is called a "pixel." There are several image and graphic format that have been used in this application:

- .BMP
- .JPG
- .TIFF
- .PSD (Adobe Photoshop)
- .AI (Adobe Illustrator)

3. Audio and Music

Any sound that can be heard is called audio. It is a type of energy that moves like waves through the air. Audio can be used to talk to people, entertain people, and make art. Music is a type of art that uses sounds to make people feel something. It usually has more than one sound, like a melody, harmony, or beat. The sounds and music in this application will serve as background music and voice. Voice-overs are part of this application, and they need to be recorded correctly according to the script. This is a way for the voice over to help users understand how to use this app. There are several audio formats that have been used in this application:

- .WAV
- .MP3

4. Animation

Animation is a form of visual art that gives the impression of movement by quickly showing a series of pictures one after the other. This illusion is made by showing each frame or drawing repeatedly, generally 24 times per second. Animation will be used as a multimedia feature in this project to make the app more fun, and interactive animation will be used to show a video that teaches kids how to count. This gets kids interested in learning more and having fun while using this app.

iv. Template Design

For this project, a template was made so that it would be easy to make a new document with the same settings for publishing, devices, and stage size. The stage size for the document template is 2400 pixels by 1080 pixels.

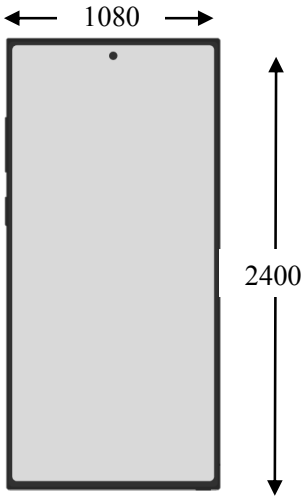


Figure 4.16 Template Design

4.5 Conclusion

In this application, the design part of this application was talked about. During this design process, there will be a lot of steps to make sure that all of the requirements are met. The design part is very important because it will serve as a guide for the whole process of making and putting this project into action.

In the next chapter, the focus will be on putting this project into action, which will use all the information from this chapter.

CHAPTER 5: IMPLEMENTATION

5.1 Introduction

The phase that best describes the work that goes into this application's implementation is crucial. This task's objective is to learn about the project's contents, including the different audio, music, text, and graphic formats. This phase also covers the methods of production, including animation, the creation of 2D images, the integration process, etc. Software configuration management is an additional duty in this implementation phase.

5.2 Media creation

The following segment will elucidate the media advent method, together with a practical method to transforming the media additives into the media integration segment before merging.

This technique facilitates the advent of narrative, visual picture, audio song, and animation.

5.2.1 Production of Texts

Text serves as a practical description and information presentation, making it one of the most crucial multimedia components. An image is meaningless without text. Numerous factors, like the font, size, colour, and background of the text, were considered when creating this project. To avoid appearing messed up, the displayed text must seamlessly blend in with the surroundings.

Most of the description and text explanation in this programme employed a typeface, and the font used for the title is Naughty Squirrel Demo. This programme utilised a font for the description and text explanation. The font sizes utilised range from 20 to 60. Perfect font size selection is necessary to prevent alphabets and digits from crowding the little screen. Table 5.1 shows the example of the fonts use in the Counting Question application.

Table 5.1 Sample of the fonts

No	Family Font	Sample
1.	Naughty Squirrel Demo	SAMPLE
2.	Kidstoy	SAMPLE
3.	Kidsfun	SAMPLE
4.	Kidplay	SAMPLE
5.	Comic Sans MS	SAMPLE

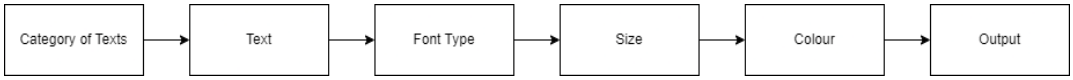


Figure 5.1 Text Production Process

5.2.2 Production of Graphic

In development of graphic, 2D graphic are used to develop in Adobe Animate. Some of graphics are edited in Adobe Illustrator because some of graphic cannot be edited in Adobe Animate because lack of tools. Then it will be saved as .PNG or .JPEG format.

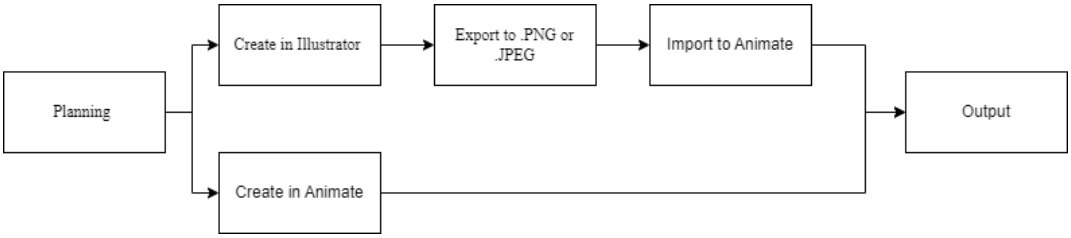


Figure 5.2 Process of Graphic Production

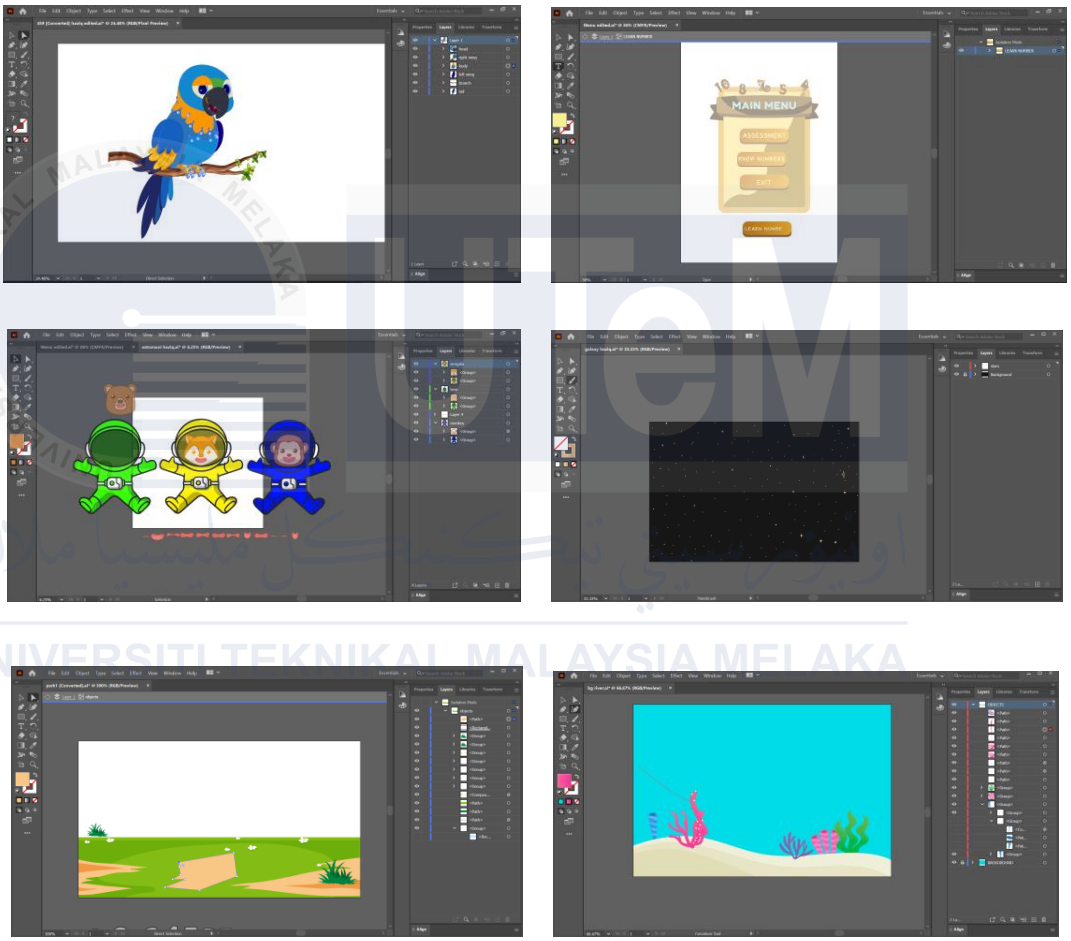


Figure 5.3 Examples of Graphic Creation in Illustrator

5.2.3 Production of Audio

Some applications will be made more intriguing and enticing using sound and audio. As a result, this application contains audio and audio sound. The three kinds of audio used in audio production are narrator, background music, and sound effects. Each button also contains a sound effect that alerts the user when the button is pressed. Typically, audio production comes after text and graphic integration. To

coordinate with all the multimedia components, the audio is incorporated within the animation and text. narration audio Backing Tracks Sound Effect Editing and Searching 41. The audio files for this project are in MP3 format. The audio for the background music was downloaded from the internet and is not from a site that is protected by copyright. A video clip file is converted to an audio file using an online video converter, and the audio file is then stored in the MP3 or WAV formats. The audio file is edited and chopped using the programme Audacity to compress it. Figure 5.3 depicts the audio production process.

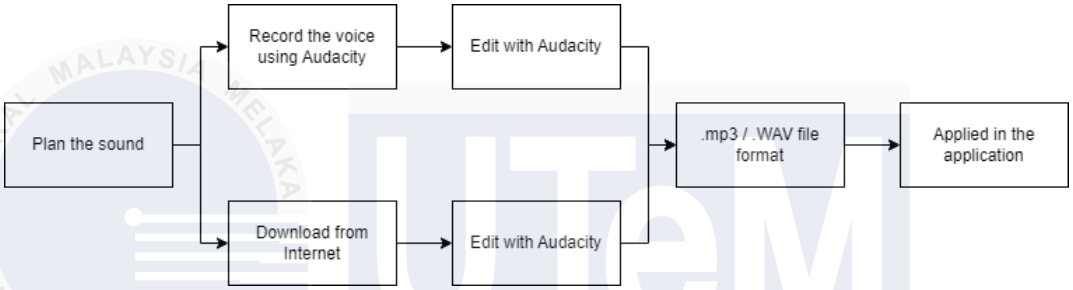


Figure 5.4 Process of audio production

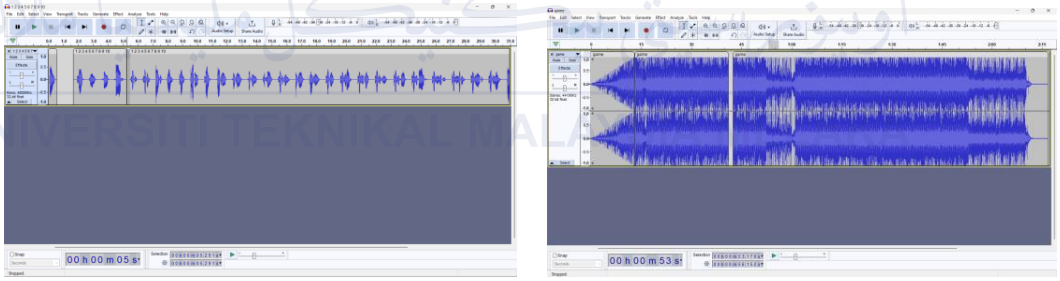


Figure 5.5 Examples of Audio Editing

5.2.4 Production of Animation

Based on the storyboard created during pre-production, the setting is created in this section. The colour scheme and the full environment were created in Adobe Illustrator. The character's eyes and body were already created for this animation, which made animating the character simpler. To make a movement, all the previously separated pieces were saved in Adobe Illustrator and exported to Adobe Animate.

In this project, a few animation principles were used, including squash, stretch, and staging. Squash and stretch are a drawing method used to depict the hyperbolic motions of figures. An essential animation principle that governs how a character moves is squash and stretch. For instance, the opening text scene's movement utilised the squash and stretch. Figure 5.4 show the example of the squash and stretch.

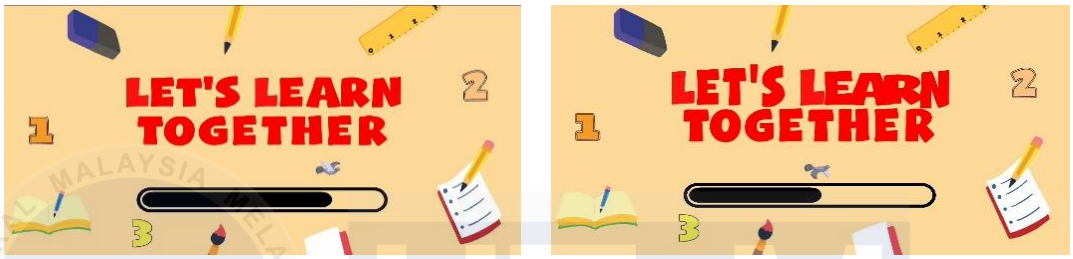


Figure 5.6 Examples of the squash and stretch

Furthermore, rather than using each frame with a different position method in Adobe Animate, motion tween is used to make the character move more fluidly. The motion tween example in this project was the star jumping and waving its hand as well as the hand movements of the bear, monkey, and fox. Each and every file and video clip combo use Adobe Premier Pro. mp4 format is used for publication and final rendering. Any output can be seen on a computer, laptop, or mobile device. The example of a motion tween is shown in Figure 5.5.

Figure 5.7 Examples of motion tween

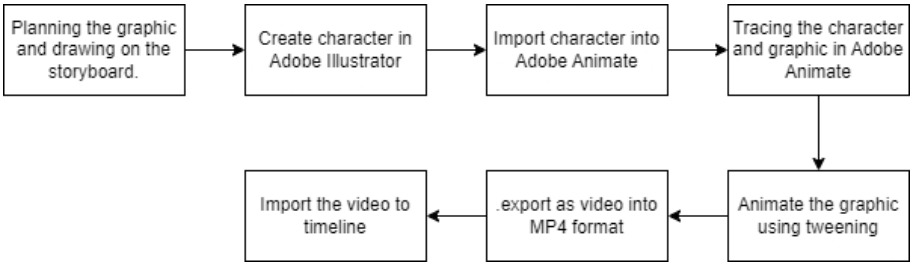


Figure 5.8 Process of animation

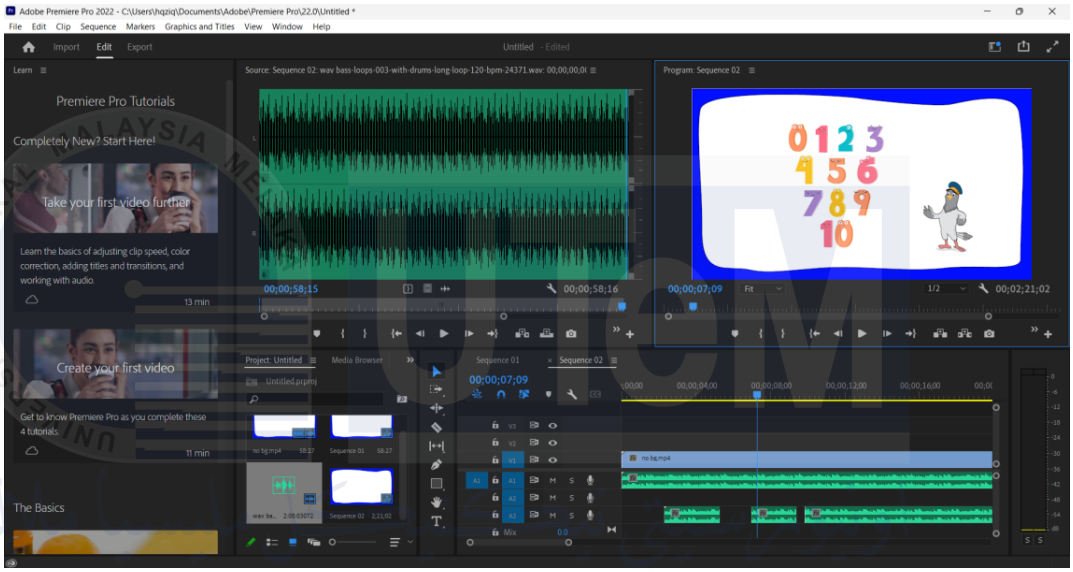


Figure 5.9 Example of editing Video Animation in Adobe Premiere Pro

5.3 Media Integration

Adobe Animate is the primary platform used to combine the entire component. It is primarily needed because this programme relies on action script to run. There is also a little animated video that incorporates a variety of multimedia components. All the produced graphics and animations were created using Adobe Illustrator. Adobe Illustrator was used to create the character and object, while Adobe Animate was used to make the animation.

5.4 Product Configuration Management

This project employed Adobe Illustrator as a tool for creating illustrations of characters and objects. The characters and objects were rendered using vector layers. The completion of all colouring and shading is executed at this location. Once the process of sketching the character and object is completed, the resulting artwork will be exported to Adobe Animate. Subsequently, the animation will be meticulously crafted frame by frame within the software. Once the animation has been completed, the subsequent step involves incorporating the textual subtitles into the animation. Subsequently, the project will be converted into the video format MP4.

5.4.1 Configuration Environment Setup

Software	Configuration
Adobe Illustrator	**View Port Configuration** Size: 1920 x 1080 Ruler Units: Pixels Raster Effect: 72 ppi Colour Mode: RGB **Output Setting** Output Size: 1920 x 1080 Quality: High Quality Format: PNG
Adobe Animate	**Development Configuration** Size Stage: 2400 x 1800 px Background: white

	Frame rate: 24fps (frame per second) **Publish Setting** Version: Adobe Animate 2022 Load order: Bottom Up Action Script version: Action Script 3.0 Target: AIR 50.2.2.6 for Android JPEG Quality: 80% **Music and Sound Effect** Audio Stream: MP3, 160 kbps, Stereo Audio Event: MP3, 160 kbps, Stereo

Figure 5.10 Software and Configuration Setup

5.4.2 Version Control Procedure

This application's development is based on the most recent and reliable software version. The project that is now under development needs the version control process. It is a safety measure implemented to guarantee that the project can be constructed and successfully used in the future.

5.5 Implementation

The development process for this project is tracked and documented using the implementation status. Each module of the development programme will be covered in this section.

Phase 1	Content Verification
Module name	Content Verification with Subject matter Experts
Duration	3 weeks
Description	Conducted to make sure that the content that will be used is correct.
Total (weeks)	3

Phase 2	Storyboard Design
Module name	Storyboard
Duration	2 weeks
Description	Storyboard was sketch with script and flow of the system
Total (weeks)	5

Phase 3	Character Design
Module name	Character Design
Duration	3 weeks
Description	The background, button, characters and other graphic will be design using Adobe Illustrator.

Total (weeks)	8

Phase 4	Flow of the System
Module name	Flow of the System
Duration	1 week
Description	Create scene by scene and each scene has their functionality for with navigation button.
Total (weeks)	9

Phase 5	Create animated scene
Module name	Animating
Duration	5 weeks
Description	Create the animation frame by frame by using Adobe Animate
Total (weeks)	14

Phase 6	Sound
Module name	Sound

Duration	5 days
Description	The animations voice over recorded. Also insert sound effects and other appropriate background music.
Total (weeks)	14.8

Phase 7	Publish the Application
Module name	Publish Animation
Duration	1 Days
Description	The background, button, characters and other graphic will be designed using Adobe Illustrator.
Total (weeks)	15

5.6 Conclusion

The manufacturing and implementation process are described in this chapter. In addition, this chapter covered explanations of software configuration and the software tools that facilitate setup. So, additional testing is required to ensure that all functions are working properly. Testing will be emphasised in the following chapter.

CHAPTER 6: TESTING

6.1 Introduction

A predetermined action that may be planned and carried out systematically is testing. Testing needs to be done after the installation phase is over. The testing stage will outline how to evaluate and analyse the project's output after all the cycle and process development phases have been accomplished. Testing is done to ensure that the project will go as planned and that the application's content will be useful to the intended audience. The testing procedure used to construct this application will be briefly covered in this chapter.

6.2 Test Plan

The test plan will clarify the intended user of the project, the scope of the project, the surroundings, and the activities that are planned.

6.2.1 Test User

Children who are still learning basic mathematics and are between the ages of 5 and 6 will participate in the testing for this project. The instructor who teaches mathematics is the other tester. The individual who is familiar with multimedia makes up the rest of the testers.

a) **Kids aged 5 and 6 years old**

If the app is finished and used, kids in this age range will be the main users. This type of tester will compare how well the app worked before and after it was used.

b) Subject Matter Expert

This person will give suggestions and feedback to help this project. She also decides that this project will attract kids and help them learn to count.

c) Multimedia Expert

A person who is a specialist in both multimedia and information technology is called a "multimedia specialist." They chose the graphic designer, animator, videographer, and lecturer to take the test. At the end of the development process, this test is done before the product is put on the market. They will test the application with a focus on the project's interface, interaction, design, integration of multimedia features, and content layouts.

6.2.2 Test Environment

Test environment involves the location held for the tests. Other than that, hardware and software requirements to launch the Counting Quest app. A conducive environment helps to carry out tests providing accurate answers. The location of the test held is Tadika Al-Fateh Genius, Ayer Keroh, Melaka.

i. Hardware Requirement

The Counting Quest can be accessed by smartphone. The tester must have a device to test the application.

ii. Software Requirement

The software requirement is android smartphones. The application only supports android smartphones with android 10 and above.

6.2.3 Test Schedule

The test schedule is created to guarantee that the test will proceed as scheduled within the allotted time. The data will then be analysed. The testing phase's timetable is displayed in Table 6.1.

Table 6.1 Testing Phase Schedule

Test	Duration (day)	Start	Finish
Test Planning	6	5 August 2023	11 August 2023
Test Plan and Schedule Preparation	9	19 August 2023	27 August 2023
Test Environment and Questionnaire Preparation	4	2 September 2023	6 September 2023
Testing	6	12 September 2023	18 September 2023
Total (days)	25		

6.3 Test Strategy

There are three types of users that need to do the test, which are kids, subject matter expert, and multimedia experts. The testers will use the Counting Quest application and need to answer the questionnaires given. All three types of users will

be given different questionnaires but the same pattern. They have five rating ranges from one to five.

6.4 Test Implementation

Implementing a test is the process of putting an evaluation strategy into action. It entails everything from making exams and organising testing dates to collecting data, keeping information secure and private, scoring tests, giving feedback, and analysing outcomes. The goal of this procedure is to collect useful information that can be used to guide educational decisions and enhance student achievement on standardised tests. Maintaining tests' validity, reliability, and alignment with educational goals requires meticulous documentation and ongoing improvement efforts, both of which are essential to efficient test administration.

6.4.1 Test Description

Thirty kindergarteners, three Multimedia Experts, and one subject matter expert make up the user testing populations for the different sets. The kindergarteners' desire for information has been met through guidance, and queries will be answered independently by Multimedia Experts and Subject Matter Experts.

6.4.2 Test Data

Test data is the information and answers that are collected during tests, such as questions, answers, and scores. It is important for figuring out who is competent, making decisions, and making training and accreditation programmes better. It is very important to keep its privacy and authenticity.

Table 6.2 User testing's detail

Testing	Questionnaire	Questionnaire	Questionnaire
Position	Kids aged 5 and 6 years old	Subject Matter Expert	Multimedia Expert

General Information	Person who learns in school	Person who teaches mathematics in preschool	Multimedia Designer who works and experienced in multimedia field.
Total user	30	1	3

Position	**Details**
Kids aged 5 and 6 years old	30 kids from Tadika Al-Fateh Genius, Ayer Keroh, Melaka
Subject Matter Expert	Nurul Azmin binti Abd Rahim Head Academic at Tadika Al-Fateh Genius, Ayer Keroh, Melaka
Multimedia Expert	1. Dr. Mohd Khalid Mokhtar (20 years' experience) 2. Ts. Muhammad Helmy bin Emran (22 years' experience) 3. Ikmal Faiq Albakri bin Mustafa Albakri (5 years' experience) All are lecturer from UTeM

6.4.2.1 Testing Result for Kids aged 5 and 6 years old

The outcomes of the test for Kids aged 5 and 6 years old are presented in Table 6.3.

Table 6.3 Testing Result for 5 and 6 Years Old Kids

No	Question	1	2	3	4	5	Yes	No
Section 2: Gamification Experience								
1	Have you played question-answering game or quiz game before?	-	-	-	-	-	17	13
2	How comfortable are you with using a smartphone?	1	1	3	5	20	-	-
3	How often do you like to answer questions or solve puzzles	0	3	2	17	8	-	-
Section 3: Game Engagement								
1	Did you find the questions in the game interesting and suitable for your age?	-	-	-	-	-	28	2
2	How engaged were you while answering the questions?	1	0	0	7	22	-	-
Section 4: Learning Experience								
1	Did you learn something new from answering the questions in the game?	-	-	-	-	-	24	6
2	There are potential challenges or limitations in evaluating the learning effectiveness of such modules.	Animation video		Assessment		Know Number		
		10		19		6		
3	Were there any questions that you found confusing or difficult to answer?	-	-	-	-	-	13	17
Section 5: Motivation								
1	How motivated were you to keep	0	1	3	6	20	-	-

	answering questions as you progressed through the game?							
Section 6: Overall Impression								
1	How would you rate the overall experience of playing this question-answering game?	1	0	2	5	22	-	-
2	To what extent did this game help you learn in an interesting way?	0	0	2	8	20	-	-

6.4.2.2 Testing Result for Subject Matter Expert

The outcomes of the test for Multimedia Expert are presented in Table 6.4.

Table 6.4 Testing Result for Subject Matter Expert

No	Question	1	2	3	4	5
Section 2: To identify gamification techniques that can increase children's motivation in learning						
1	The proposed gamification techniques can effectively enhance children's motivation to learn mathematics.				1	
2	The proposed gamification techniques align with effective math teaching strategies				1	
3	Gamification can be adapted to various mathematical concepts effectively.				1	
Section 3: To develop mobile learning modules for children that apply the proposed gamification techniques.						
1	Mobile learning modules are a suitable platform for teaching mathematics to children.				1	
2	The proposed mobile learning modules effectively incorporate gamification elements.			1		
3	The mobile learning modules are likely to engage children in mathematical learning.				1	

Section 4: To evaluate the learning effectiveness of the mobile learning modules in increasing children's online learning motivation.						
1	Assessing the learning effectiveness of the mobile modules is essential for educational improvement.				1	
2	The project's methods for evaluating online learning motivation are valid and reliable.				1	
3	The project's approach to measuring the impact of gamification on motivation is appropriate.				1	
Section 5: General Assessment						
1	Overall, do you believe this project has the potential to positively impact children's math learning motivation through gamification techniques?				1	
Section 6: Additional Comments						
1	Please provide any additional comments or suggestions regarding the project's objectives, methodology, or overall suitability for math education.	Please improve on assessment, adding wrong or right after answering question				

6.4.2.3 Testing Result for Multimedia Expert

The outcomes of the test for Multimedia Expert are presented in Table 6.5.

Table 6.5 Testing Result for Multimedia Expert

No	Question	1	2	3	4	5
Section 2: Gamification Techniques						
1	I am familiar with the concept of gamification in educational contexts.			1	1	1
2	I believe the proposed gamification techniques will be effective for motivating children in learning.				1	2

3	I have additional gamification techniques in mind that could be beneficial for the "COUNTING QUEST" project.				1	2
Section 3: Mobile Learning Modules						
1	I believe the proposed mobile learning modules will engage and effectively educate children.			2	1	
2	Design and usability considerations are important when developing mobile learning modules for children.					3
Section 4: Learning Effectiveness						
1	The proposed methods or metrics will be effective for evaluating the learning effectiveness of the mobile learning modules in terms of increasing children's online learning motivation.			2	1	
2	There are potential challenges or limitations in evaluating the learning effectiveness of such modules.				1	2
Section 5: Overall Feedback						
1	I am confident that the project will succeed based on the provided information			2	1	
Section 6: Additional Comments						
1	Please provide any additional comments or suggestions regarding the project's objectives, methodology, or overall suitability for math education.	1. Need to improve 2. Should improve on interface. The radio button is too small. The type face too cannot see want to type the name. The animation should more or else use e-book as delivery platform. Add more module. 3. Please ensure your UI is clear enough. There is no				

		wrong indication when you submit the wrong answer.

6.5 Test Results and Analysis

Diagrams will be presented in this study based on the outcomes of the overview and testing procedures. This figure depicts the evaluation testing that was conducted. Based on the information obtained from the test results, a few charts were made to illustrate the conclusion of the evaluation.

6.5.1.1 Testing Result Kids aged 5 and 6 years old

There are 30 students who respond to the survey. They have been provided the questionnaire. All gathered information will be analysed and compiled into a chart.

The data pertaining to User Experience has been collected and is presented below, categorised accordingly

i. General Information

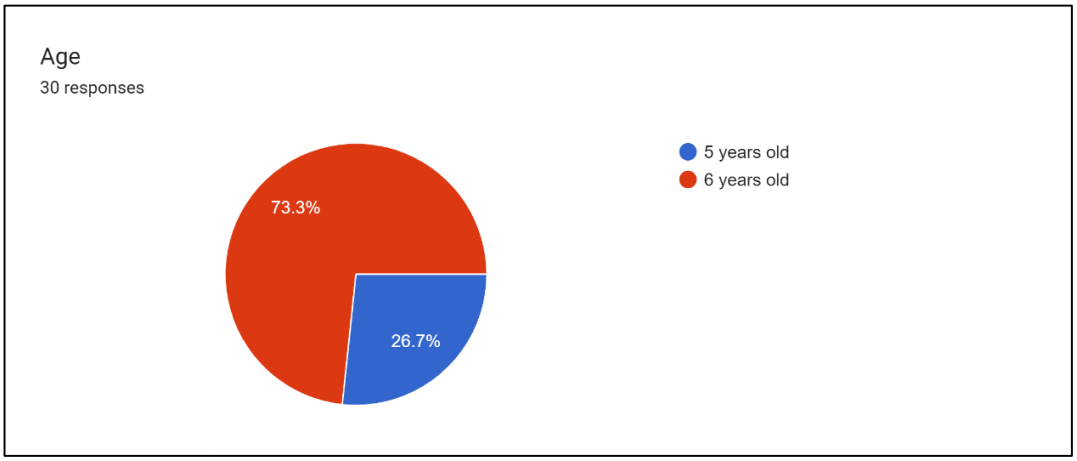


Figure 6.1 Data for Age

The data in Figure 6.1 shows for first question collected are 22 respondents are 6 years old when the remaining 8 respondents are 5 years old.

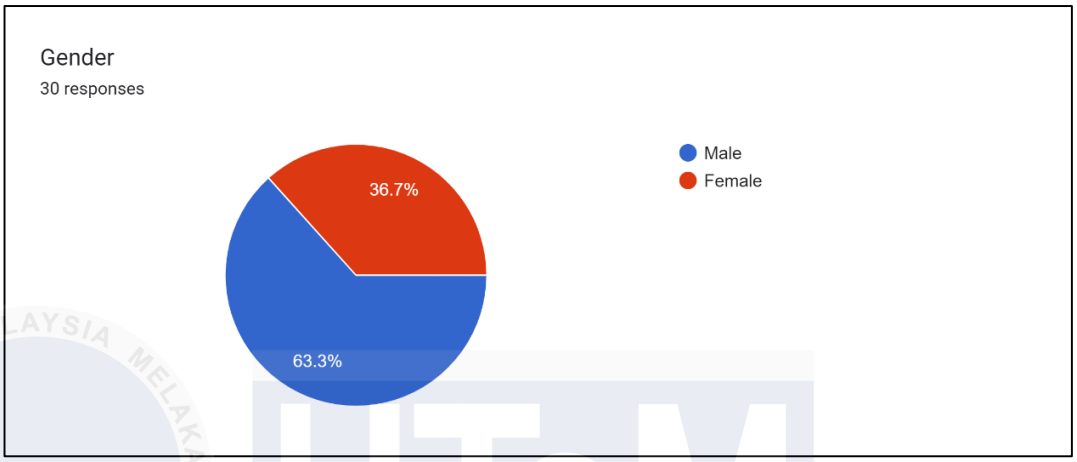


Figure 6.2 Data for Gender

The data in Figure 6.2 shows that are 19 respondents are male and the remaining 11 respondents are female.

ii. Game Experience

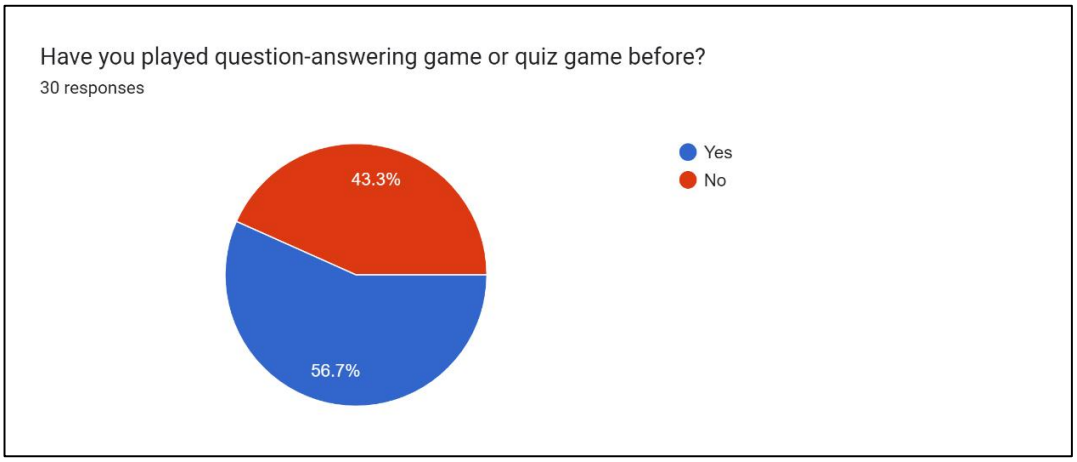


Figure 6.3 Data for whether they have been playing question-answering before or not

Based on figure 6.3 it shows that 56.7% which is 17 respondents have been played question-answering game or quiz before while the balance 43.3% which is 13 respondents never played the game before.

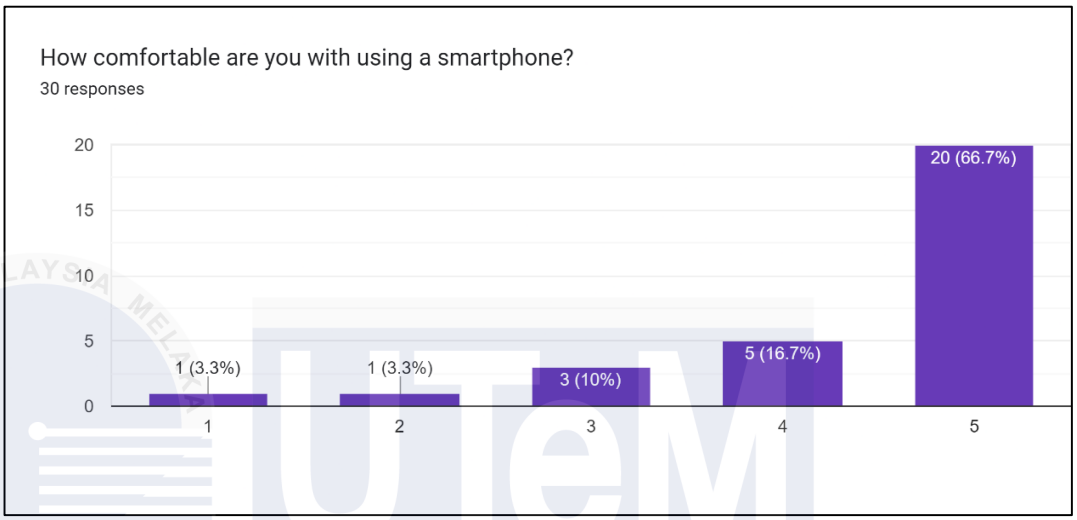


Figure 6.4 Data for whether respondents are comfortable or not using smartphone

The score 1 to 5 is identified as:

1 – Very Uncomfortable

2 – Somewhat Uncomfortable

3 – Neutral

4 – Somewhat Comfortable

5 – Very comfortable

Based on figure 6.4 above, the data shows 20 respondents very comfortable, 5 respondents somewhat comfortable, 3 respondents neutral, 1 respondent somewhat uncomfortable and 1 respondent very uncomfortable using smartphone.

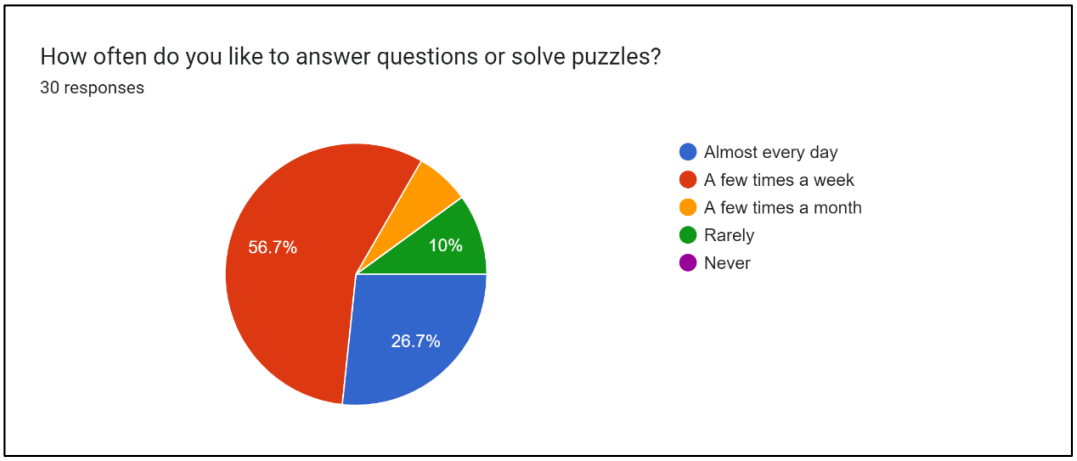


Figure 6.5 Data for how often respondent like to answer questions or solve puzzles

Based on figure 6.5, the data show how often respondent like to answer questions or solve puzzles shows are 8 respondents almost every day, 17 respondents a few times a week, 2 respondents a few a month and 3 respondents rarely.

iii. Game Engagement

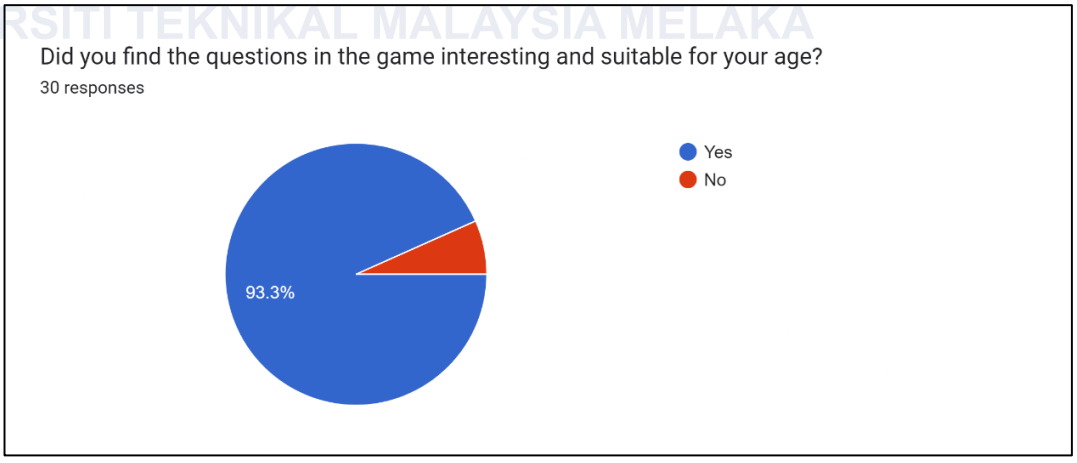


Figure 6.6 Data for whether game interesting and suitable for kids' age

Based on figure 6.6, 92.9% which is 26 respondents are agree that they find the questions in the game interesting and suitable for their and 7.1% which is 4 respondents did not agree.

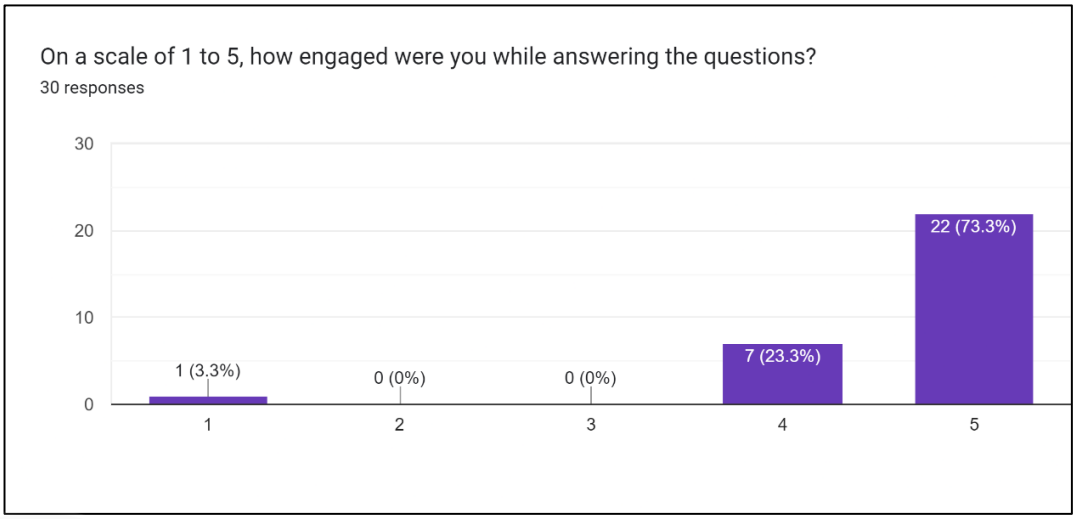


Figure 6.7 Data how engaged were respondent while answering questions

The score 1 to 5 is identified as:

1 – Not Engaged at All
2 – Slightly Engaged
3 – Moderately Engaged
4 – Engaged
5 – Extremely Engaged

Based on figure 6.7, the data show majority voted extremely engaged for this project. 22 respondents voted extremely engaged, 7 respondents voted engaged and 1 person voted not engaged at all.

iv. Learning Experience

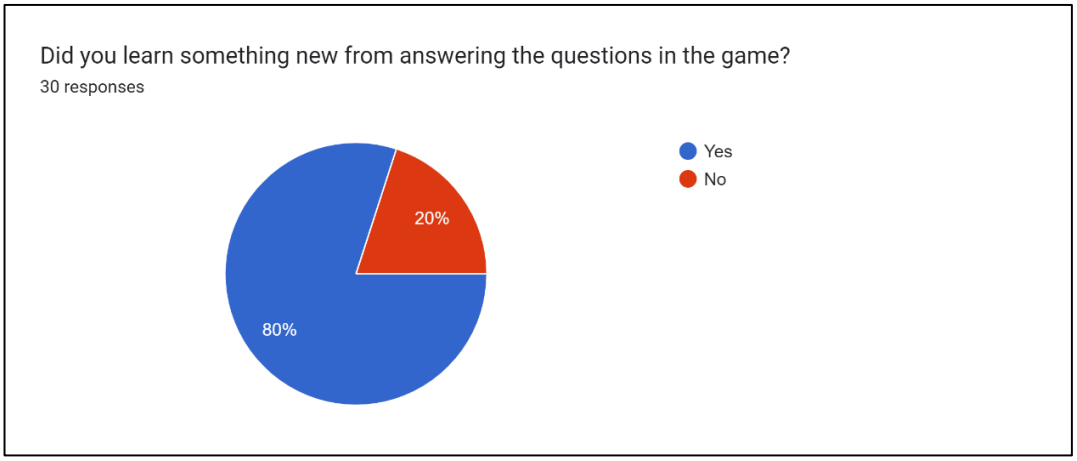


Figure 6.8 Data for whether learn something from the game

Based on figure 6.8, 80% which is 24 respondents voted yes for learn something new from answering the question in the game and 20% voted for no.

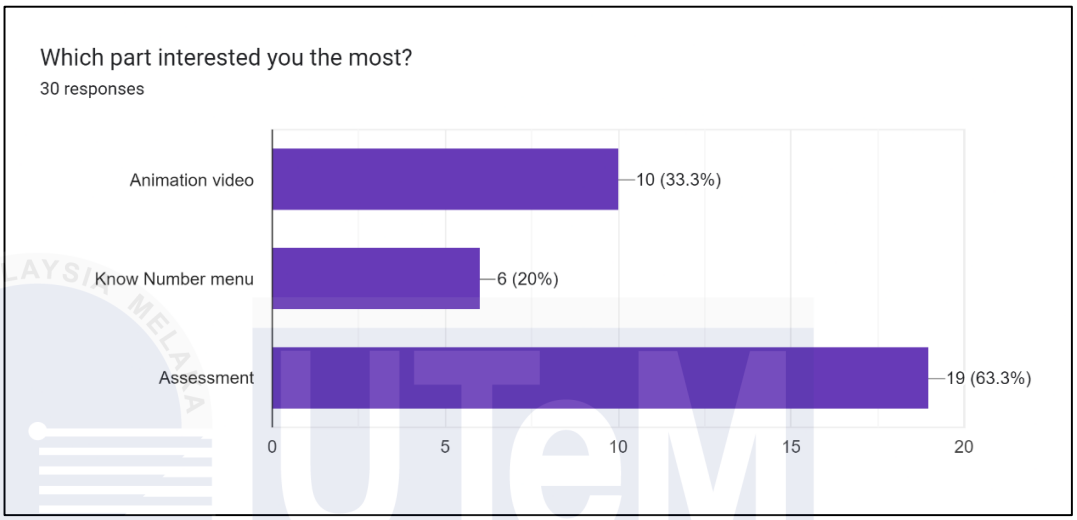


Figure 6.9 Data for which part interested in the game

Based on figure 6.9, the data shows that 19 respondents interested in the assessment which is the highest. The second highest is animation video which is 10 respondents and lastly 6 respondents voted for 'Know Number menu'.

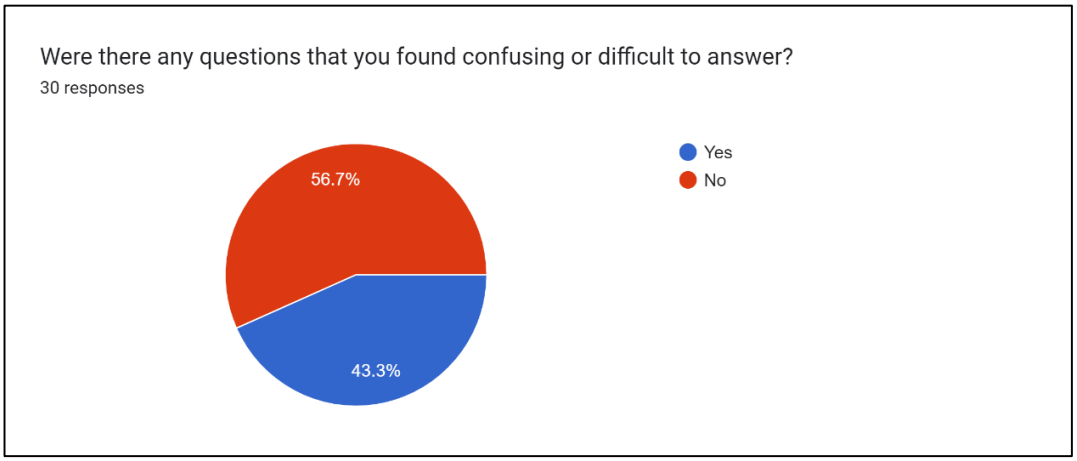


Figure 6.10 Data for whether there is confusing or difficult question to answer

Based on figure 6.10, the data shows that majority of respondents which is 17 voted for no and the balance 13 respondents

voted yes that were any questions is confusing or difficult question to answer.

v. Motivation

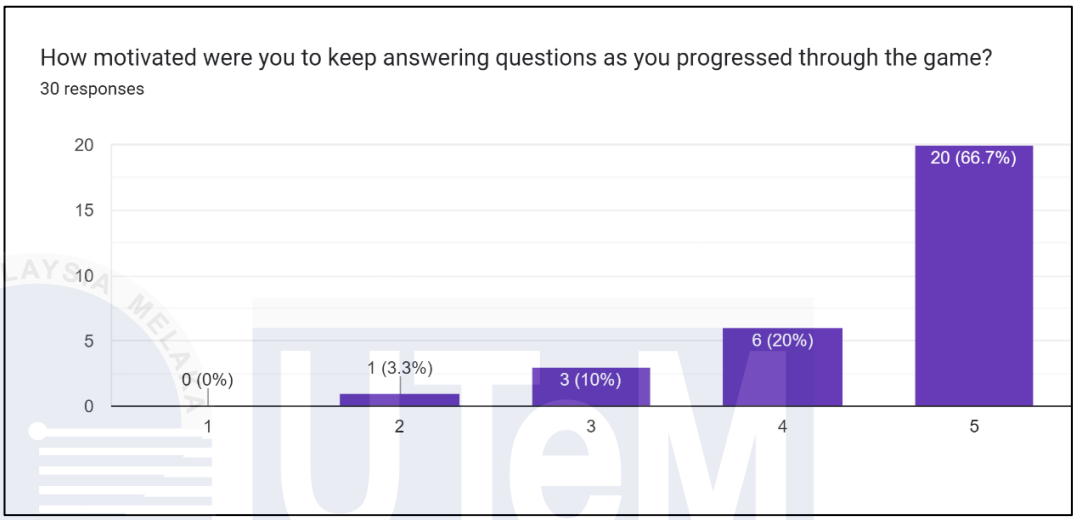


Figure 6.11 Data for whether motivated to keep answering question

The score 1 to 5 is identified as:

1 – Not Motivated at All
2 – Slightly Motivated
3 – Moderately Motivated
4 – Motivated
5 – Extremely Motivated

Based on figure 6.11, the data shows 20 respondents voted for extremely motivated, 6 respondents for motivated and 1 respondent for slightly motivated about motivation to keep answering questions as you progressed through the game.

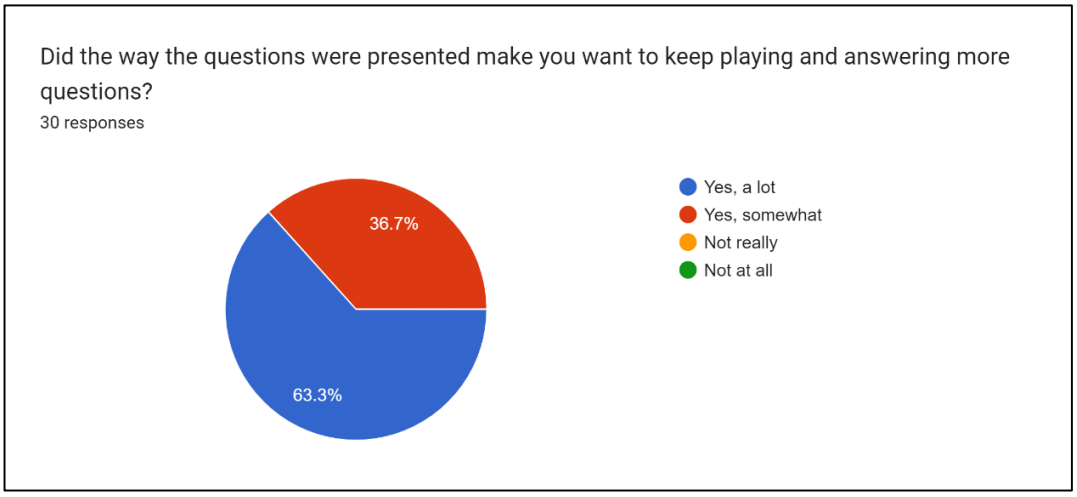


Figure 6.12 data for whether the question will make they keep playing and answering more questions

Based on figure 6.12, the data shows that 19 respondents voted for 'yes, a lot' for the way questions were presented make they want to keep playing and answering more questions and 11 respondents voted for 'yes, somewhat'.

vi. Overall Impression

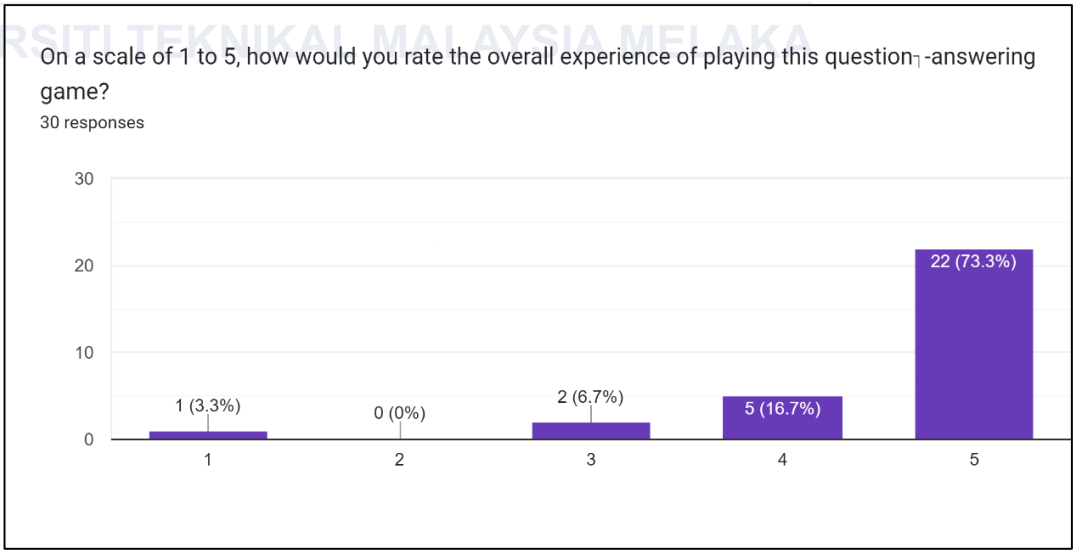


Figure 6.13 Data for rate overall experience

The score 1 to 5 is identified as:

1 – Not Enjoyable at All

2 – Slightly enjoyable

3 – Neutral

4 – Enjoyable

5 – Very Enjoyable

Based on figure 6.13, the data about rating the overall experience of playing this question-answering game shows that 22 respondents voted very enjoyable, 5 respondents for enjoyable, 2 respondents for neutral and 1 respondent for not enjoyable at all.

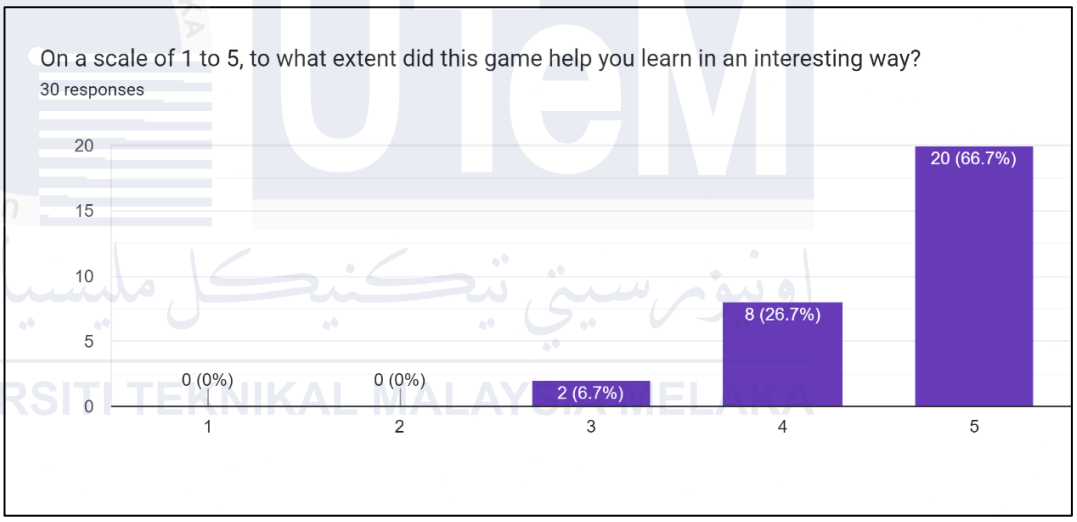


Figure 6.14 Data for the extent game help in learning

The score 1 to 5 is identified as:

1 – Not at All

2 – Not very Much

3 – Somewhat

4 – Quite a bit

5 – A lot

Based on figure 6.14, the data shows that 20 respondents voted for a lot, 8 respondents for quite a bit and 2 respondents for somewhat about did this game help you learn in an interesting way.

(a) Summary Result for Kids Aged 5 and Years Old

Below table and figures show summary of questionnaire kids 5 and 6 years old.

Table 6.6 Summary Result for Questionnaire 5 and 6 Years Old

Question	Average Rating (100%)					Yes or No Question (100%)	
	1	2	3	4	5	Yes	No
Game Experience	1.67%	6.67%	8.33%	38.33%	46.67%	56.7%	43.3%
Game Engagement	3.33%	-	-	23.33%	73.33%	92.9%	7.1%
Learning Experience	-	-	-	-	-	61.65%	38.35%
Motivation	-	1.67%	5%	28.33%	65%	-	-
Overall Impression	1.67%	-	6.67%	21.67%	70%	-	-

6.5.1.2 Subject Matter Expert

The questionnaire that was distributed for the Subject Matter Expert, by giving hand out. The collected data will be examined, then assembled into a chart.

The score 1 to 5 is identified as:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

i. **To identify gamification techniques that can increase children's motivation in learning.**

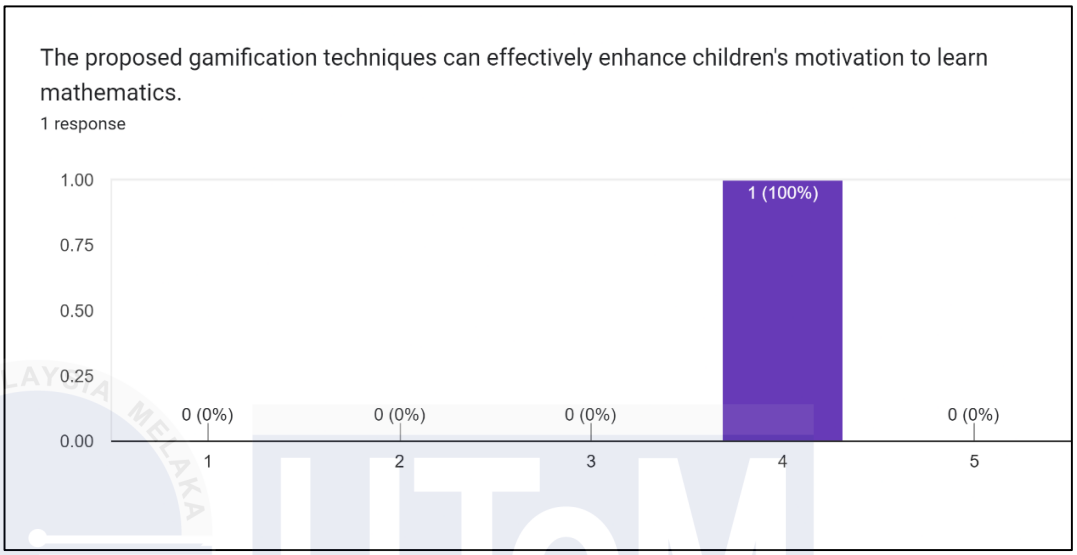


Figure 6.15 Data of Proposed Gamification Techniques can Effectively children motivation

Based on figure 6.15, the expert agrees that the proposed gamification techniques use can effectively enhance children's motivation to learn mathematics.

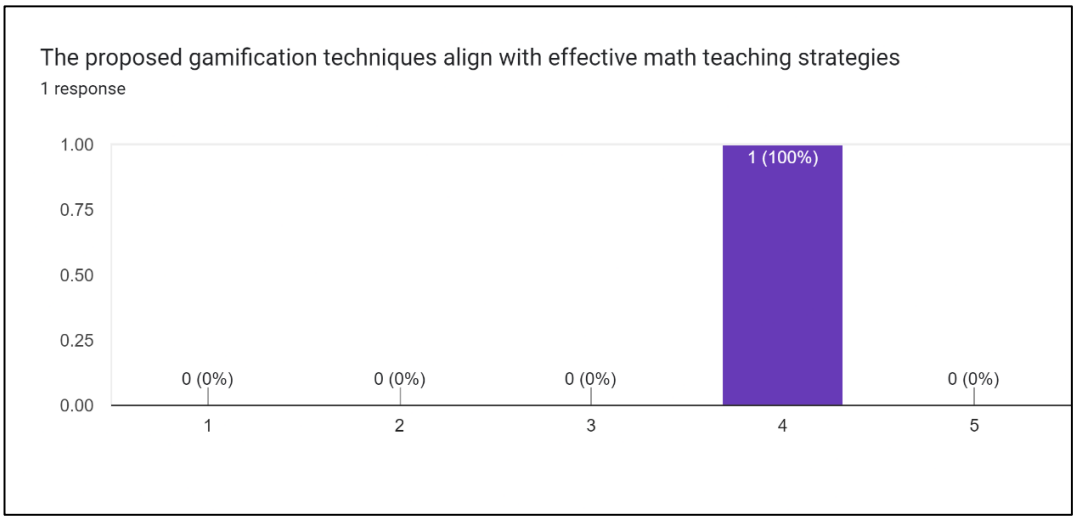


Figure 6.16 Data for Proposed Gamification Techniques Align Effective Math Strategies

Based on figure 6.16, the expert agrees that the proposed gamification techniques align effective math strategies.

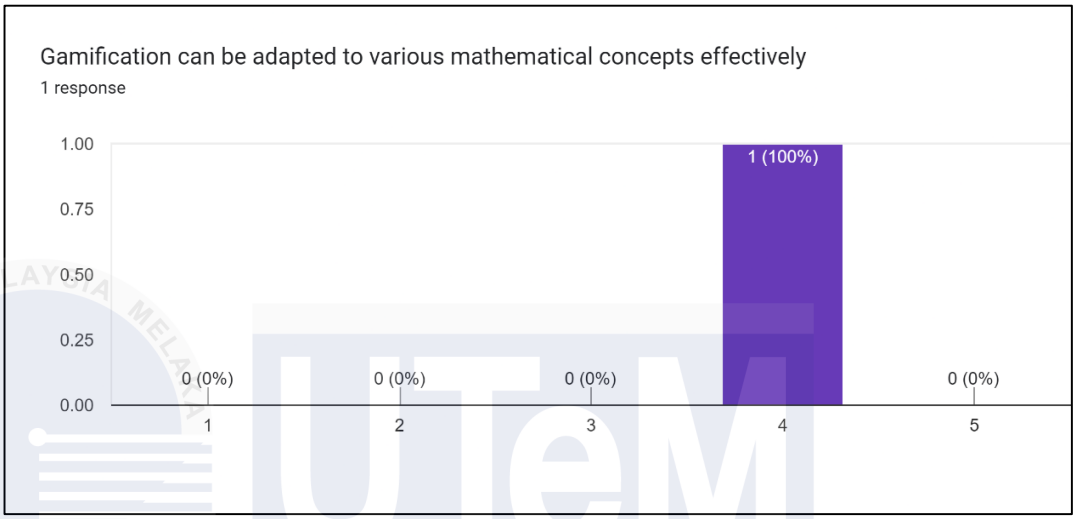


Figure 6.17 Data for Gamification can be Adapted to various Mathematical Concept Effectively

Based on figure 6.17, the expert agrees that gamification can be adapted to various mathematical concepts effectively.

ii. To develop mobile learning modules for children that apply the proposed gamification techniques.

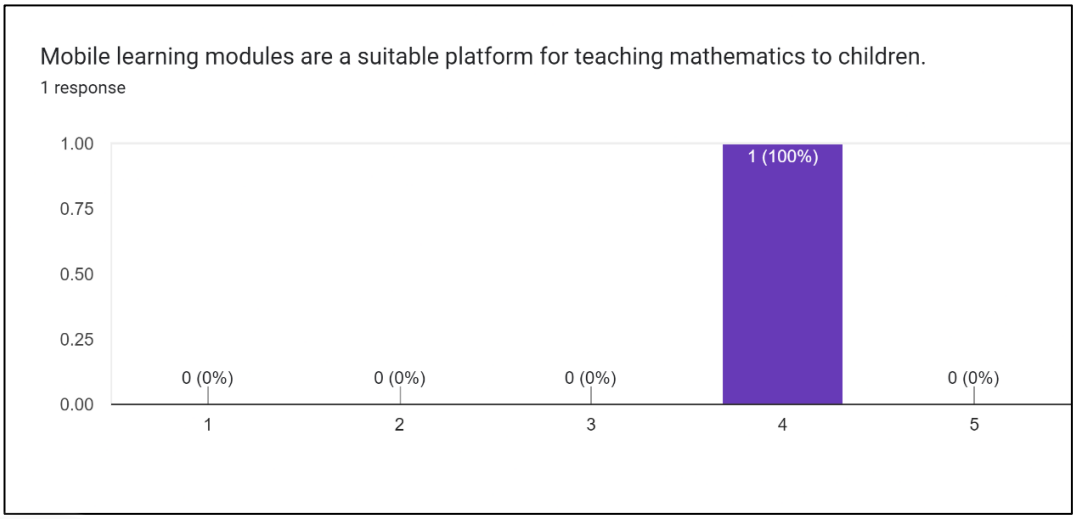


Figure 6.18 Data for Mobile Learning Modules are Suitable Platform for Teaching Mathemathics

Based on figure 6.18, the expert agrees that mobile learning modules are suitable platform for teaching mathematics to children.

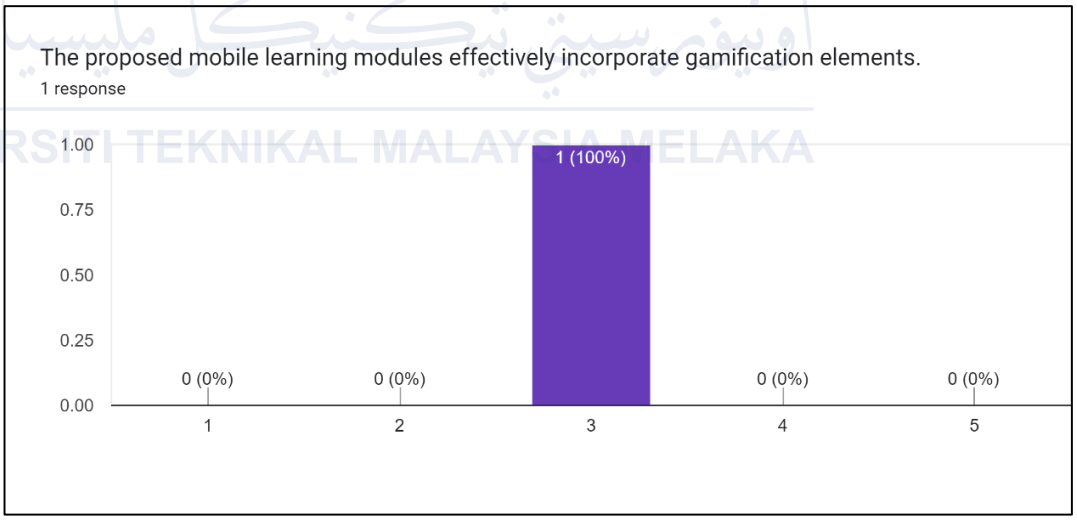


Figure 6.19 Data for the Proposed Mobile Learning Modules Effectively Incorporate Gamification Elements

Based on figure 6.19, the expert neutral that the proposed mobile learning modules effectively incorporate gamification elements.

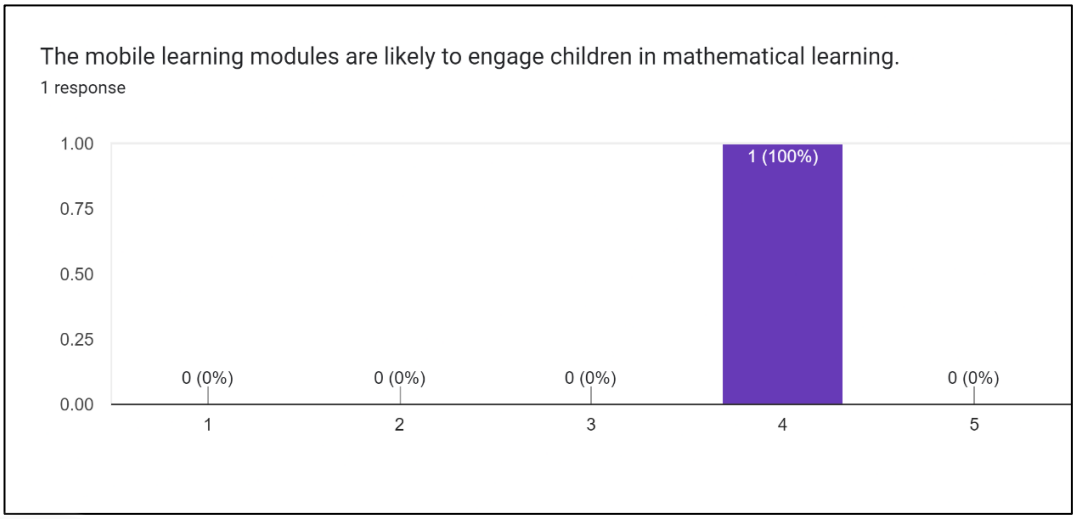


Figure 6.20 Data for Mobile Learning Modules are Likely to Engage Children in Mathematical Learning

Based on figure 6.20, the expert agrees that mobile learning modules are likely to engage children in Mathematical learning.

iii. To evaluate the learning effectiveness of the mobile learning modules in increasing children's online learning motivation.

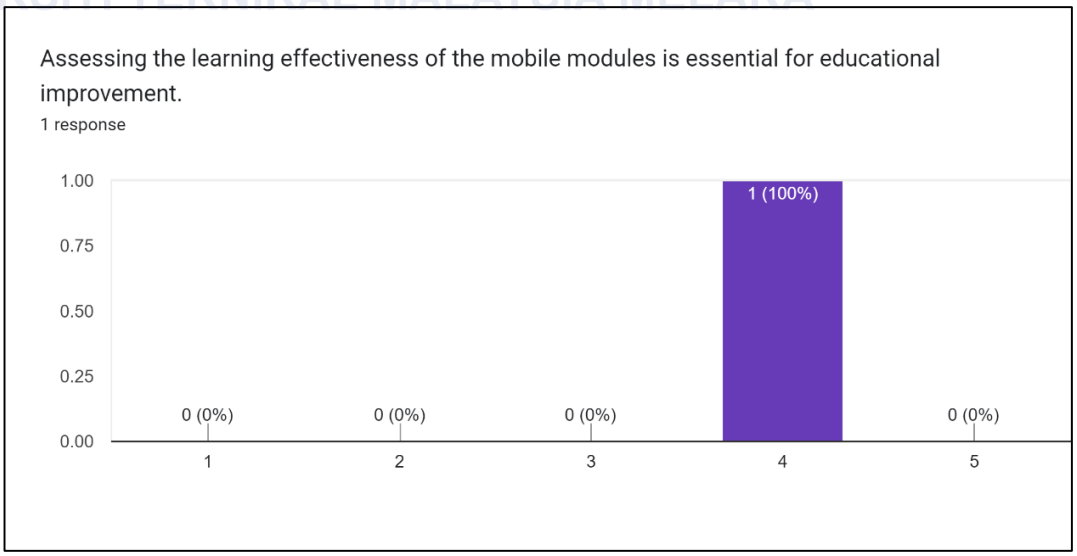


Figure 6.21 Data for Assessing the Learning Effectiveness of the Mobile Modules is Essential for Educational Improvement

Based on figure 6.21, the expert agrees that the assessing the learning effectiveness of the mobile modules is essential for educational improvement.

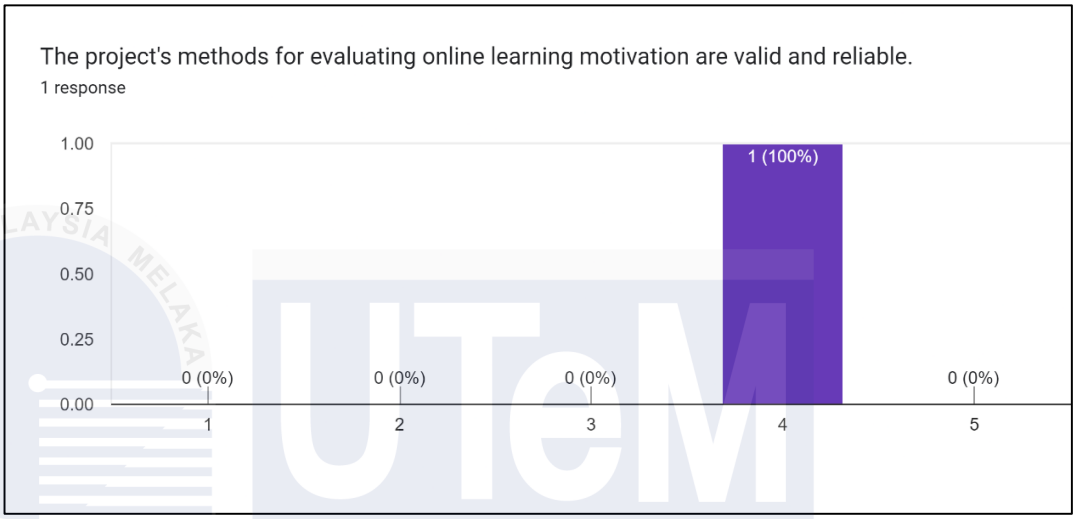


Figure 6.22 Data for the Project's Methods for Evaluating online Learning Motivation are Valid and Reliable

Based on figure 6.22, the expert agrees that the proposed gamification techniques use can effectively enhance children's motivation to learn mathematics.

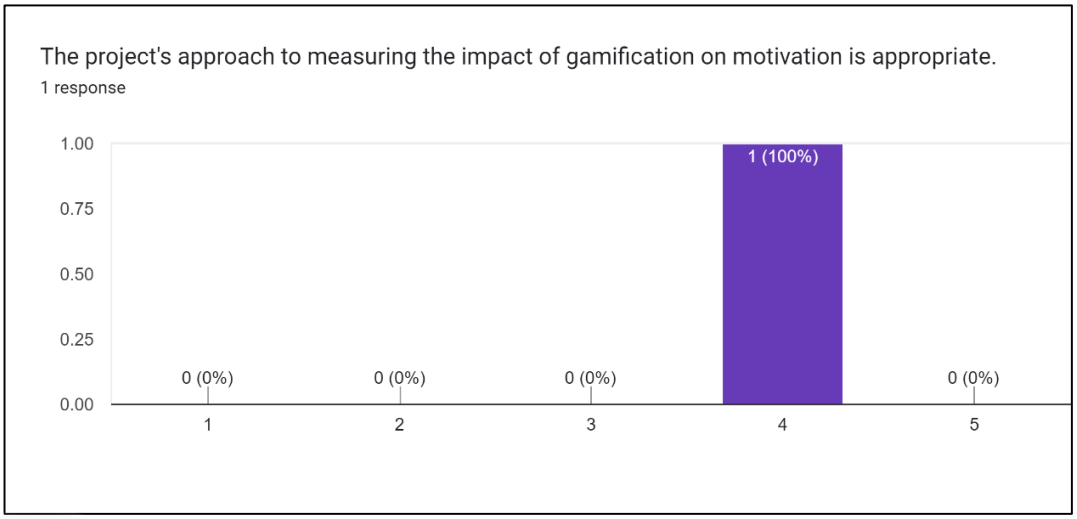


Figure 6.23 Data for the Project's Approach to Measure the impact of gamification on Motivation is Appropriate

Based on figure 6.23, the expert agrees that the project's approach to measure the impact of gamification on motivation is appropriate.

iv. General Assessment

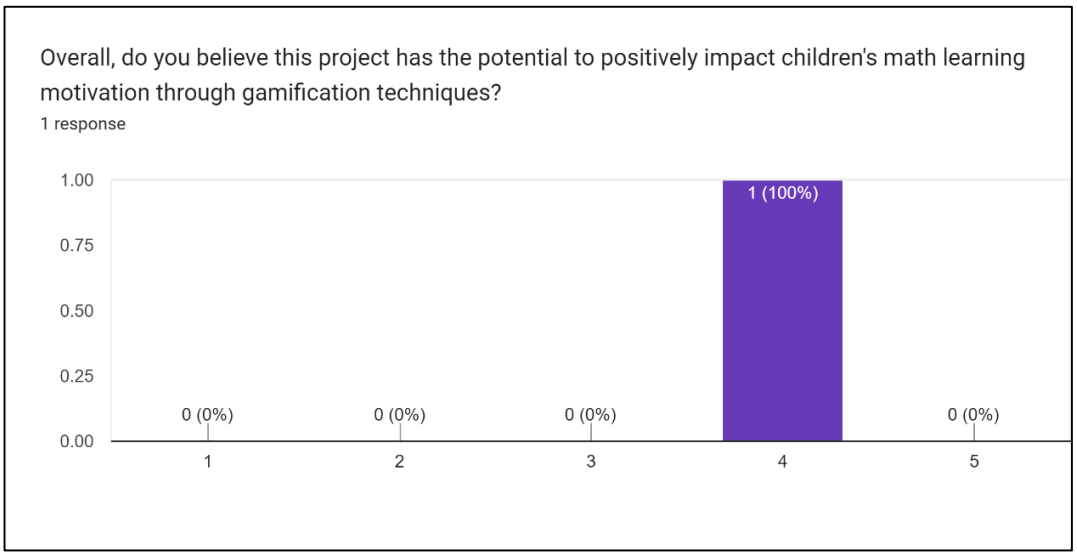
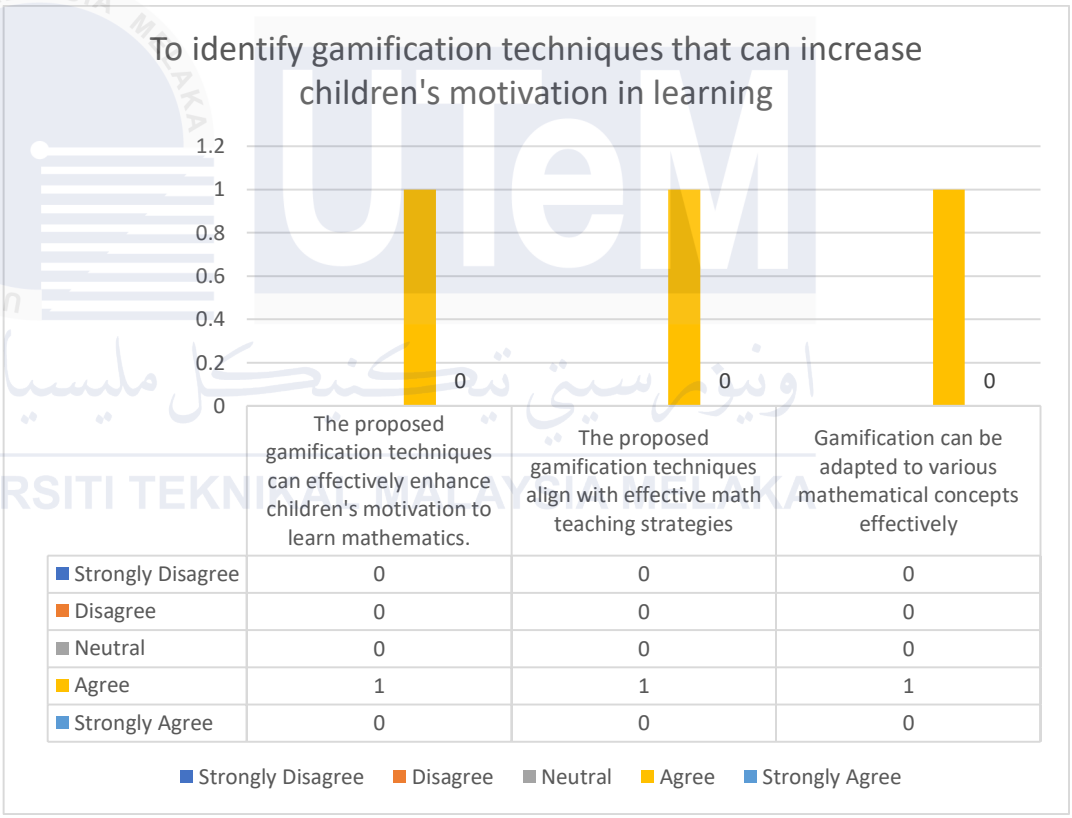


Figure 6.24 Data for Believe this Project has Potential to Positively Impact Children's Math Learning Motivation

Based on figure 6.24, the expert agrees that the believe this project has potential to positively impact children's math learning motivation through gamification techniques.

(b) Summary Result for Subject Matter Expert

Figures and table below show summary for subject matter expert from questionnaire.



	The proposed gamification techniques can effectively enhance children's motivation to learn mathematics.	The proposed gamification techniques align with effective math teaching strategies	Gamification can be adapted to various mathematical concepts effectively
Strongly Disagree	0	0	0
Disagree	0	0	0
Neutral	0	0	0
Agree	1	1	1
Strongly Agree	0	0	0

Figure 6.25 Summary Data for Identify Gamification Techniques that can Increase Children's Motivation in Learning

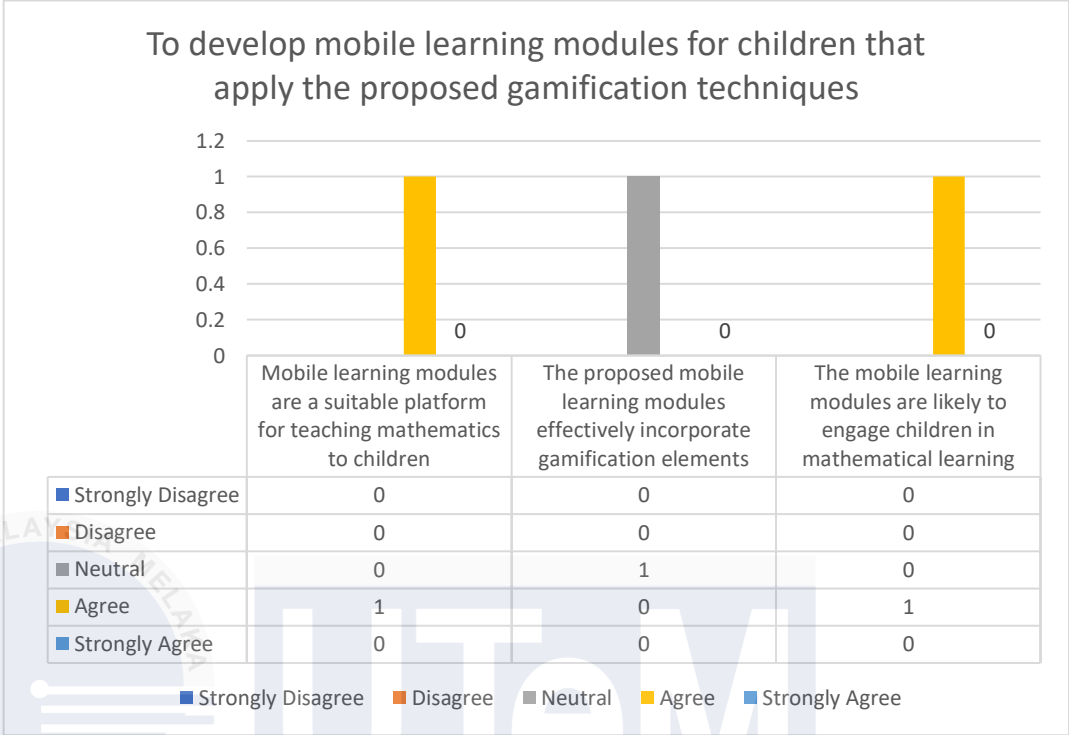


Figure 6.26 Summary Data for Develop Mobile Learning Modules for Children that Apply the Proposed Gamification Techniques

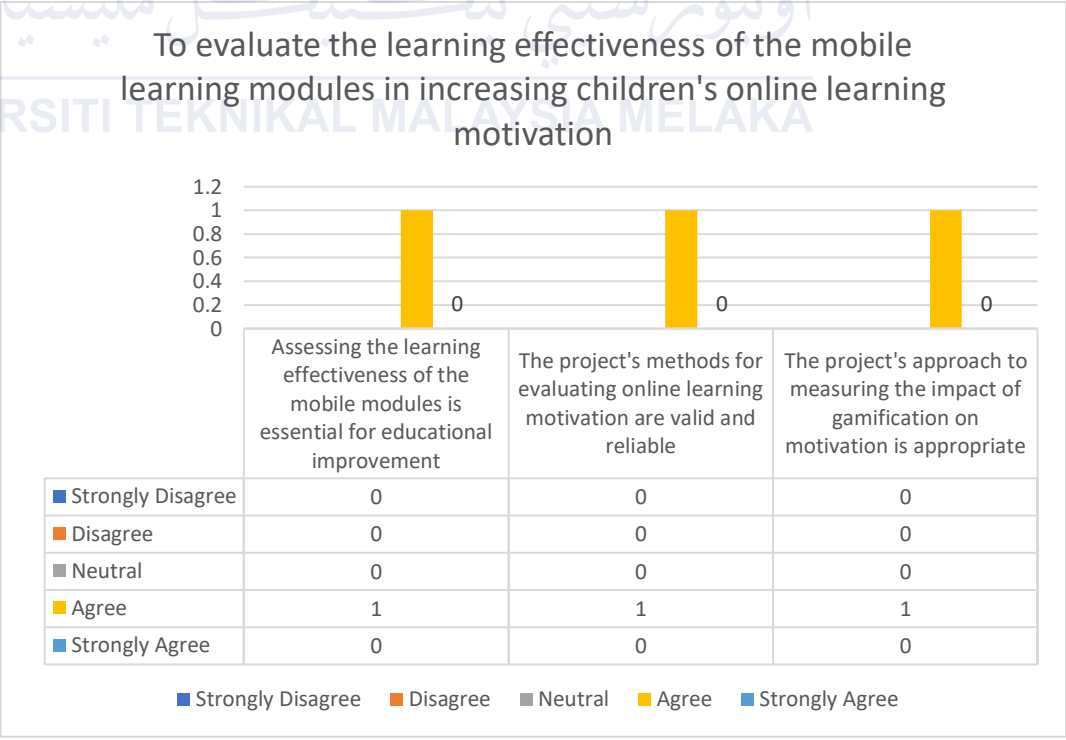


Figure 6.27 Summary data to Evaluate the Learning Effectiveness of the Mobile Learning Modules in Increasing Children's Online Learning Motivation

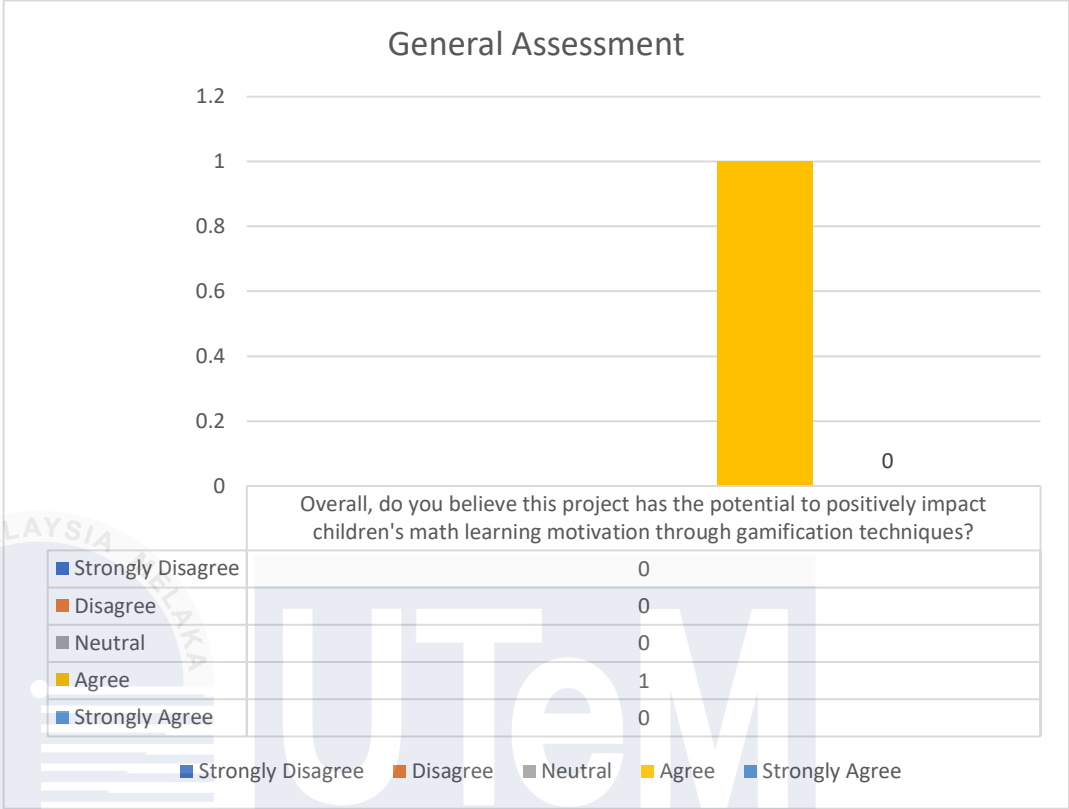


Figure 6.28 Summary Data for General Assessment

Table 6.7 Summary result for Subject matter Expert

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
Identify Gamification Techniques	-	-	-	100%	-	100%
Mobile Learning Modules	-	-	33.33%	66.67%	-	100%
Learning Effectiveness	-	-	-	100%	-	100%

General Assessment	-	-	-	100%	-	100%

In conclusion, the subject matter expert gives the additional comment or suggestions the I need to improve in assessment segment by adding when the kid's answering questions that they know the answer is right or wrong.

6.5.1.3 Multimedia Expert

Participating in the testing method were a graphic designer and a multimedia specialist. Multimedia specialists were to evaluate the effectiveness of the animation video's multimedia elements, including the content, audio, video, and interface design. The collected data will be analysed before being compiled into a chart.

The score 1 to 5 is identified as:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

i. Gamification Techniques

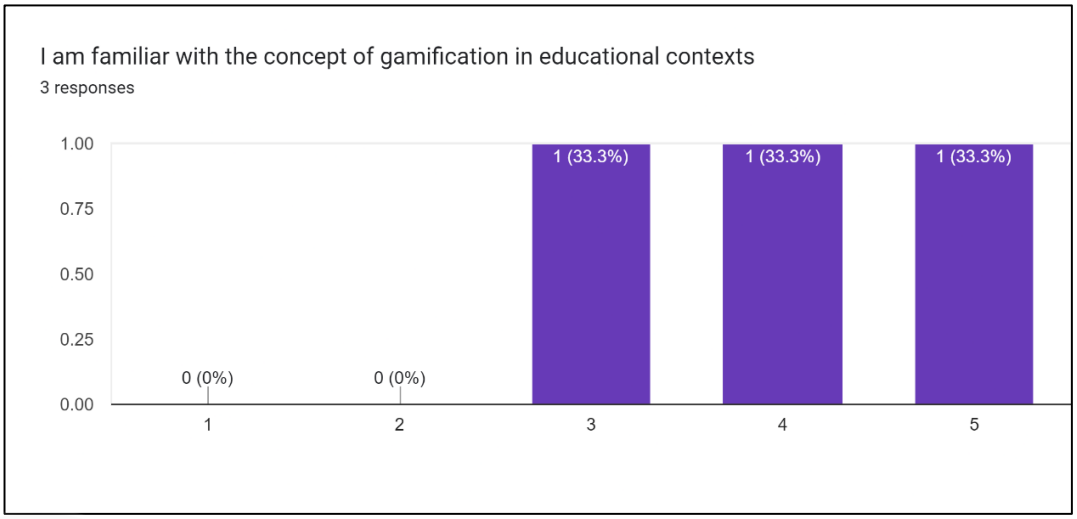


Figure 6.29 Data for whether Familiar of Gamification in Education Context

Based on figure 6.29, the data shows that 1 Multimedia expert voted for strongly agree, 1 voted for agree and remaining 1 voted neutral that familiar with the concept of gamification in educational contexts.

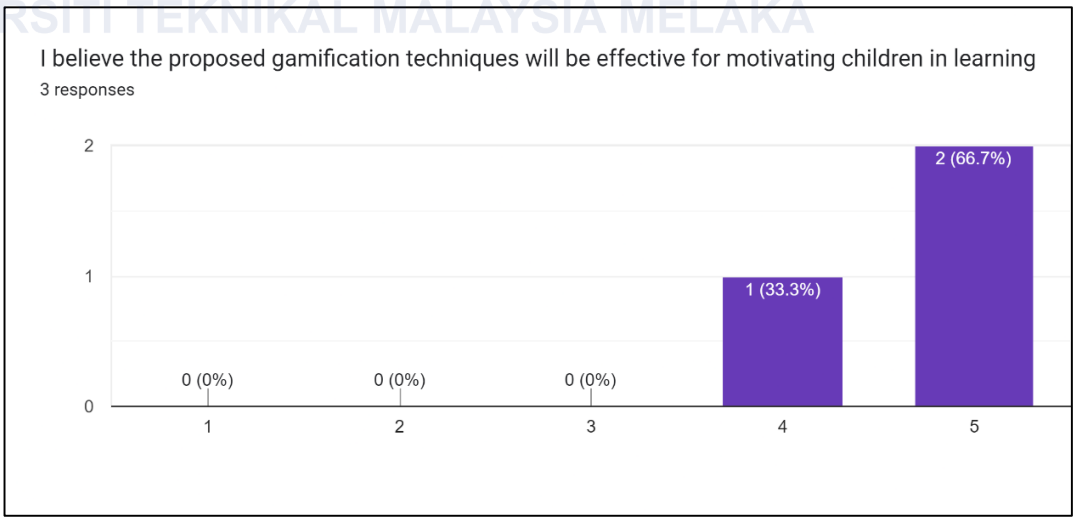


Figure 6.30 Data for whether the Proposed Gamification Techniques will be Effective for Motivating Children in Learning

Based on figure 6.30, the data shows that 2 Multimedia experts voted for strongly agree and 1 voted for agree about believe

the proposed gamification techniques will be effective for motivating children in learning.

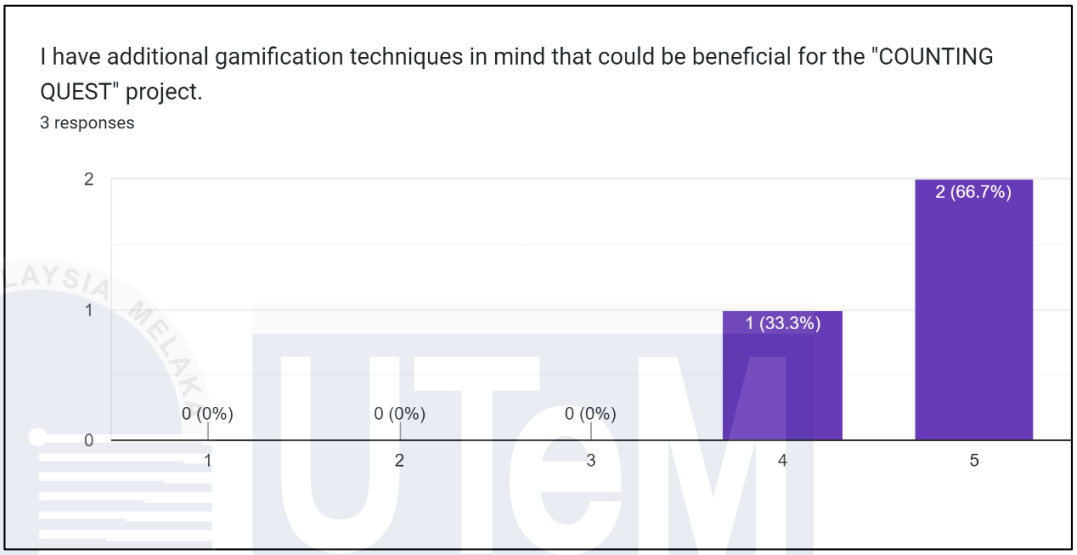


Figure 6.31 Data for whether have Additional Gamification Techniques in Mind that could Beneficial

Based on figure 6.31, the data that have additional gamification techniques in mind that could be beneficial for "Counting Quest" project shows that 2 Multimedia experts voted for strongly agree and 1 voted for agree.

ii. Mobile Learning Modules

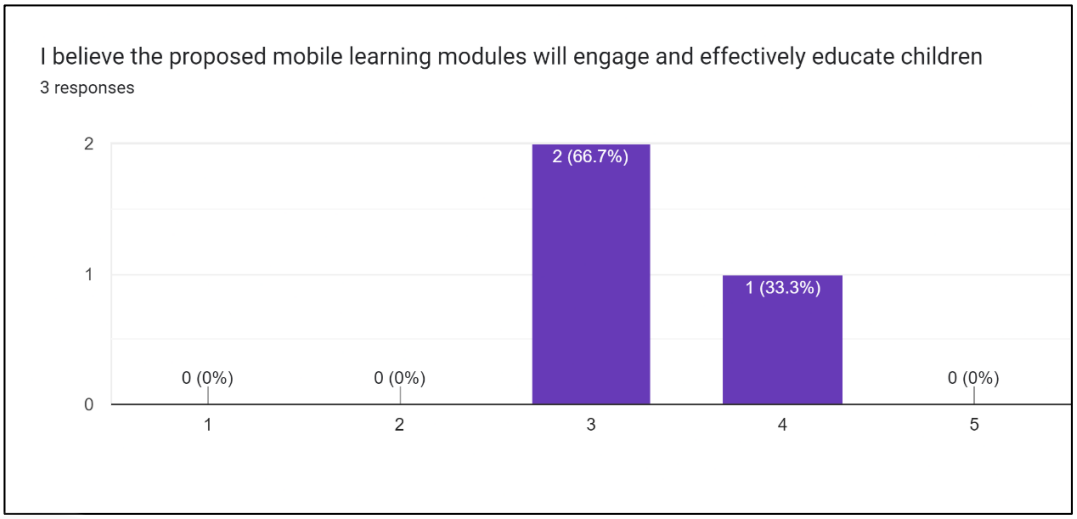


Figure 6.32 Data for Believe the Proposed Mobile Learning Modules will engage and Effectively Educate Children

Based on figure 6.32, the data shows that 1 Multimedia expert voted for agree and 2 voted for neutral that I believe the proposed mobile learning modules will engage and effectively educate children.

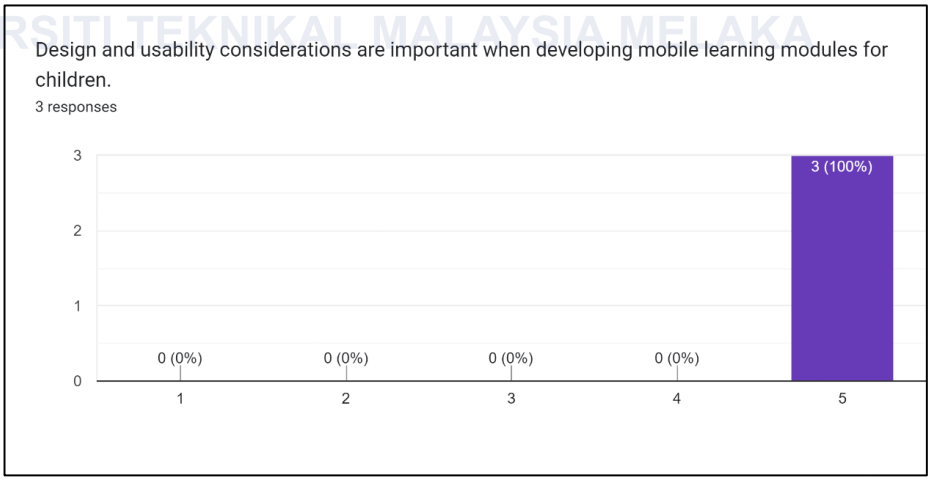


Figure 6.33 Data for Design and Usability considerations are important when Developing Mobile Learning Modules

Based on figure 6.33, the data shows that all 3 Multimedia expert voted for strongly agree that the design and usability

considerations are important when developing mobile learning modules for children.

iii. Learning Effectiveness

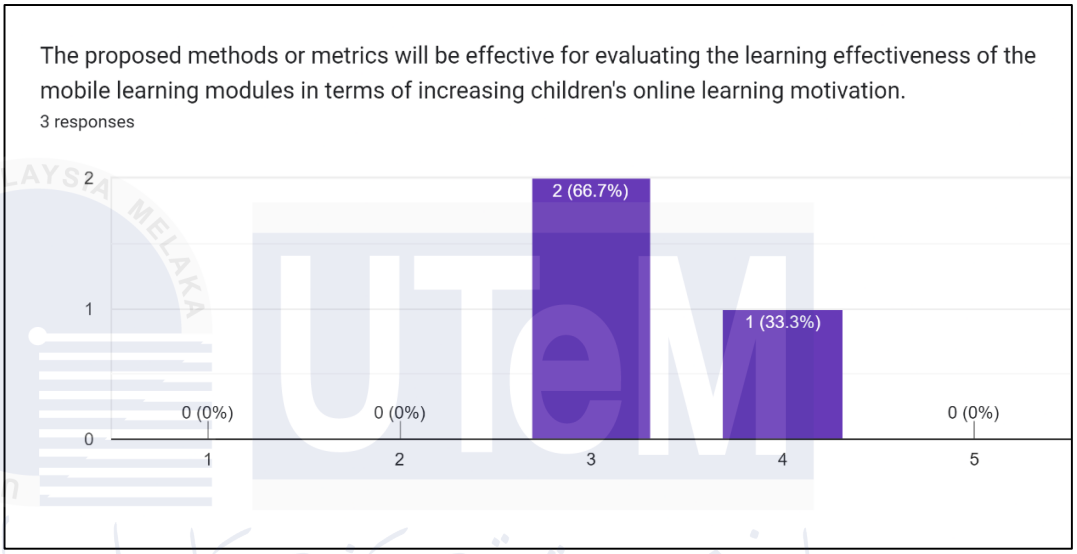


Figure 6.34 Data for the Proposed methods or Metrics will be Effective for Evaluating Effectiveness of the Mobile Learning Modules

Based on figure 6.34, the data shows that 1 Multimedia expert voted for agree and remaining 2 voted neutral that the proposed methods or metrics will be effective for evaluating the learning effectiveness of the mobile learning modules in terms of increasing children's online learning motivation.

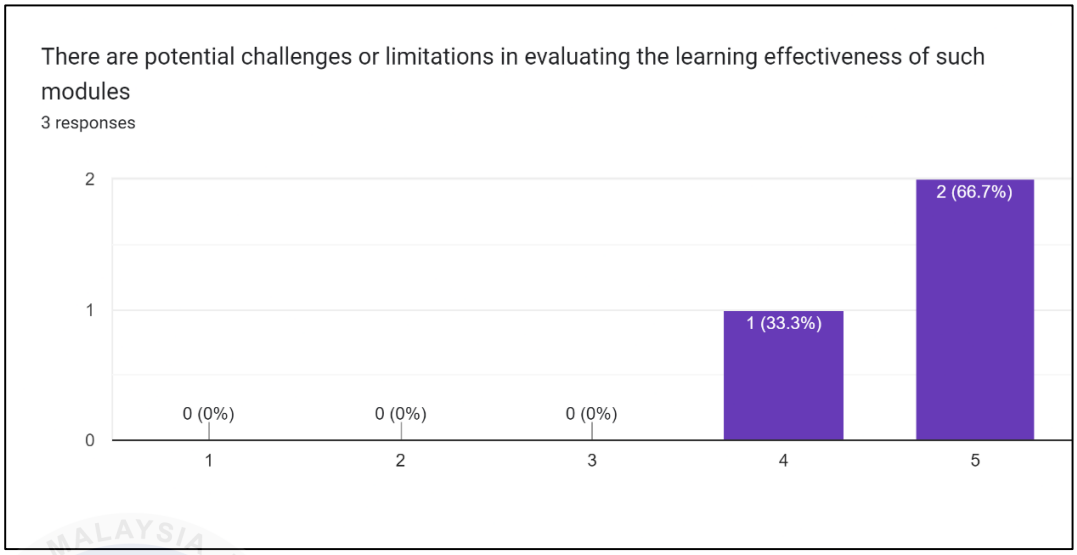


Figure 6.35 Data for there are Potential Challenges or Limitations in Evaluating the Learning Effectiveness

Based on figure 6.35, the data shows that 2 Multimedia experts voted for strongly agree and remaining 1 voted agree there are potential challenges or limitations in evaluating the learning effectiveness of such modules.

(c) Summary Result for Multimedia Expert

Figures and table below show summary results questionnaire from multimedia expert.

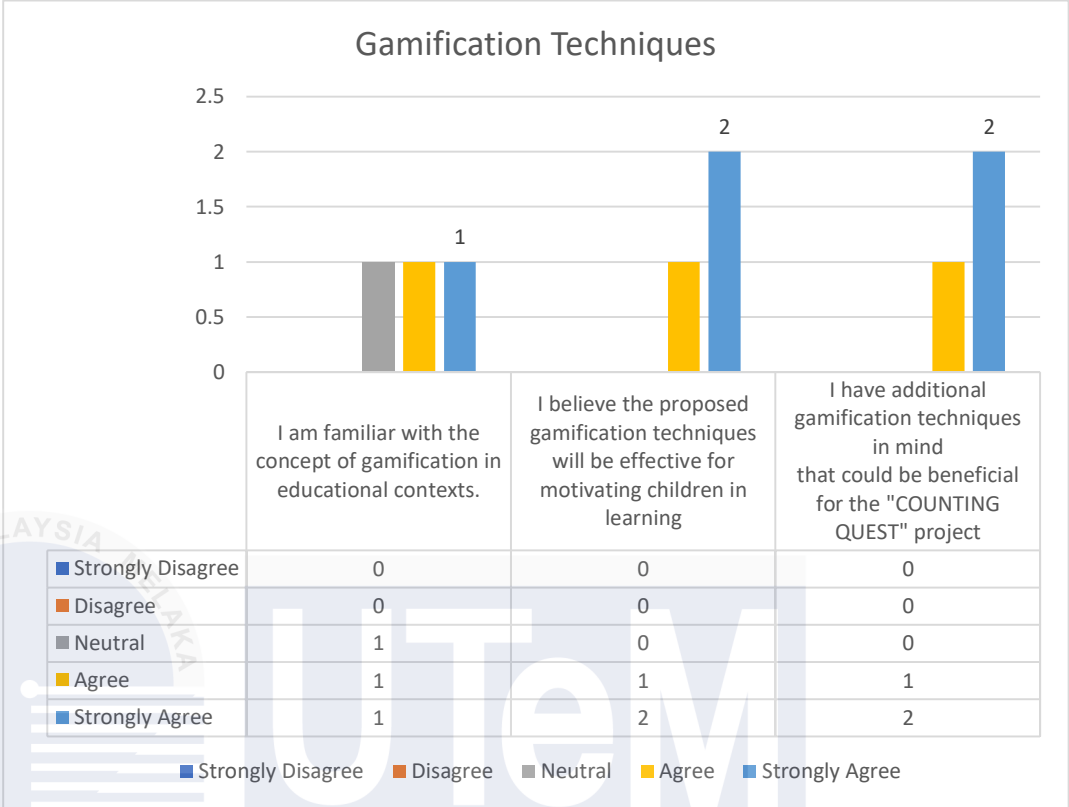


Figure 6.36 Data Summary for Gamification Techniques

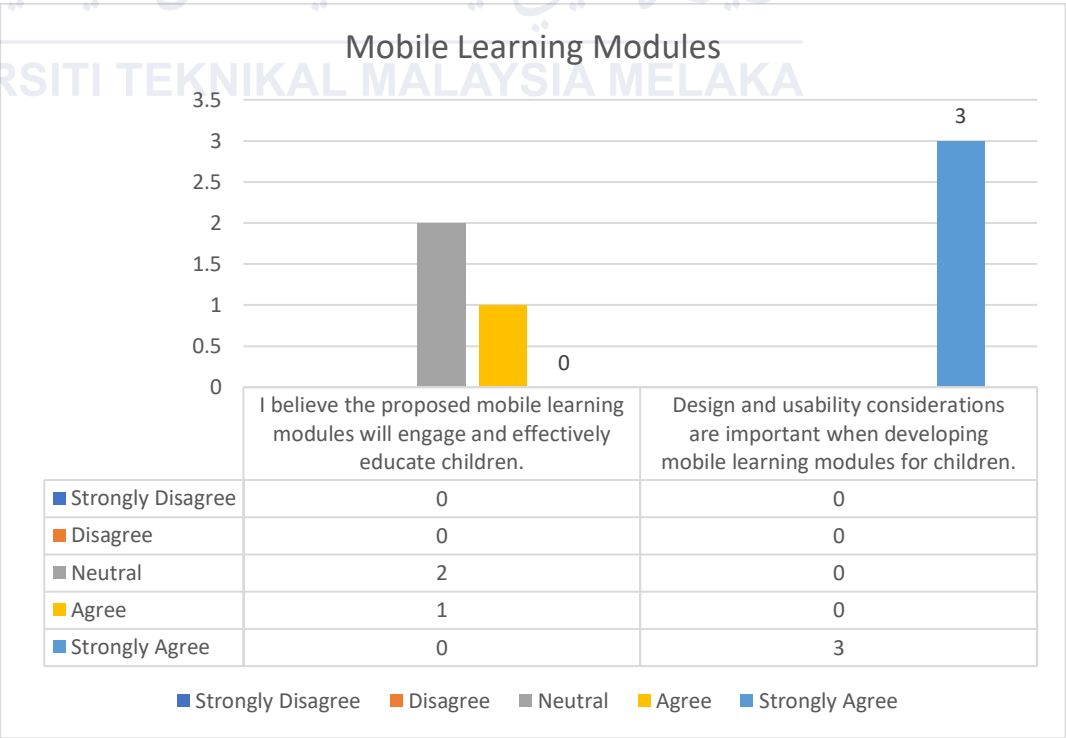


Figure 6.37 Data Summary for Mobile Learning Modules

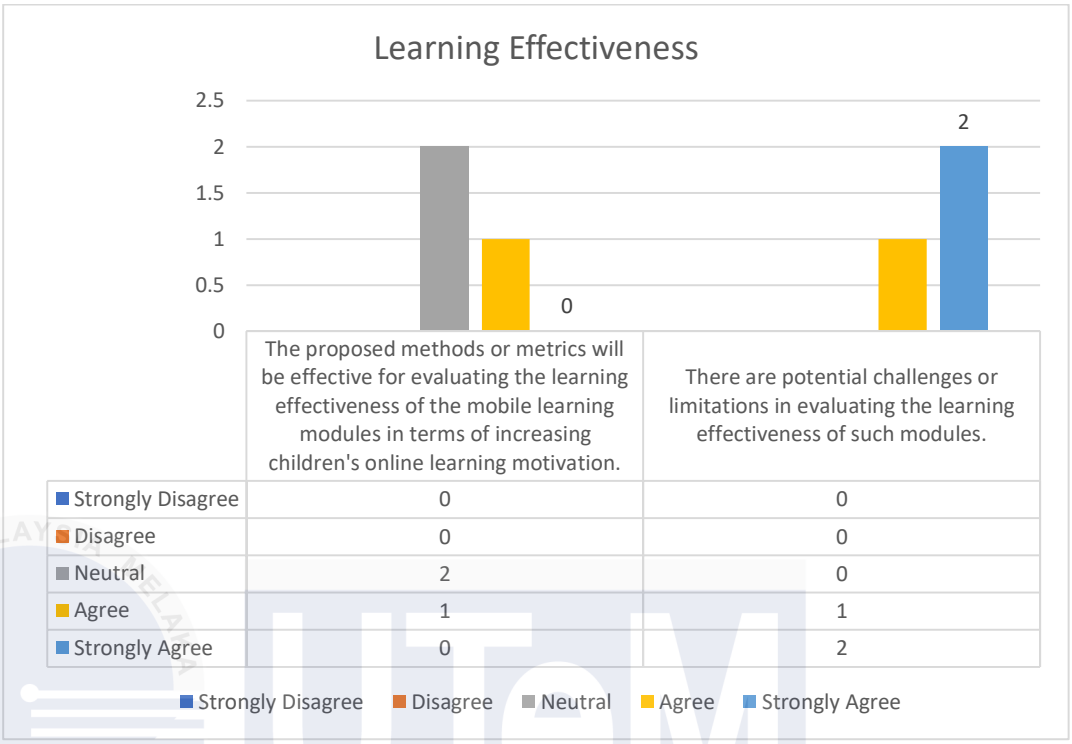


Figure 6.38 Data Summary for Learning Effectiveness

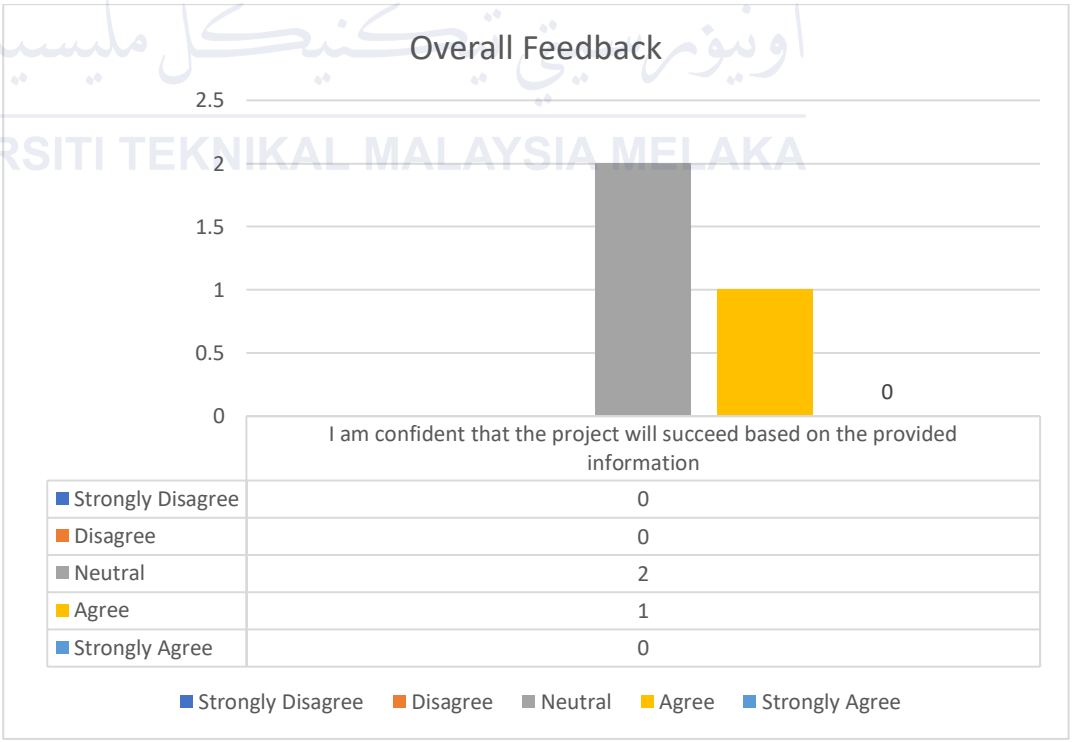


Figure 6.39 Data Summary for Overall Feedback

Table 6.8 Summary Result for Multimedia expert

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
Gamification Techniques	-	-	11.11%	33.33%	55.55%	100%
Mobile Learning Modules	-	-	33.33%	16.67%	50%	100%
Learning Effectiveness	-	-	33.33%	33.33%	33.33%	100%
Overall Feedback	-	-	66.67%	33.33%	-	100%

In conclusion, Multimedia expert give me suggestion or additional comments about I need to improve my system. Next, I should improve on interface because the radio button to small, the type face and the animation should more or use e-book as delivery platform not to forget adding more modules. The last one is please ensuring your UI is clear enough because there is no wrong indicator when you submit the wrong answer. There is also result I asked question in questionnaire whether confident that the project will be succeed based on the provided information. The two experts voted for neutral and remaining one expert voted for agree.

6.6 Conclusion

This process is essential while developing software since it demonstrates whether the product satisfies the user's needs and can be utilised in the future. All test results are examined. All the project's objectives have been accomplished, yet that is not sufficient. We discover the project's shortcomings. These issues could be utilised to enhance this project.

CHAPTER 7: PROJECT CONCLUSION

7.1 Introduction

This final chapter analyses the project's advantages and disadvantages in the project. During the testing phase of this project, the strengths and weaknesses of the product are found. There are some problems with this project that need to be fixed for it to be a good one. The proposal will help improve the project for future use by considering the changes and suggestions made during testing.

7.2 Observation on Weaknesses and Strength

Every system has both advantages and disadvantages. Considering the preceding action, analysis has been used to identify Counting Quest's weaknesses and strengths.

Absence of Counting Quest, which does not have a database to save children's names and scores. The kids are unable to view their earlier score if they want to compare their current score to it. Due to a database connection problem with Adobe Animate, this happened. Next, the interface I need to improve is the radio button too small. I trying to enlarge the radio button but the font getting larger instead of the radio button maybe there is bugs in animate. The type of interface is hidden when keyboard opened and need to put right or wrong indicator after the kid’s answering questions because it is not easy to kids to understand whether the answer is right or wrong based on marks only.

This project's strength is the inclusion of necessary multimedia elements like animation, graphics, text, music, and sound. The graphics used is vibrance that can

attract children to use it. Next, the button is clear make the kids can navigate it smoothly. The animation in video is very interactive. The movement of the characters there make the kids for fun and more motivated to watch it. If there is an internet connection to see the video, this programme can be utilised whenever and wherever. These components will entice children to study and comprehend number counting. Also, children may easily utilise this application. After trying the Counting Quest a few times, kids can complete it without any problems.

7.3 Propositions for Improvement

Based on the system's advantages and disadvantages, Counting Quest might be improved by adding more modules. Next, I need to improve on assessment by adding wrongs or right indicator after answering questions because kids do not understand if they want to know whether the answer is right or wrong based on marks only. Moreover, radio button is too small and not to forget when first user when to enter name, user cannot see the character because of the keyboard. The animation of the characters in assessment is too short, so I need to make it longer. The next step is to create a database so that it can maintain and save data so that students can see the progress they have made.

7.4 Project Contribution

The interactive learning environments for preschools used in this study have shown kids new ways to use their cell phones to learn. Even though it's not a big project, people hope it will help kids learn how to count. This will be another way for teachers to teach kids about numbers.

7.5 Conclusion

In short, this new way to teach kids how to count can be a lot better than using books. Because it has multimedia parts that make kids want to learn. Hopefully, that this plan can be used in the future and is always available. The goal of this project was to get kids more interested in learning, and it has been a success at that. Also, by mixing 2D animations, tools, and visual techniques, it got kids to think of their own ideas, understand what they saw, and draw what they thought.

REFERENCES

ABC 123 Letsgoo. (2023, August 8). *Fun Learn Number 1-10 | Numbers Song | Nursery Rhymes Kids Video* [Video]. YouTube. https://www.youtube.com/watch?v=N2gsmDbqYRg

Arnab, S., Lim, T., Carvalho, M. B., Bellotti, F., De Freitas, S., Louchart, S., Suttie, N., Berta, R., & De Gloria, A. (2014). Mapping learning and game mechanics for serious games analysis. *British Journal of Educational Technology*, *46*(2), 391–411. https://doi.org/10.1111/bjet.12113

Dicheva, D., Dichev, C., Agre, G., & Angelova, G. (2015). Gamification in Education: A Systematic Mapping Study. *ResearchGate*. https://www.researchgate.net/publication/270273830_Gamification_in_Education_A_Systematic_Mapping_Study

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does Gamification Work—A Literature Review of Emperical Studies on Gamification. 47th Hawaii International Conference on System Science, 3025-3034 - References - Scientific Research Publishing. (n.d.). https://www.scirp.org/(S(i43dyn45teexjx455qlt3d2q))/reference/ReferencesPapers.aspx?ReferenceID=2153185

Hanus, M., & Fox, J. (2015). Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance. *Computers & Education*, *80*, 152–161. https://doi.org/10.1016/j.compedu.2014.08.019

Hssina, K., & Erritali, M. (2019). A personalized pedagogical objective based on a genetic algorithm in an adaptive learning system. Educational Technology & Society, 22(3), 112-127.

Kapp, K. (2012). The gamification of learning and instruction: Game-based methods and strategies for training and. . . *ResearchGate*. https://www.researchgate.net/publication/273947281_The_gamification_of_learning_and_instruction_Game-based_methods_and_strategies_for_training_and_education_San_Francisco_CA_Pfeiffer

Morrison, J. (2020, January 1). *An Evaluation of Prodigy: A Case-Study Approach to Implementation and Student Achievement Outcomes*. https://jscholarship.library.jhu.edu/handle/1774.2/62841

Plass, J. L., Homer, B. D., & Kinzer, C. K. (2014). Games, learning, and engagement: A review of empirical research. Review of Educational Research, 84(4), 961-1012.

The Singing Walrus - English Songs For Kids. (2017, June 1). Funky Counting Song | Numbers 1-10 | The Singing Walrus [Video]. YouTube. https://www.youtube.com/watch?v=HkkYaj0m6cg

Appendix

APPENDIX A: QUESTIONNAIRE

COUNTING QUEST: ENGAGING MOBILE LEARNING WITH GAMIFICATION FOR KIDS

QUESTIONNAIRE

Assalamualaikum and good day. I am Muhammad Haziq bin Zafri, final year student UTeM from Faculty of Information and Communication Technology. Thank you for taking the time to help me evaluate my question-answering game prototype for children aged 5 to 6. Your input is crucial in creating an engaging and effective learning experience. Kindly share your thoughts by responding to the following questions.

(Assalamualaikum dan hari yang baik. Saya Muhammad Haziq bin Zafri, pelajar tahun akhir UTeM dari Fakulti Teknologi Maklumat dan Komunikasi. Terima kasih kerana mengambil masa untuk membantu saya menilai prototaip permainan menjawab soalan untuk kanak-kanak berumur 5 hingga 6 tahun. Input anda adalah penting dalam mencipta pengalaman pembelajaran yang menarik dan berkesan. Sila kongsikan pendapat anda dengan menjawab soalan berikut.)

Section 1: General Information (Maklumat Umum)

1. Age (Umur):

   ☐ 5 years old (5 tahun)

   ☐ 6 years old (6 tahun)

2. Gender (Jantina):

   ☐ Male (Lelaki)

   ☐ Female (Perempuan)

Section 2: Game Experience (Pengalaman Permainan)

1. Have you played question-answering game or quiz game before?
   (Adakah anda pernah bermain permainan jawab soalan atau permainan kuiz sebelum ini?)

   ☐ Yes

   ☐ No

2. How comfortable are you with using a smartphone?
   (Tahap keselesaan anda dengan menggunakan telefon pintar?)

   ☐ Very comfortable (Sangat Selesa)

   ☐ Somewhat comfortable (Agak selesa)

   ☐ Neutral (Neutral)

   ☐ Somewhat uncomfortable (Agak tidak selesa)

   ☐ Very uncomfortable (Sangat tidak selesa)

3. How often do you like to answer questions or solve puzzles?
   (Seberapa kerap anda suka menjawab soalan atau menyelesaikan teka-teki?)

   ☐ Almost every day (Setiap hari)

   ☐ A few times a week (Beberapa kali seminggu)

   ☐ A few times a month (Beberapa kali sebulan)

   ☐ Rarely (Jarang)

   ☐ Never (Tidak pernah)

Section 3: Game Engagement (Permainan Menarik)

1. Did you find the questions in the game interesting and suitable for your age?
   (Adakah anda dapati soalan-soalan dalam permainan ini menarik dan sesuai dengan umur anda?)

   ☐ Yes

   ☐ No

2. On a scale of 1 to 5, how engaged were you while answering the questions?
   (Dalam skala 1 hingga 5, seberapa menarik anda semasa menjawab soalan-soalan tersebut?)

   ☐ 1 - Not engaged at all (Tidak menarik langsung)

   ☐ 2 - Slightly engaged (Menarik sedikit)

   ☐ 3 - Moderately engaged (Sederhana menarik)

   ☐ 4 - Engaged (Menarik)

   ☐ 5 - Extremely engaged (Sangat menarik)

Section 4: Learning Experience (Pengalaman Pembelajaran)

1. Did you learn something new from answering the questions in the game?
   (Adakah anda belajar sesuatu yang baru dari menjawab soalan-soalan dalam permainan ini?)

   ☐ Yes

   ☐ No

2. Which part interested you the most? Can you tell us why?
   (Bahagian apa yang paling menarik minat anda?
   Bolehkah anda kongsikan mengapa?)

☐ Animation video (Animasi video)

☐ Know Number menu (menu "Know Number")

☐ Assessment (Penilaian)

3. Were there any questions that you found confusing or difficult to answer? Please describe.
(Adakah terdapat soalan-soalan yang anda dapati membingungkan atau sukar untuk dijawab?

☐ Yes (Ya)

☐ No (Tidak)

Section 5: Motivation

1. How motivated were you to keep answering questions as you progressed through the game?
(Seberapa termotivasi anda untuk terus menjawab soalan-soalan sepanjang anda bermain permainan ini?)

☐ Not motivated at all (Tidak bermotivasi langsung)

☐ Slightly motivated (Agak bermotivasi)

☐ Moderately motivated (Sederhana bermotivasi)

☐ Motivated (Bermotivasi)

☐ Extremely motivated (Sangat bermotivasi)

2. Did the way the questions were presented make you want to keep playing and answering more questions?
(Adakah cara soalan-soalan tersebut dibentangkan membuat anda ingin terus bermain dan menjawab lebih banyak soalan?)

- ☐ Yes, a lot (Ya, sangat ingin)
- ☐ Yes, somewhat (Ya, agak ingin)
- ☐ Not really (Tidak sebegitu)
- ☐ Not at all (Tidak sama sekali)

Section 6: Overall Impression (Impresi Keseluruhan)

1. On a scale of 1 to 5, how would you rate the overall experience of playing this question-answering game?
   (Pada skala 1 hingga 5, bagaimana anda menilai keseluruhan pengalaman bermain permainan menjawab soalan ini?)
   - ☐ 1- Not enjoyable at all (Sangat tidak menyeronokkan)
   - ☐ 2- Slightly enjoyable (Tidak begitu menyeronokkan)
   - ☐ 3- Neutral (Sederhana)
   - ☐ 4- Enjoyable (Menyeronokkan)
   - ☐ 5- Very enjoyable (Sangat menyeronokkan)
2. On a scale of 1 to 5, to what extent did this game help you learn in an interesting way?
   (Pada skala 1 hingga 5, sejauh mana permainan ini membantu anda belajar dengan cara yang menarik?)
   - ☐ 1- Not at all (Tidak membantu langsung)
   - ☐ 2- Not very much (Tidak begitu membantu)
   - ☐ 3- Somewhat (Agak membantu)
   - ☐ 4- Quite a bit (Membantu)
   - ☐ 5- A lot (Sangat membantu)

COUNTING QUEST: ENGAGING MOBILE LEARNING WITH GAMIFICATION FOR KIDS

QUESTIONNAIRE

[SUBJECT MATTER EXPERT]

Assalamualaikum and hello. I'm Muhammad haziq bin Zafri, student of 3 BITM from Faculty of Information and Technology (FTMK). Thank you for participating in this subject matter expert evaluation. Your valuable insights will help enhance the "COUNTING QUEST: ENGAGING MOBILE LEARNING WITH GAMIFICATION FOR KIDS" project. Please provide your expert opinions and suggestions based on your experience and knowledge in Mathematics.

Section 1: Expert Information

Name:

Affiliation (Company/Institution):

Years of experience in Mathematics:

Direction: Please rate the following question according to the following scale:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

No	Question	1	2	3	4	5
Section 2: To identify gamification techniques that can increase children's motivation in learning						
1	The proposed gamification techniques can effectively enhance children's motivation to learn mathematics.					
2	The proposed gamification techniques align with effective math teaching strategies					
3	Gamification can be adapted to various mathematical concepts effectively.					
Section 3: To develop mobile learning modules for children that apply the proposed gamification techniques.						
1	Mobile learning modules are a suitable platform for teaching mathematics to children.					
2	The proposed mobile learning modules effectively incorporate gamification elements.					
3	The mobile learning modules are likely to engage children in mathematical learning.					
Section 4: To evaluate the learning effectiveness of the mobile learning modules in increasing children's online learning motivation.						
1	Assessing the learning effectiveness of the mobile modules is essential for educational improvement.					
2	The project's methods for evaluating online learning motivation are valid and reliable.					
3	The project's approach to measuring the impact of gamification on motivation is appropriate.					

Section 5: General Assessment						
1	Overall, do you believe this project has the potential to positively impact children's math learning motivation through gamification techniques?					
Section 6: Additional Comments						
1	Please provide any additional comments or suggestions regarding the project's objectives, methodology, or overall suitability for math education.					

COUNTING QUEST: ENGAGING MOBILE LEARNING WITH GAMIFICATION FOR KIDS

QUESTIONNAIRE

[MULTIMEDIA EXPERT]

Assalamualaikum and hello. I'm Muhammad haziq bin Zafri, student of 3 BITM from Faculty of Information and Technology (FTMK). Thank you for participating in this expert evaluation. Your valuable insights will help enhance the "COUNTING QUEST: ENGAGING MOBILE LEARNING WITH GAMIFICATION FOR KIDS" project. Please provide your expert opinions and suggestions based on your experience and knowledge in multimedia and gamification.

Section 1: Expert Information

Name:

Affiliation (Company/Institution):

Years of experience in multimedia:

Direction: Please rate the following question according to the following scale:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

No	Question	1	2	3	4	5
Section 2: Gamification Techniques						
1	I am familiar with the concept of gamification in educational contexts.					
2	I believe the proposed gamification techniques will be effective for motivating children in learning.					
3	I have additional gamification techniques in mind that could be beneficial for the "COUNTING QUEST" project.					
Section 3: Mobile Learning Modules						
1	I believe the proposed mobile learning modules will engage and effectively educate children.					
2	Design and usability considerations are important when developing mobile learning modules for children.					
Section 4: Learning Effectiveness						
1	The proposed methods or metrics will be effective for evaluating the learning effectiveness of the mobile learning modules in terms of increasing children's online learning motivation.					
2	There are potential challenges or limitations in evaluating the learning effectiveness of such modules.					
Section 5: Overall Feedback						
1	I am confident that the project will succeed based on the provided information					

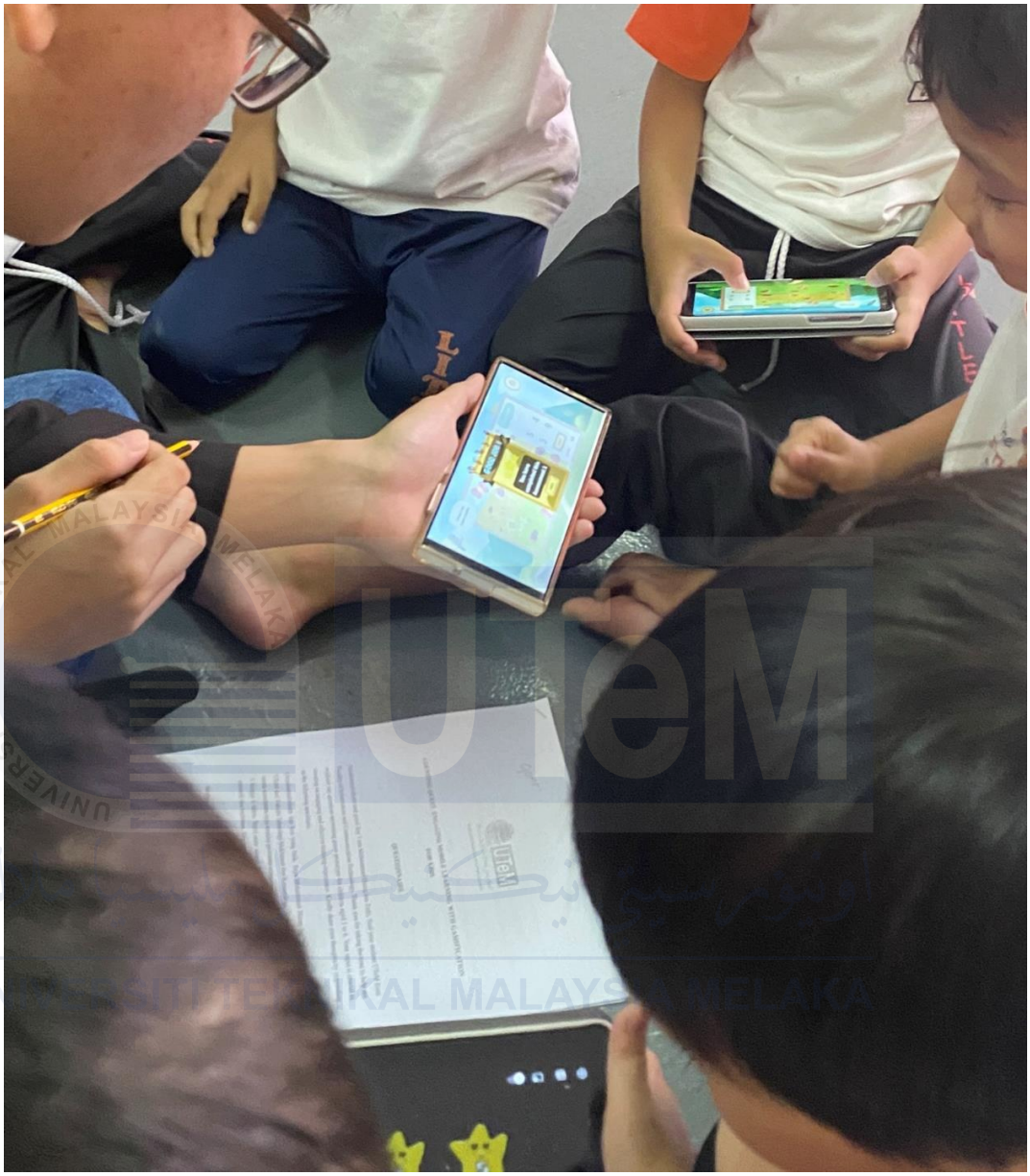
Section 6: Additional Comments		
1	Please provide any additional comments or suggestions regarding the project's objectives, methodology, or overall suitability for math education.	

APPENDIX B: TESTING PICTURES

Kids Aged 5 and Years Old


KG1L6 Talhah


LITTLE CALIPHS



Subject Matter Expert

Multimedia Expert