MULTIMEDIA-BASED COURSEWARE FOR LEARNING MATHEMATICS

By

Tan Fhih Ling

A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF INFORMATION SYSTEMS (HONS)

INFORMATION SYSTEMS ENGINEERING

Faculty of Information and Communication Technology

(Kampar Campus)

MAY 2020

UNIVERSITI TUNKU ABDUL RAHMAN

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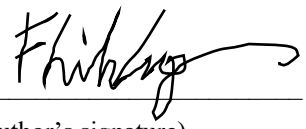

(Author's signature)

Verified by,

(Supervisor's signature)

Address:
LOT 12393, NO. 128,
LORONG BERLIAN 2, PEKAN BARU,
36000 TELUK INTAN, PERAK.

Khor Siak Wang
Supervisor's name

Date: 9 SEPTEMBER 2020

Date: 10/9/2020

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DECLARATION OF ORIGINALITY

I declare that this report entitled "**MULTIMEDIA-BASED COURSEWARE FOR LEARNING MATHEMATICS**" is my own work except as cited in the references. The report has not been accepted for any degree and is not being submitted concurrently in candidature for any degree or other award.

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Name : TAN FHIH LING

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ACKNOWLEDGEMENTS

I would like to express my sincere thanks and appreciation to my supervisors, Dr. Khor Siak Wang who have given me this bright opportunity to develop this interactive multimedia-based courseware for learning Mathematics. Throughout the development of this project, Dr. Khor moderator, Ms. Chan Lee Kwun had guided me and provided their professional advices and ideas.

Finally, I would like to thank my beloved friends and family for all the support love and encouragement during the period of developing this project. Thanks for the suggestion in enhancing the system.

ABSTRACT

Due to the advancement of technologies, the application of e-learning has become more commonly used to deliver information for modern education. This project is aimed to develop an interactive multimedia-based courseware for the target audience which is Year Six students who aged twelve years old to learn Mathematics.

The content of this system is fit with the school syllabus to ensure that the students will not confuse with the knowledge that they had learnt in school. This system is developed to help to improve and motivate students in self-learning because of interactivity content is more interesting and attracting compared with traditional teaching. Besides that, learning through interactive multimedia-based courseware enable students to learn at their own pace furthermore enhance their learning experience.

ADDIE Model is the common method that applied as the approach in order to develop the proposed system. There are five phases included in ADDIE Model, which are Analysis, Design, Development, Implementation and Evaluation that perform their own tasks in developing the system. Furthermore, this system will be published as a free access offline courseware so that the users can use it to learn Mathematics anywhere, when they have access to a computer. Instead of learning Mathematics through the learning module that included in the system, users can also choose to learn and enhance their understanding through practical module, game module and quiz Module that provided in the system.

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LIST OF ABBREVIATIONS

GBL	Game Base Learning
UI	User Interface
UPSR	Ujian Pencapaian Sekolah Rendah

CHAPTER 1 INTRODUCTION

Chapter 1: Introduction

Nowadays, to develop individuals who are prepared for the demands of globalization, a high-quality education is critical. The utilization of Mathematics is gaining attention in this demanding globalized environment. According to Hassan et al., (2018), Malaysia has introduced Science, Technology, Engineering and Mathematics (STEM) for the aforementioned challenges in the Malaysia Education Blueprint (2013-2015).

Mathematics, however, is often considered a subject which is hard for students to understand and master whether they are in primary or secondary school. Based on the research of Zuber and Sulaiman (2019), out of the 440,496 candidates who sat for the Ujian Pencapaian Sekolah Rendah (UPSR) Mathematics paper in 2016, 21.6% of them failed this subject. One of the main factors is most of the Malaysian students are passive in the learning process and they have to learn facts by memorizing which will make them to fail to think deeply (Chan et al., 2017). Hence, enhance the learning and teaching method by introducing interactive multimedia-based courseware can help the students to get interest in learning.

1.1 Problem Statement and Motivation

Problem statement is a succinct summary of the problem or problems that a project aims to solve. It is a valuable communication mechanism that will help ensure that anyone working on a project understands what the issue they need to solve is and why the project matters. There were three problem statements have been defined in this project which included students have different learning pace, lack of learning process in classroom and loss of interest and attention in learning.

1.1.1 Problem Statement

- **Students have different learning pace.**

  Dealing with the learning pace of naturally varying skilled learners are one of the challenges in traditional learning environment. Not all learners will have the same learning pace (Srithar et al., 2015). Teachers often apply the teaching methods

that reflect their own preferences in learning. Students with faster learning pace may feel boring with the lesson and a slow learner may find difficulties to understand or catch up with the lesson since everyone has their own learning pace. Slow learners should be taught at their own pace or ability (Azan Mat Zin, 2009). Hence, it is difficult for a teacher to accommodate student's learning pace when the lesson has a large number of students.

- **Lack of learning process in classroom.**
  According to Kusmaryonoi (2014), students are focused on memorize and hoard many information instead of being required to understand the information that is remembered and created into meaningful learning experiences during the learning process in classroom. The ability of student to memorize information is only theoretically smart, but they are weak applications. This is a problematic because the students are taking on a passive role in learning, which can hinder learning.

- **Loss of interest and attention in learning.**
  The learning material that used by most of the traditional classroom is in the form of hard copy such as books and notes. In additional, there are learning material in the form of soft copy materials that have been used which is free or paid video. The limitation of usual learning materials is less interactive content which may cause the students got bored and exhausted about learning (Abadi et al., 2018). Students may lose their interest and attention since these learning materials are only providing one-way communication.

1.1.2 Motivation

The motivation to create this project is supposed to solve the problems stated above in order to help the students to have a better understanding and learning experience in Mathematics. Instead of learning in the traditional method, an interactive multimedia courseware that consists with text, image, video, audio and animation can help to develop skill in both language and subjects' areas. It is one of the useful tools that can attract

users especially children. According to Sow et al. (2017), study showed that creating interactive environment that focuses on arithmetic operations as an alternative option to help children to get better understanding in Mathematics calculations. Hence, the learning process will become more attractive and interesting by integrating games and multimedia elements in courseware.

1.2 Project Scope

The purpose of this project is to develop an interactive multimedia-based courseware that focus on primary school Year Six students in learning Mathematics. This is because the syllabus of Mathematics for Year Six has covered all the mathematical knowledge that should be learned in the entire primary school life. The included syllabuses are Whole Numbers and Operations, Fractions, Decimals, Percentage, Money, Time, Length, Mass and Volume of Liquid, Space, Coordinate, Ratio and Proportion, Data Handling and Probability.

This project consists of four modules which are learning module, practical module, game module and quiz module.

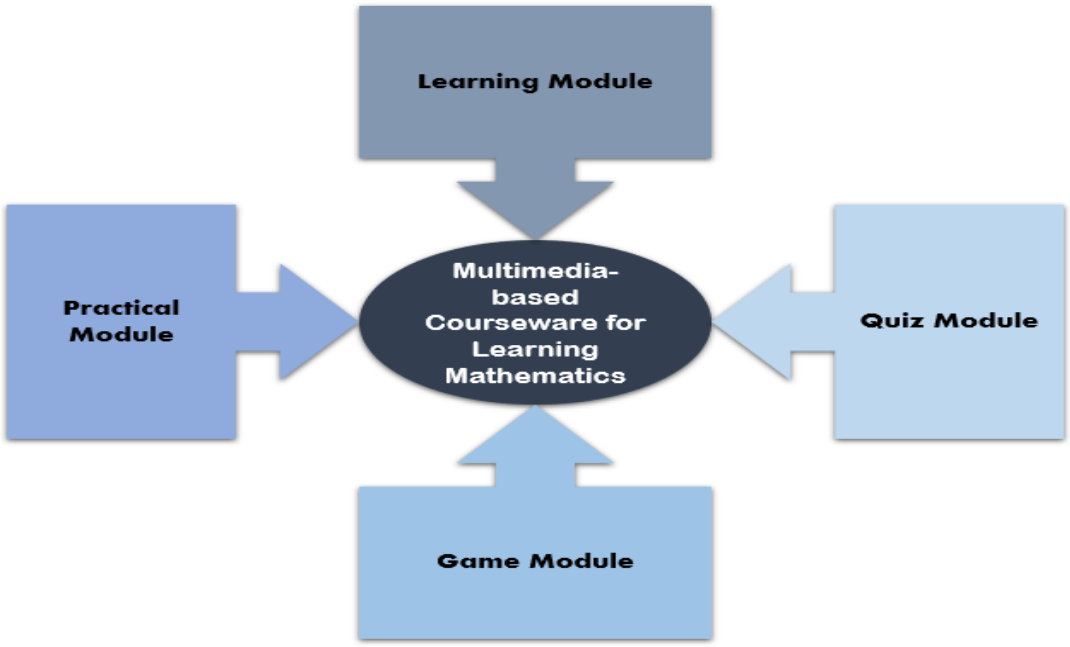


Figure 1-1 Structure diagram for proposed multimedia-based courseware.

Students are allowed to choose their preferred topic in all of the modules. In learning module, not only explanation text will be provided for students to learn Mathematics, an explanation video will also be provided to help students to have a better understanding about the topic. Practical module is used to help student to enhance their understanding through practices. In game module, there are two types of games provided for students, which were memory game and matching game. Memory game was designed to help students to memorize some useful Mathematical formula. Matching game was to let students solve the problems by using what they have learned. Next, quiz module is used to test their understanding and standard in learning Mathematics through questions. The difference between practical module and quiz module is the questions provided in practical module are depending on its topic and the questions in quiz module are mixed from all topics. Quiz module consists of three levels that included easy level with 20 question, medium level with 30 questions and hard level with 40 questions. All the question designed were referred to a practical book, SUCCESS MATHEMATICS UPSR.

Besides that, text, image, video, audio, and animation are included to the design of UI. This is because the needs of a child are one of the important considerations for designing the interface. Therefore, a colorful and interesting user interface design with special effect can easily attract a child's attention.

1.3 Project Objectives

The purpose and aim of the project are to develop an interactive multimedia-based courseware to help the children in learning the basic Mathematics. They can learn Mathematics through the lessons and education game that will be provided in the system and attempt the quiz to test their learning level. There are three major challenges that faced by the learners. Firstly, everyone has their own learning pace which makes the teacher hard to accommodate all student's learning pace. Secondly, passive in learning is hard for the learners to absorb the knowledge transferred by the teacher. Thirdly, lack of interactive content in the learning materials can easily loss the learner's interest and attention in learning Mathematics since Mathematics is one subject that full of numbers and formula to memorize.

CHAPTER 1 INTRODUCTION

The main objective of this project is to improve the interest and attractiveness of students in learning Mathematics with an effective way. With this multimedia courseware, students can learn or catch up the knowledge that they have missed in class. They can also learn with fun by playing the game that provided in the courseware. This main objective can be divided into three sub-objectives which are:

1. **To develop a multimedia courseware that allow children to adjust their learning pace.**

   As the problem statement mentioned above, everyone has their own different pace and styles of learning. Therefore, the courseware should be created to allow the learners to adjust their own learning pace through the interactivity that included in the module. For example, the child is not to being forcing to proceed to next topic by the courseware itself once he had already completed one topic. He is allowed to continue to the next topic by clicking the next button when he thinks he is ready to move on.

2. **To provide practices and quiz for testing.**

   Anton Chekhov quotes knowledge is of no value unless you put it into practice. Practice is important in learning and it can reinforce the concepts that people have learned. Instead of learning the lesson only through reading and memorizing, the courseware provided questions for the children to practice what they learned before. It can help to improve their skills and make them better at what they do.

3. **To integrate knowledge and cooperative approaches to learning into an interactive multimedia learning environment in order to improve students' Mathematics.**

   A multimedia courseware that allows interactivity not only can transform the boring content into an engaging learning experience, it can also create interest and improve the attractiveness among the learners. Other than allows learners to explore and evaluate, the interactivity also become involved with the content as opposed to passively reading the information in the hard copy or watching videos.

1.4 Impact, Significance, and Contribution

This project is designed to improve the interest and motivation of children to learn Mathematics in an effective way. According to Shabiralyani et al. (2015), visual aids such as those sensory objects or images that can initiate or support learning. It can also be used to make the learning process more real, more active and more accurate. Develop a multimedia-based courseware for learning Mathematics is not to replace the traditional teaching-learning process in the classroom, but to enhance the learners' learning experiences. By using the courseware, it can help o improve the children's understanding because multimedia elements such as video, sound, image and animation are included in the system instead of text only. As a child, these elements can attract their attention easily and they will be more interesting in learning rather than learning through a book in words. Words can explain everything, but visual elements help to improve understanding and recall better. Besides that, children can learn and practice the Mathematics through the lesson and game that included in the system by themselves when they are not understood what the teacher taught at school. Therefore, an interactive multimedia-based courseware is a useful tool that can help children to improve their Mathematics.

1.5 Background Information

William Paul Thurston (Cook, 2018), a known geometric visionary and mathematician of the twentieth century, once stated:

> *"Mathematics is not about numbers, equations, computations, or algorithms: it is about understanding."*

As of now Mathematics is part of the human search for understanding. Mathematics is all around us and it provides us a way in understanding trends, quantifying relationships, and forecasting the future. It is also a driving force for most of the technological and scientific developments. Therefore, it has always been treated as an important and compulsory subject for all from childhood.

Some studies show that students experience anxiety in Mathematics which is feeling tension and fear that affects their learning of Mathematics. This may be regarded to the application of teaching methods in the classroom. The common method of teaching

CHAPTER 1 INTRODUCTION

Mathematics is the traditional method with teacher-directed and giving lecture is the dominant situation. Some studies have shown that traditional methods in education system came to the conclusion that there are many defeats and flaws with the traditional methods. Not only does the traditional teaching method fail the transfer of knowledge and the transfer power from the teacher to students, students are also unable to move the knowledge they have learned beyond the classroom (Fahiminezhad et al., 2012).

Besides that, CD-ROM also has been used in the teaching and learning process. CD-ROM is one of the medium that able for change the curriculum balances from the memorization of facts to the development of evaluation and comprehension skills in the collection, critical assessment and manipulation of databases consisting of documents, numbers and other information structures. But there is no difference in the time taken by using books or CD-ROM for learning. It is also lack of prior familiarity with the CD-ROM materials (Riding and Chambers, 1992).

According to Moreno et al. (2000), student comprehension can be improved by the use of interactive multimedia learning systems consisting of animation and narration which offer a potentially venue. Thus, implement an interactive multimedia technology in teaching Mathematics is considered a more effective way for teaching and learning since multimedia stimulates multiple senses of audiences at a time.

Due to the problem of using traditional method for teaching and learning Mathematics, there are more and more multimedia and computer-based courseware has been proposed to overcome the challenges encountered in learning Mathematics. Using multimedia-based courseware for learning and teaching Mathematics is not to replace the traditional classroom activities but it is an additional aided learning tool to enhance the learners learning experience.

Chapter 2: Literature Review

Literature review is a study of a particular subject from academic sources. It offers an overview of existing knowledge, enabling people to recognise related research hypotheses, approaches and gaps. In this chapter, the research topics included learning through multimedia, self-paced learning and game-based learning. The existing systems that used in the comparison section are AdaptedMind Math, infinut Math, Meteor Multiplication, OnlineMathLearning.com and IXL.

2.1 Learning through Multimedia

Nowadays, application of multimedia technology is common in everywhere. It becomes a useful tool for making presentation especially provides special advantages in the field of education. The application of multimedia provides a way that a learner can experience their subject in vicarious manner by having simultaneous graphics, audio and video (Almara'beh et al., 2015). Besides that, the application of multimedia allows teachers to integrate the media elements, such as text, graphics, animation, sound and video into one package to present comprehensive information for their students (Yamauchi, 2008).

2.1.1 Strengths:

Learning through multimedia, the learning process can become more goals oriented, more participator, more flexibility in time and space, will not affected by the distance and tailored to individual learning style, and improve collaboration between teachers and student. The integration of medias also helps to achieve specified course outcomes.

2.1.2 Weaknesses:

Although using multimedia courseware in teaching and learning is beneficial to teachers and students, there is also a limitation which is blind encouraging multimedia classroom teaching. The multimedia technology and the classroom teaching information are related by the form and content. Any content has a certain form, any form is the form of certain content. On the other hand, the content determines the form and the form has reaction to the content. It means that not all the courses suitable with multimedia teaching

technology. The form of the transition for teaching information is determined by the course nature and course content (Zhang et al., 2013).

2.1.3 Recommendations:

Using multimedia teaching when you need a lot of image or caption to show teaching content, or large amount of data and complicated charts, or the experiments that need to show teach knowledge but without experimental conditions. It will be better than blind encouraging multimedia classroom teaching.

2.2 Self-paced Learning

The traditional teaching method in classroom was found out that it was less effectively as it does not provide self-pace learning. Learning pace that is either too fast or too slow can have negative impact on the learners. Coping with the learning pace of naturally varying learners is one of the most critical obstacles in traditional learning environments. This is because not all learners will have the same learning tendency. An interactive m-learning solution, Quizlet application which supports self-directed learning on tablets computers is suggested for students to learn at their own pace (Srithar et al., 2015).

Akram et al. (2011) also stated that based on the learner's own perception skills, they should be provided with personalized instructions to give them opportunity to learn on their own pace. Thus, an agent-based e-learning management system by which the agents act as the instructor to perform various tasks so that the system provides required flexibility which is required in the heterogeneous learning environment had been proposed to the learners.

2.2.1 Strengths:

Since multimedia-based instruction is self-paced learning, it can be efficient and effective for the learning process. The individualized learning pace enables students to separate the group instructional setting that often inhibits someone's natural progression (West & Crook, 1992). Students were able to learn at their own pace and test their learned concept in the absence of teacher. Teachers also found that a remarkable improvement in both interest and performance of their students toward the subjects.

2.2.2 Weaknesses:

There are some limitations that found in self-paced learning. Lack of interaction with others is one of the problems with educators lacking communication with students associated with regular teaching in the classroom. There are also some limitations about the students may want to rush through the learning activities in flexible formats and proceed to an assessment with minimal work (Misko, 2000).

2.2.3 Recommendations:

Develop a direct real-time feedback from the tablet apps that helps to moderate the level of students' distraction, since it allows them to flow on to the next activity at hand. Besides, combine self-paced learning with the collaborative learning in the classroom is a complementary way of learning. Students can share and interact with more perspectives on the problems and questions at hand.

2.3 Game-based Learning (GBL)

Game-based learning means that applying certain principles of game design to the learning process to get tips, techniques, and tools. It is a dynamic way to engage learners and help the educators to assess learning. Game-based learning is using the technique of games to stimulate student rethinking of the knowledge and the students will not feel bored because it allows students face learning in a relaxed attitude (Lai et al., 2012). Other than that, game-based learning will also meet the actual needs and interests of children and become the most famous computer activity and offer a new mode of interaction (Cheng & Su, 2011). According to Milovanović et al. (2009), game- based learning, it has probably changed the way in which the students recognize and interact with the environment.

2.3.1 Strengths:

Game-based learning makes the learners become the center of learning, which makes the process of learning become easier, more interesting and more effective. Students are "learning by doing" and can achieve individualized learning, fun, interactive into education and achieve the purpose of edutainment. Games that used various techniques

can also keep the learner motivated. Some learners have been helped to relax through the games.

2.3.2 Weaknesses:

There are usually some drawbacks in conducting a game-based learning. Learning through games might create a rule-based experiences to make play mandatory that feel just like school. Besides that, in order to make the game-based learning as neutral as possible, the design of challenges and content setting have to be carefully considered so that it not seeming trivial and boring (Furdu et al., 2017).

2.3.3 Recommendations:

GBL should not actually have to direct teach the topics of the course. Tangential learning is suggested that a game introduces a theme, technique or concept to inspire and motivate learners to further self-studies. Engaging and stimulating learning by putting related content in an attractive and engaging game context is better than teaching and learning directly (Mozelius et al., 2017).

2.4 Critical Remarks of Previous Work

2.4.1 AdaptedMind Math

AdaptedMind Math is a website that provides a series of lessons to teach kids Mathematics. For grades one through six, it assembles about 60 lessons, each with a set of 20-question practice, at least one video clip, and several worksheets. Children must take a pre-test to produce a percentage of the number learned by the program, and then go on to select any lesson in their grade, or any other grade if they wish. Cute visual badges and points toward mastery will be earned if the kids answer correctly. There are also pop-up explanations when they answer wrongly (Adaptedmind.com, 2016)

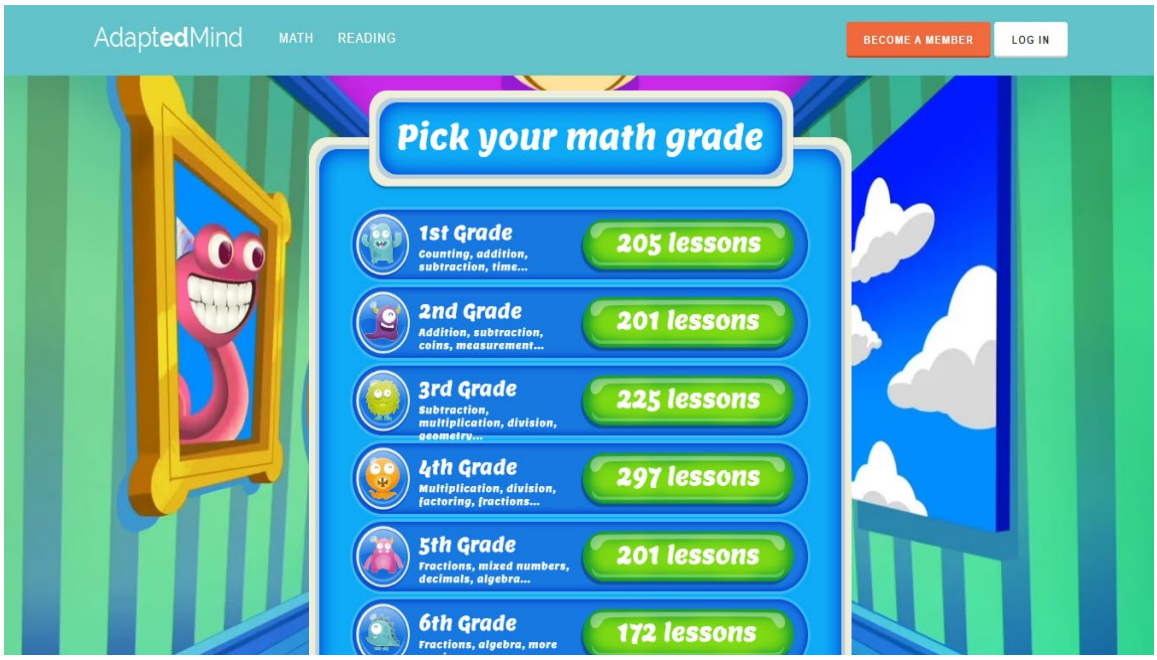


Figure 2-1 Main menu of AdaptedMind Math.

2.4.1.1 Strengths:

One of the strengths of AdaptedMind Math is it has a colourful UI design and it consists lots of graphics that can attract the children's desire to use and learn Mathematics with it. Its great graphics design will make the children want to at least try it out. It also provides explanation videos to explain each Mathematics problem by a teacher. Hence, the child is never stuck. Besides that, parents are able to see their children's progress in real-time with the reports.

2.4.1.2 Weaknesses:

AdaptedMind Math does not consist any learning module which means that if a child does not have any knowledge on the particular topic, it is hard for them to answer the question. Sometimes, the children might answer the question correctly but it does not mean that they are clear enough to understand the particular topic. However, the explanation videos will only be provided when the child answered wrongly. Hence, these limitations will hinder learning of children.

Figure 2-2 Explanation video is provided if answered wrongly.

2.4.1.3 Recommendations:

Provide a lesson module so that children can learn Mathematics from it. AdaptedMind Math can also add an option button that allow children to click and watch the explanation video for each of the question when they are not understand.

2.4.2 infinut Math

infinut Math is a free, comprehensive, fun and engaging Mathematics mobile application with proven efficacy for kindergarten, 1st and 2nd grade kids. It includes 120 lessons, 2400 play-based exercise for 5 to 8 year old kids. It is gently guides using audio and visual feedback. Students can be motivated with the engaging interactive play (Infinut.com, 2016).

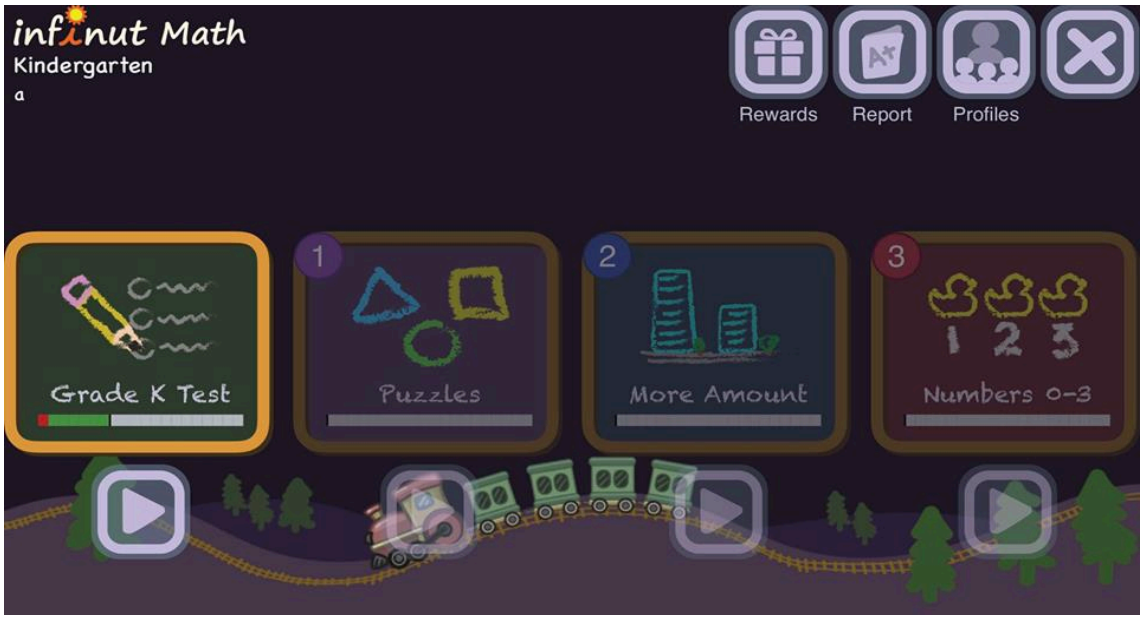


Figure 2-3 Home interface of infinut Math.

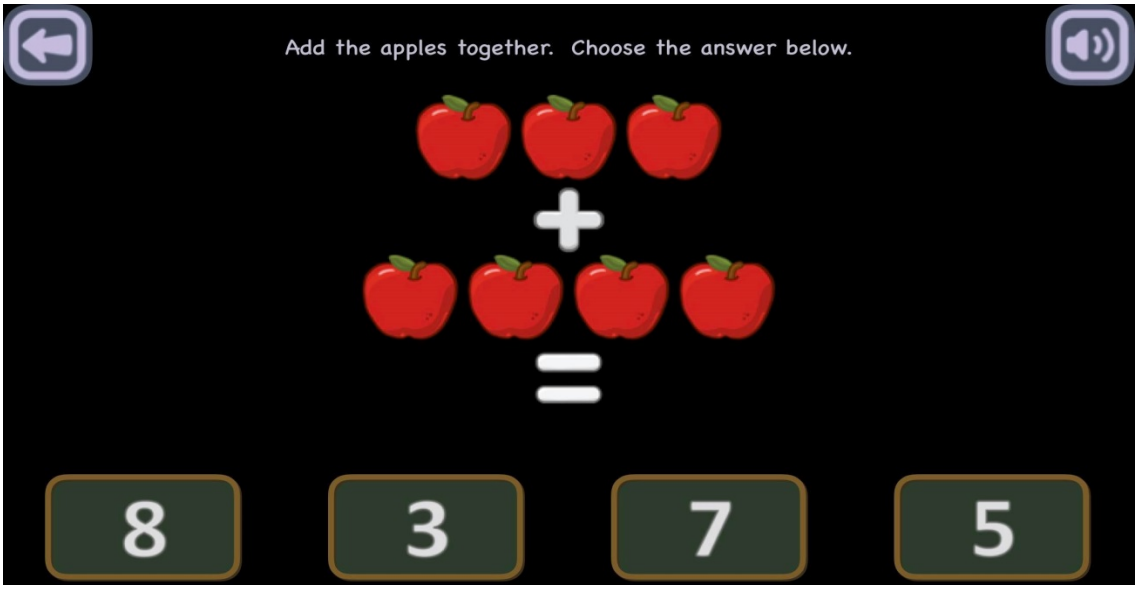


Figure 2-4 Play-based exercise of infinut Math.

2.4.2.1 Strengths:

infinut Math is a mobile application that provides interactive Mathematics mini-games featuring virtual manipulatable objects. Users can explore their learning environment in their own way and at their own pace by using infinut Math. The question of infinut Math is designed in a simple way that is easier for a child to understand.

2.4.2.2 Weaknesses:

The UI design of infinut Math is too simple that hard to attract a child's attention. Lack of music will also make the children feel bored while playing the games. Besides that, children are not given a choice to choose their desired level if they have not completed the current level. They can only proceed to the next level once they had completed one level. Some of the children may lose their patience for completing the level before proceeding to the level that they interest with. It is considered not user-friendly.

2.4.2.3 Recommendations:

Improve the UI design by adding more colourful and attractive graphics. The author can also add more sound effect or music to make the application more interesting. Other than that, provide children the choice to choose their desired level of game can help to improve their user friendliness.

2.4.3 Meteor Multiplication

Meteor Multiplication is one of the Mathematics learning games that helps children with learning multiplication. Large meteors with multiplication equations will move toward a space station in the center of the screen. Users need to fire at the meteor with the correct answer to the equation (Arcademics.com, 2019).

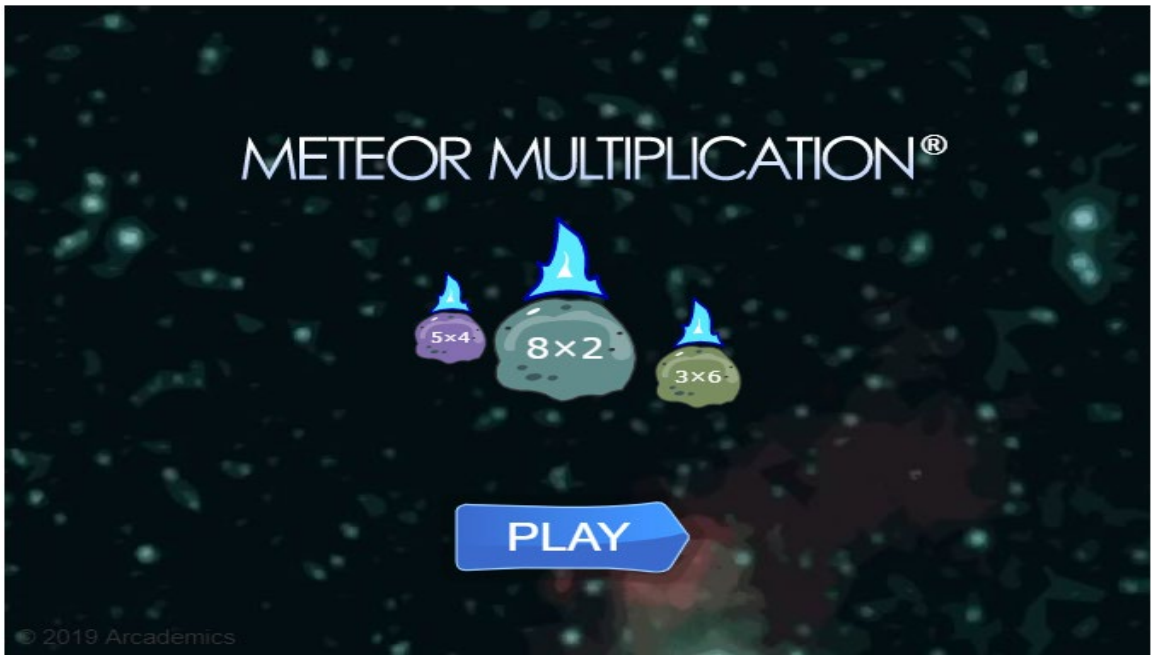


Figure 2-5 Home interface of Meteor Multiplication.

2.4.3.1 Strengths:

Meteor Multiplication can help to improve the children's mental math skill. This is because they need to multiply numbers by memory or through other efficient methods. Children is allowed to adjust the content range and game speed which match their own learning pace. When the children completed one level, result will be shown and the missed question with a correct answer is provided for them. This helps the child to make correction and learning from their past mistakes. Besides that, the animation of moving meteors makes the game become more stimulate and attractive.

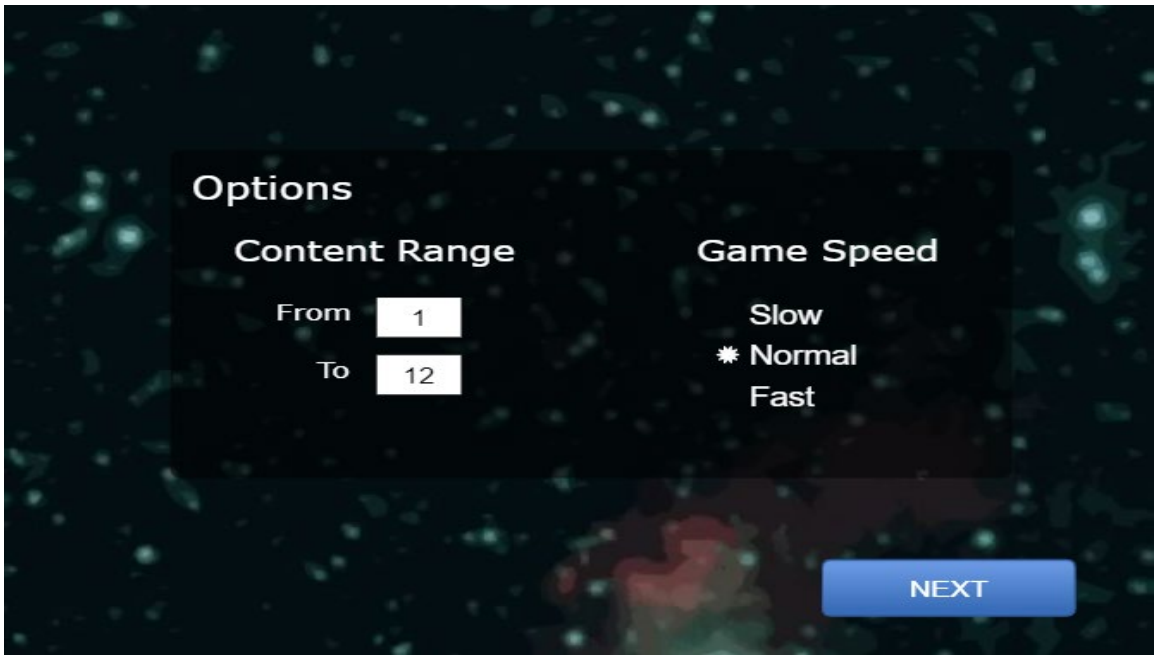


Figure 2-6 Options to adjust content range and game speed of Meteor Multiplication.

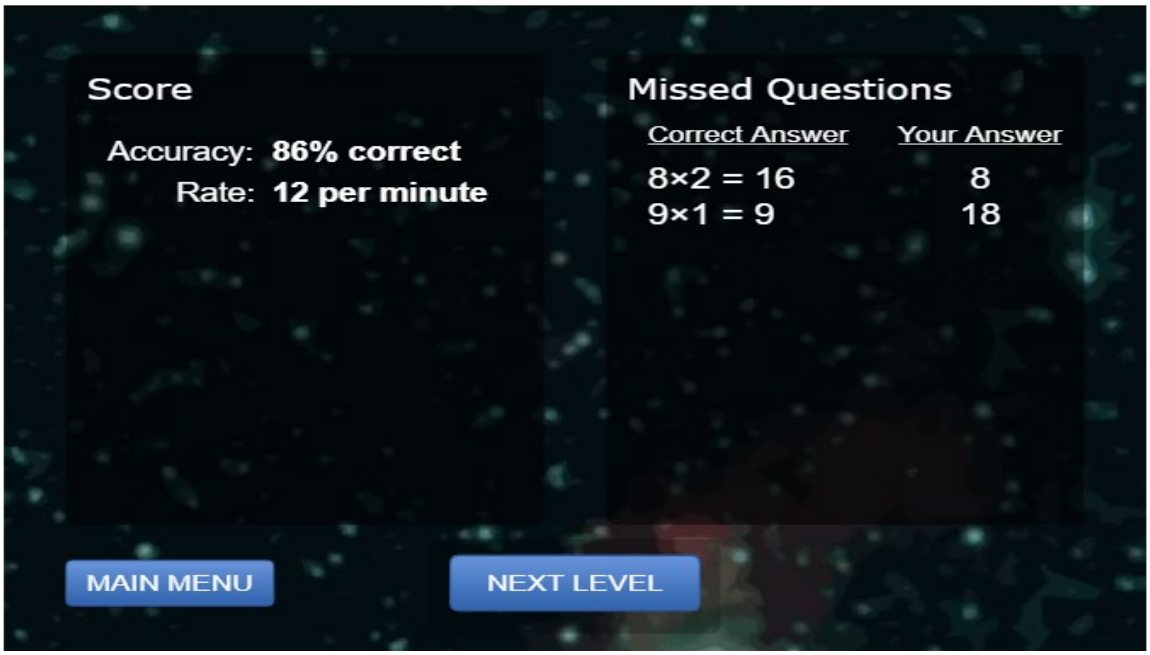


Figure 2-7 Current level's result of Meteor Multiplication.

2.4.3.2 Weaknesses:

When the children answered wrongly, the correct answer will be directly showed to the children. This will reduce challenge of the game and children may not think about correct answer by themselves.

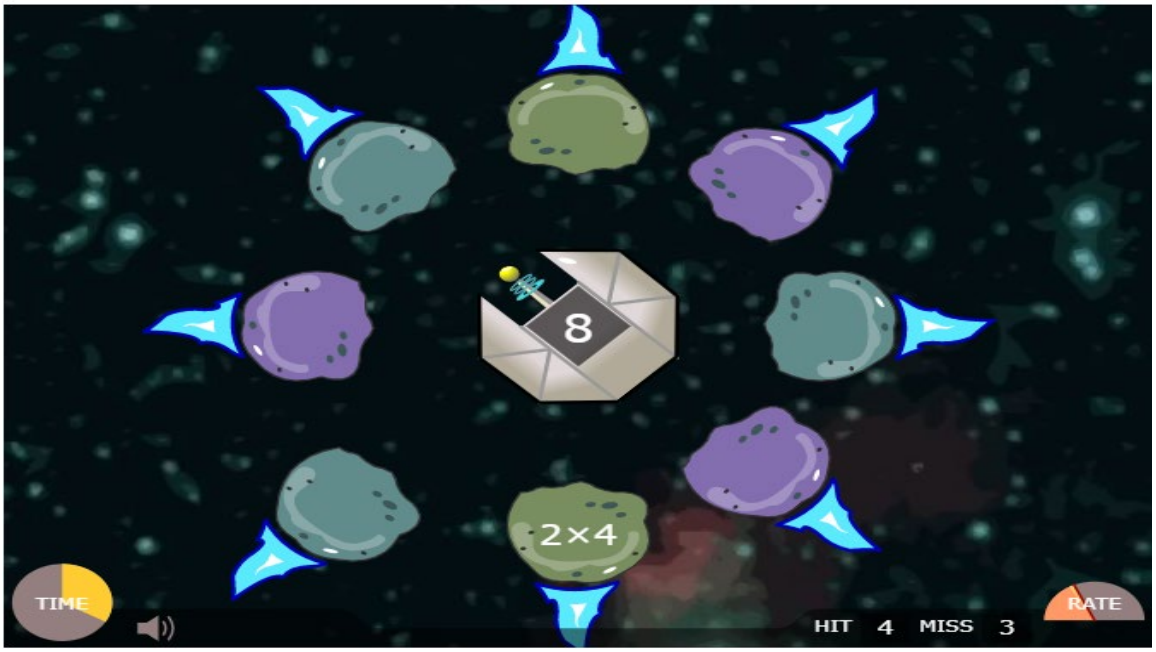


Figure 2-8 Correct answer is given when the child answered it wrongly.

2.4.3.3 Recommendations:

Provide hint instead of giving the true answer to the children. Other than that, it can also be improved by showing the correct answer when the children answered wrongly, but mess up the meteor again and let the children to search for the correct answer by themselves.

2.4.4 OnlineMathLearning.com

OnlineMathLearning.com is a free website which provides online math help, math fun and other useful resources. It is not only offering interesting quizzes, practice, homework helps and other resources for users, it also provides fun facts, games, puzzles and other cool stuff to make Mathematics something to enjoy rather than fear.

OnlineMathLearning.com is trying to help users having fun to improve their grades while learning some key skills.

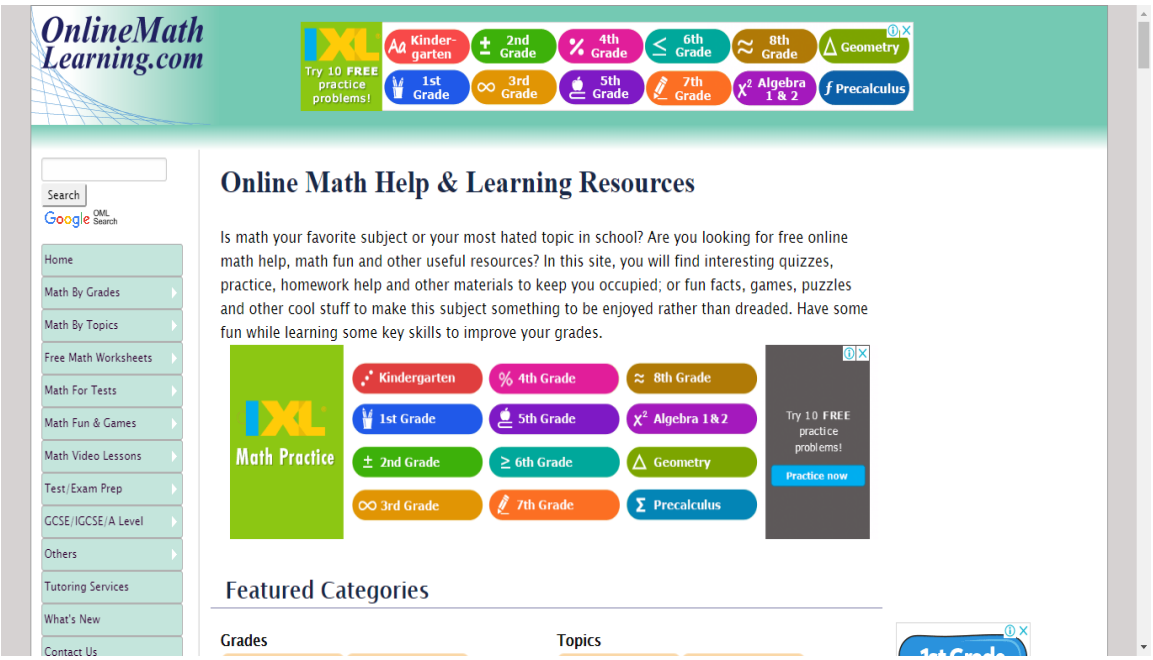


Figure 2-9 Home page of OnlineMathLearning.com.

2.4.4.1 Strengths:

OnlineMathLearning.com is an online Mathematics helps and learning resources which is free of charge for everyone. It will not cause additional cost for a family. In this site, users are allowed to choose their grades and topics that they preferred so that they can learn at their own pace. Besides of explanation text, video also used to show the step-by-step solutions that are more engaging and can help users to recall back easier.

Figure 2-10 Users are allowed to choose the grades or topics that they preferred in this site.

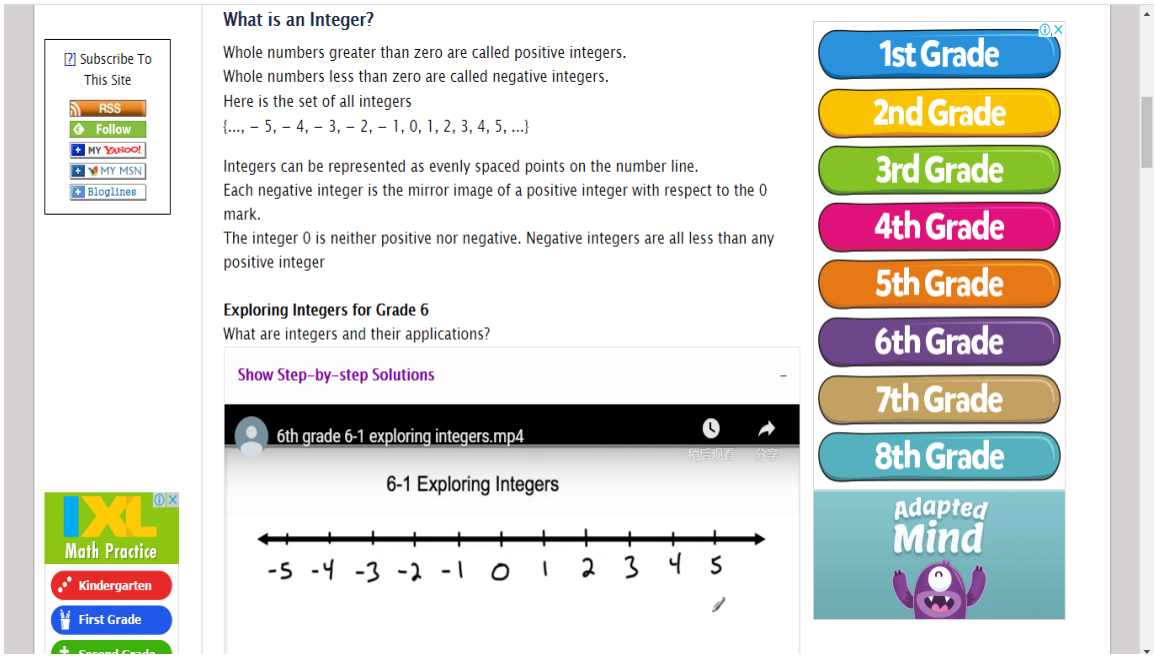


Figure 2-11 Both explanation text and explanation video are provided.

2.4.4.2 Weaknesses:

In this site is the provided video or game are not always available for the users. Video in this site is get from Youtube so that users are not allowed to watch the video if the uploader has deleted the video or their account. Same with the game which is provided in the form of hyperlink that will link to the original webpage, users are not allowed to play the game once the game is removed or renamed by the developer.

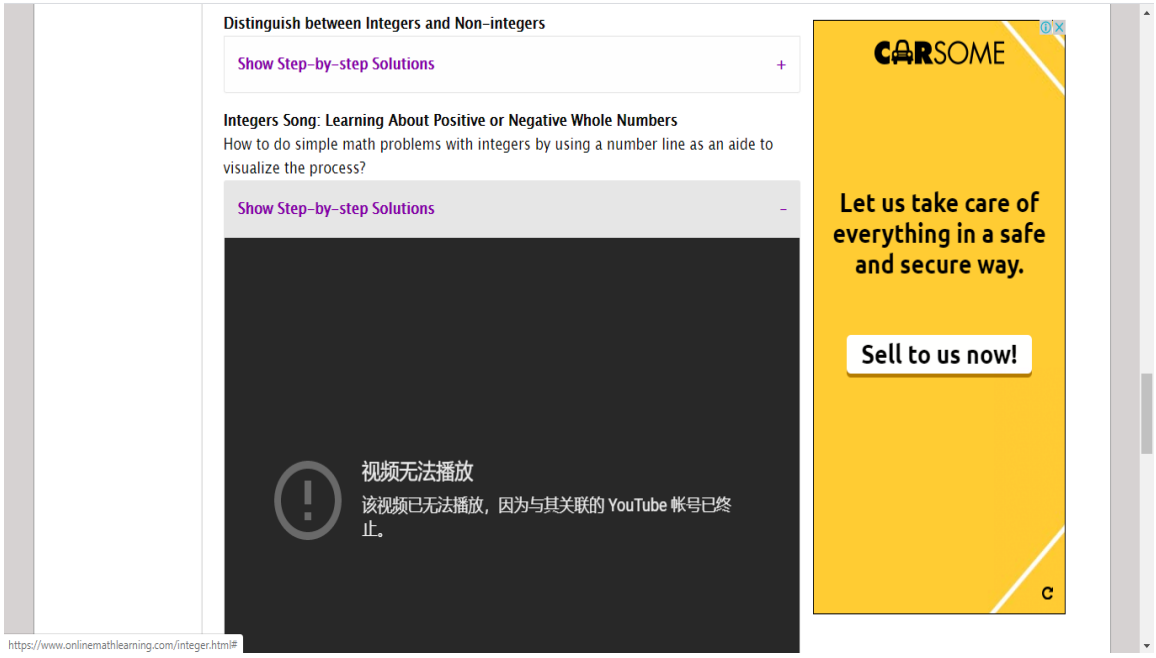


Figure 2-12 Video is unable to play since the account of the Youtube uploader had been deleted.

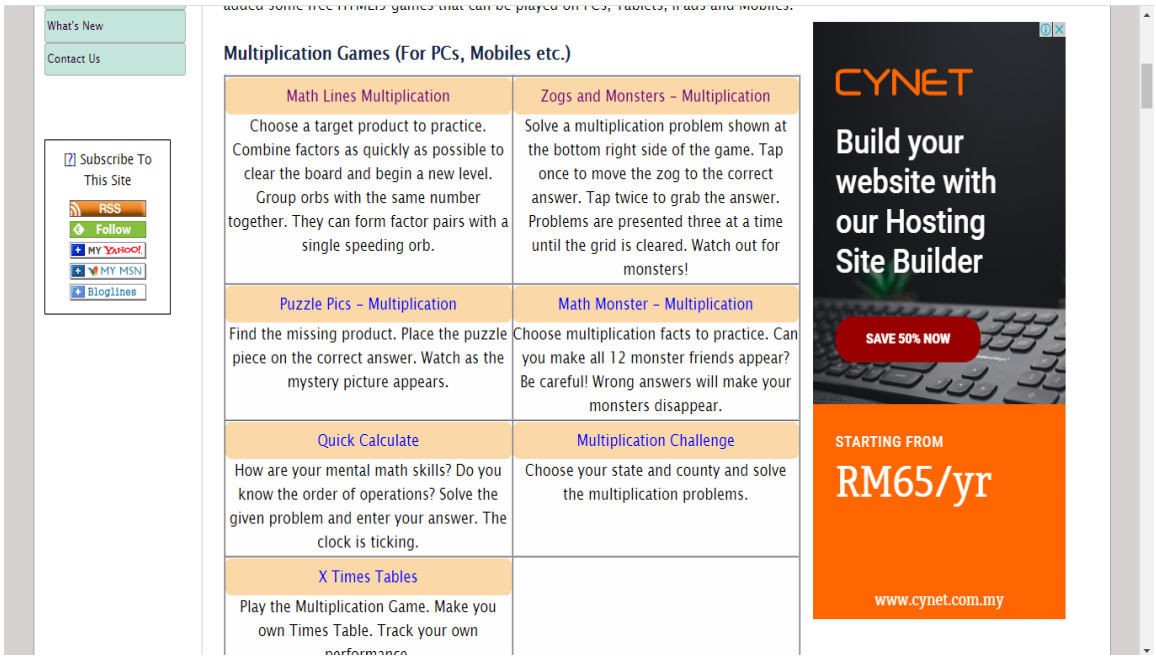


Figure 2-13 The name of the game is in the form of hyperlink that will link to the original website once the users clicked on it.

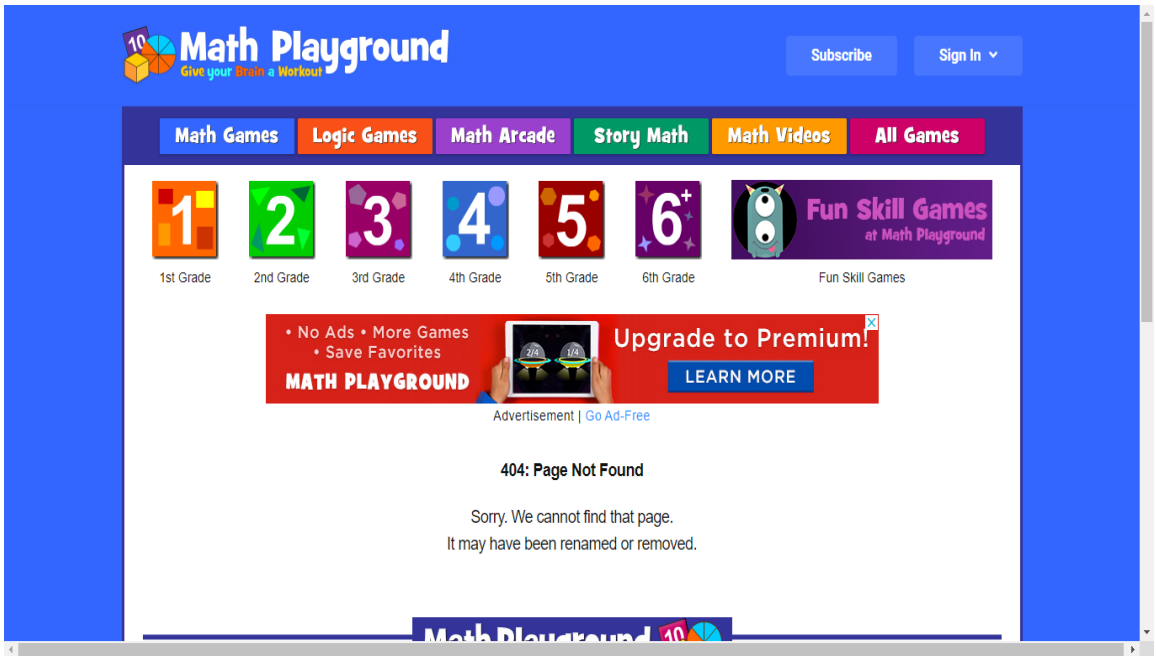


Figure 2-14 Page not found since it may have been renamed or removed.

2.4.4.3 Recommendations:

The developers of the site should always monitor and updating their resources to avoid causing inconvenience for users. Besides of attach the video that get from Youtube, developers can replace it by images or a simple explainer video that created by themselves. Same with the game that they provided in the site, they can try to create their own game rather than providing all the hyperlinks that link to the original webpage. These can prevent the resource are no longer available for users.

2.4.5 IXL

IXL is an online learning website which provides personalized learning. It meets the special needs of each learner with a detailed K-12 curriculum, individualized instruction, and real-time analytics. IXL helps its users to learn and practice various subjects such as Mathematics, language arts, Science, and social studies. IXL Math helps users to gain fluency and confidence in Mathematics at their own pace through engaging and interactive questions, built in encouragement, and inspiring awards.

Figure 2-15 Home page of IXL.

2.4.5.1 Strengths:

The user interface design of IXL is colourful and consists a lot of graphics that can catch one's eyes easily especially for children. Same with most of the similar existing systems, users are allowed to choose their grades or topics that they preferred to. Hence, users can learn at their own pace. Besides that, when users answered the question wrongly, an explanation will be provided to guide users to get the correct answer. With the explanation, users not only can learn from their previous mistakes, it also helps to consolidate users' knowledge by guiding the users step-by-step.

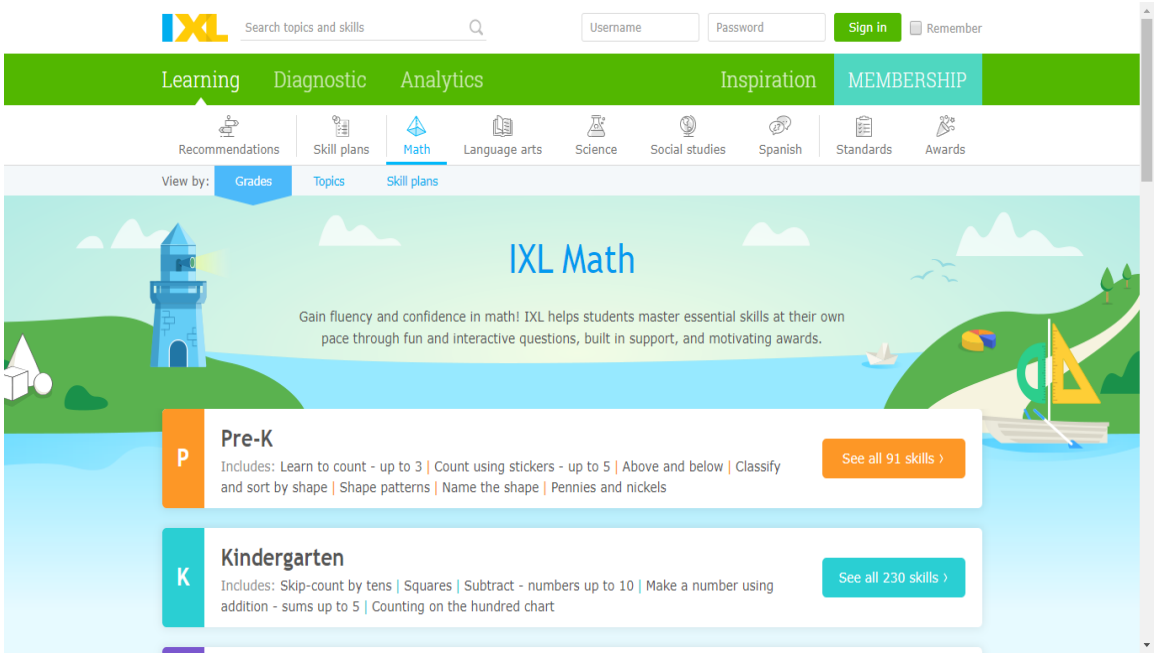


Figure 2-16 User interface design of IXL Math.

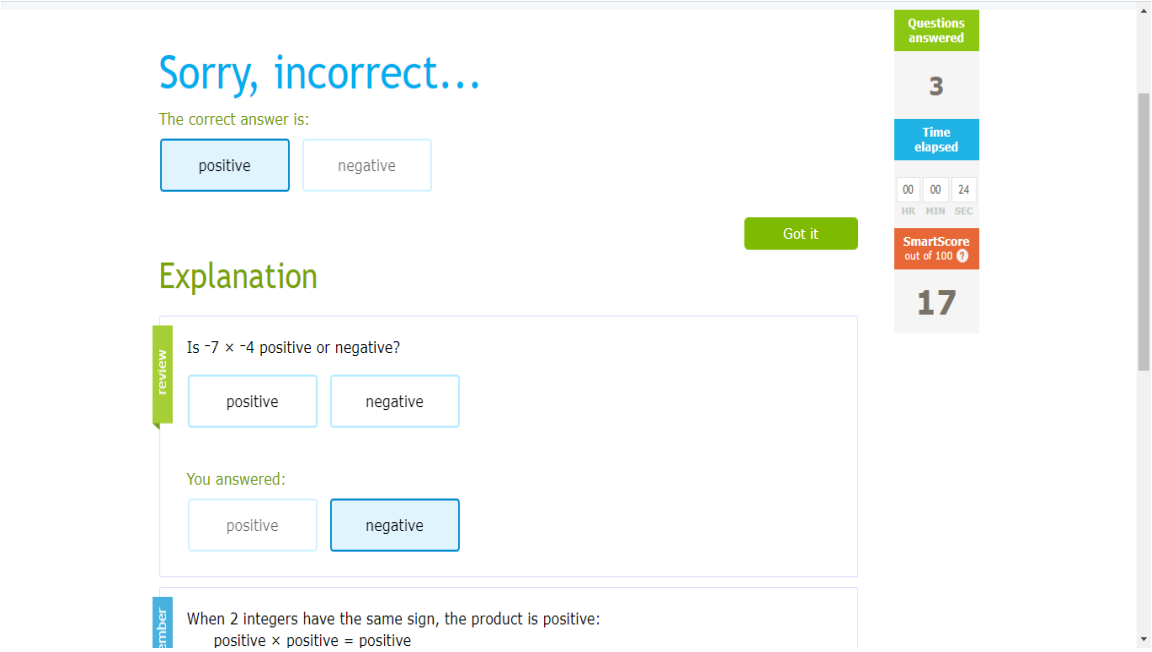


Figure 2-17 Explanation is provided when users provide an incorrect answer.

2.4.5.2 Weaknesses:

In the learning module, instead of providing learning material that users can gain knowledge from it, every topic will only start with answering the question once the users clicked on it. If the users do not consist any knowledge for the particular topic, they are difficult to answer the question. Besides, IXL is lack of sound, animation and video which can makes the learning process more attractive and engaging. Learning only by answering the question will make one get bored and hard to concentrate easily.

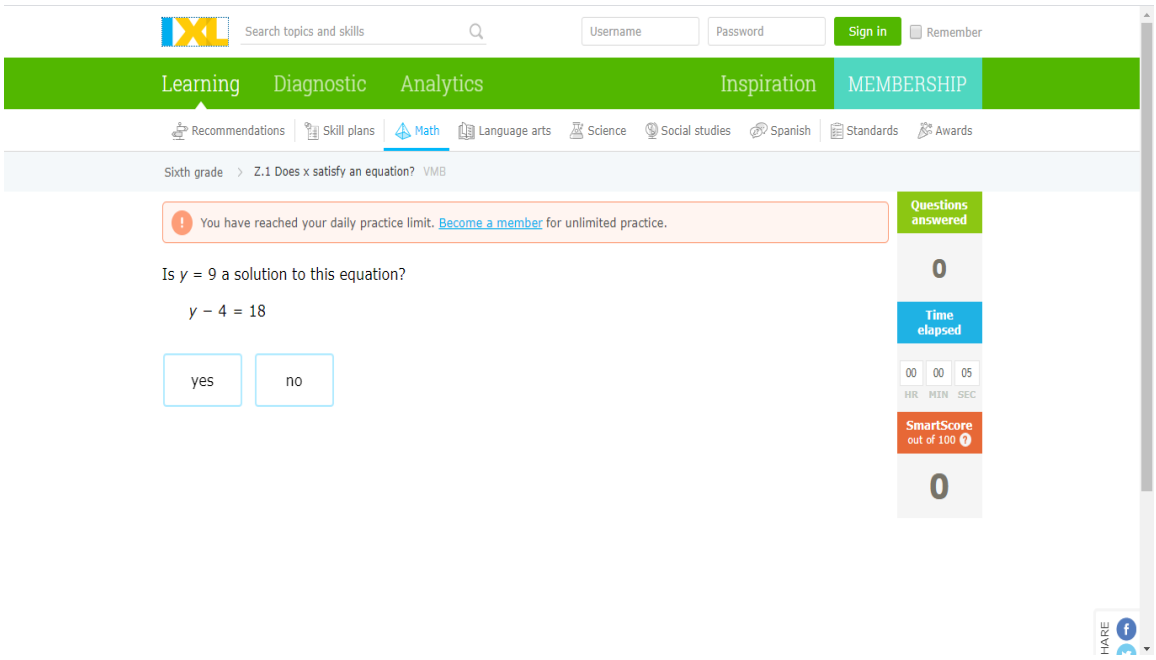


Figure 2-18 Only question is provided in Learning module.

2.4.5.3 Recommendations:

Provide learning materials that can help users to gain knowledge and build fundamental about Mathematics. Users not only can be more confident in answering the question after they learn from the provided learning materials, they can also revise the knowledge easily whenever they want. Moreover, IXL can improve their content with more animation, sound and video clips that helps to enhance content and attract more people to use it.

2.5 Comparison between Existing System and Proposed System

Table 2-1 Table of Comparison Between Existing System and Proposed System.

	AdaptedMind Math	**infinut Math**	**Meteor Multiplication**	**OnlineMath Learning .com**	**IXL**	**Proposed Multimedia-based Coursewar e**
5 Multimedia Elements (text, graphics, video, animation, audio)	√	× (No Video)	× (No Video)	√	× (No Video, Animation, and Sound)	√
User-friendly GUI	√	×	√		√	√
Learning module	×	×	×	√	×	√
Game module	√	√	√	√	×	√

	AdaptedMind Math	infinut Math	Meteor Multiplication	OnlineMath Learning.com	IXL	Proposed Multimedia-based Courseware
Practice module	×	×	×	√	√	√
Quiz module	×	×	×	√	×	√
Voice teaching	√	√	×	√	×	√
Cost	$9.95/month	Free of Charge	Free of Charge	Free of Charge	$9.95/month	Free of Charge
Platform	Website	Mobile Application	Website	Website	Website	Offline Courseware

Chapter 3: System Design

System design is the process of designing system elements such as modules, architecture, components and their interfaces and data flowing through the system. It is the process of identifying, creating and implementing structures that meets a company or organization's particular needs and requirements (*What Is Systems Design? Definition of Systems Design, Systems Design Meaning*, n.d.).

The graphical modelling language used in the system design is Flowchart. A system flowchart is a powerful tool to represent control flow through a system and how the decisions being made to control the events. System flowchart was used in the beginning of developing the system as it helped to visualize all the necessary decisions.

Besides that, storyboard was also used in the system design. Storyboard is a tool that visually forecasts and illustrates the experience that a user has with the product. It helped the author to understand over time the elements interact with and provided the author a better understanding of what's really important to users.

CHAPTER 3 SYSTEM DESIGN

3.1 System Flowchart Diagram

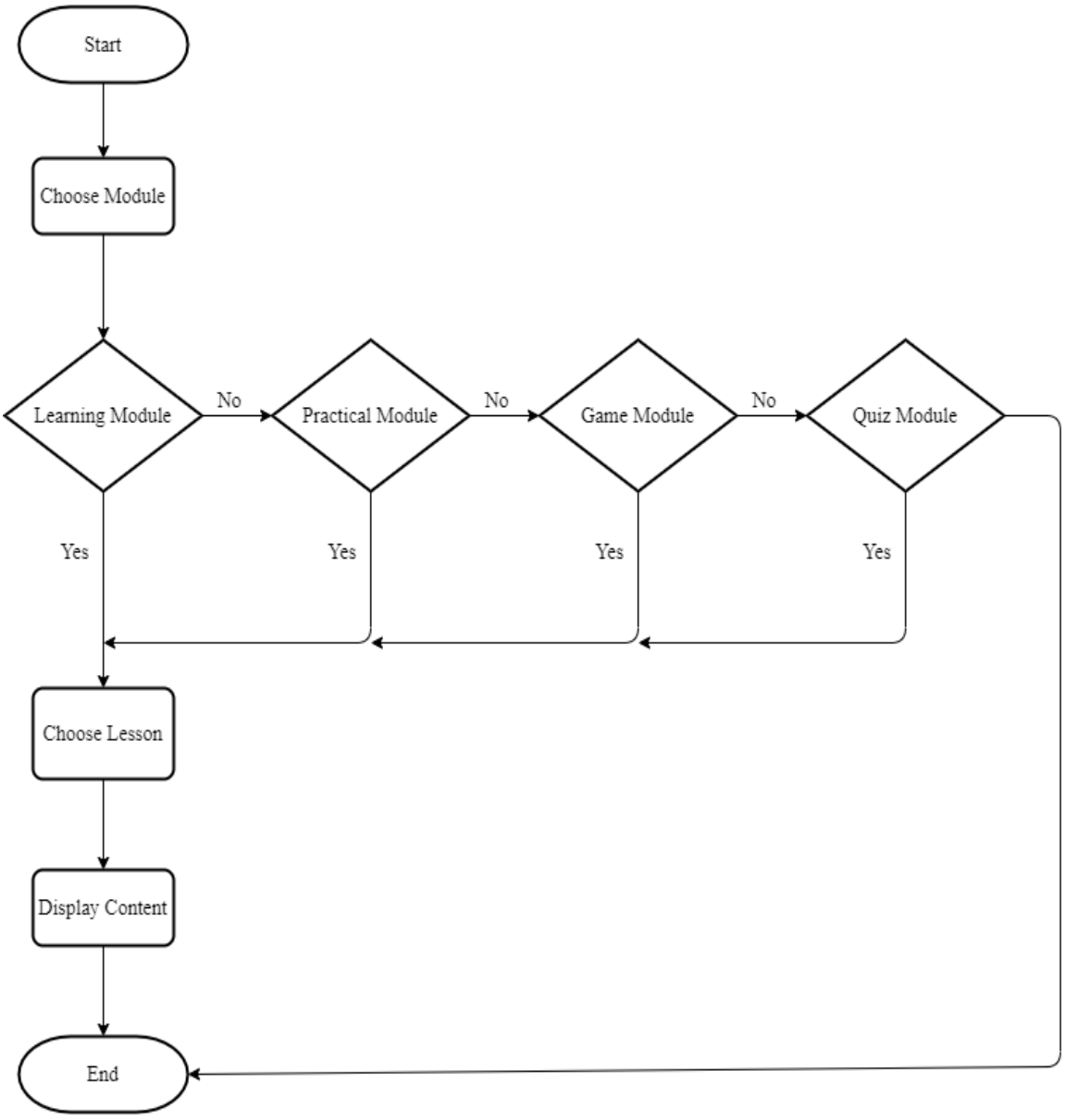


Figure 3-1 System Flowchart Diagram.

3.2 Storyboard Design

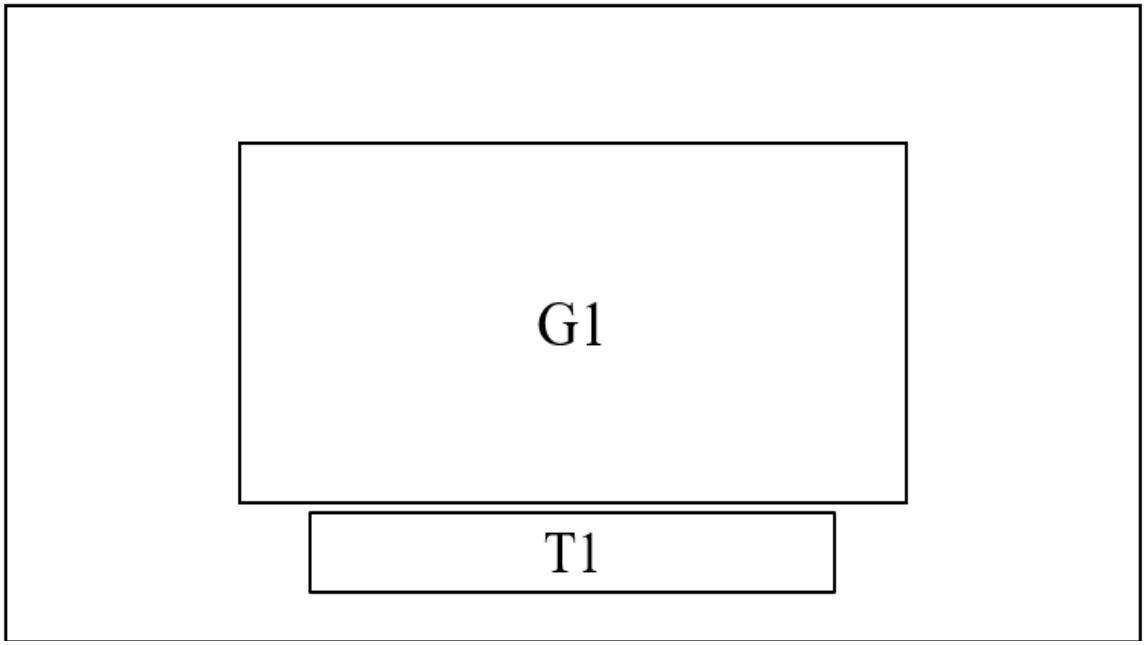


Figure 3-2 Storyboard design of Splash Screen.

Label	Description	Attribute
T1	This text element will show the welcome message.	Font: Rockwell Extra Bold Text Size: 60pt Text Colour: #FFFFFF Frame Rate: 30fps
A1	This animation element will show a space chase between a rocket and an UFO.	Size: 800 x 600 Image type: .gif Frame Rate: 30fps

Table 3-1 Storyboard design of Splash Screen.

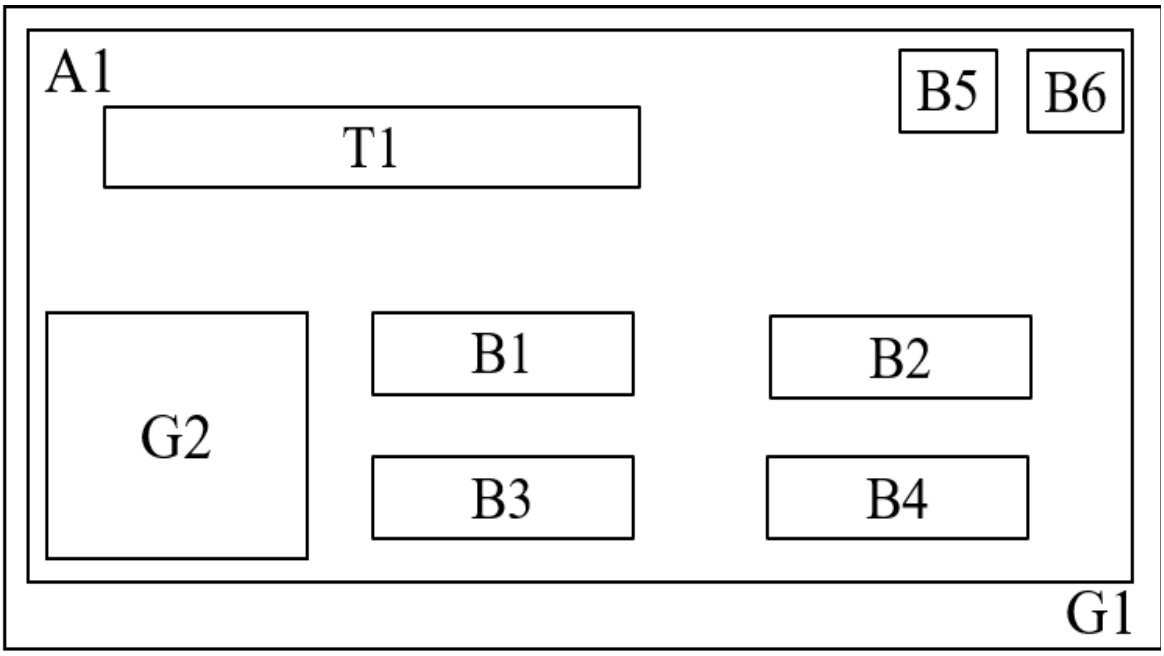


Figure 3-3 Storyboard design of Main Menu.

Label	Description	Attribute
T1	This text element shows the name of the courseware which is “Math Universe”.	*For text “Math”:* Font: Magneto Text Size: 100pt Text Colour: #FFFFFF and #6600FF *For text “Universe”:* Font: Stencil Text Size: 100pt Text Colour: #FFFFFF and #FF0033 Frame Rate: 30fps
G1	This graphic element represents as background image of the scene.	Size: 1024 x 768 Image Type: .png Frame Rate: 30fps

G2	This graphic element shows a rocket.	Size: 380 x 453 Image Type: .png Frame Rate: 30fps
B1	"Learning" button which will link to learning module.	Button type: Rounded rectangle Font: Forte Text Size: 60pt Text Colour: #000000 Frame Rate: 30fps
B2	"Practical" button which will link to practical module.	Button type: Rounded rectangle Font: Forte Text Size: 60pt Text Colour: #000000 Frame Rate: 30fps
B3	"Game" button which will link to game module.	Button type: Rounded rectangle Font: Forte Text Size: 60pt Text Colour: #000000 Frame Rate: 30fps
B4	"Quiz" button which will link to quiz module.	Button type: Rounded rectangle Font: Forte Text Size: 60pt Text Colour: #000000 Frame Rate: 30fps
B5	Sound button which the users can click to mute or unmute the background music of the system.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps

B6	Exit button that let users to quit the system.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
A1	This animation element will show a group of shooting star.	Frame Rate: 30fps

Table 3-2 Storyboard design of Main Menu.

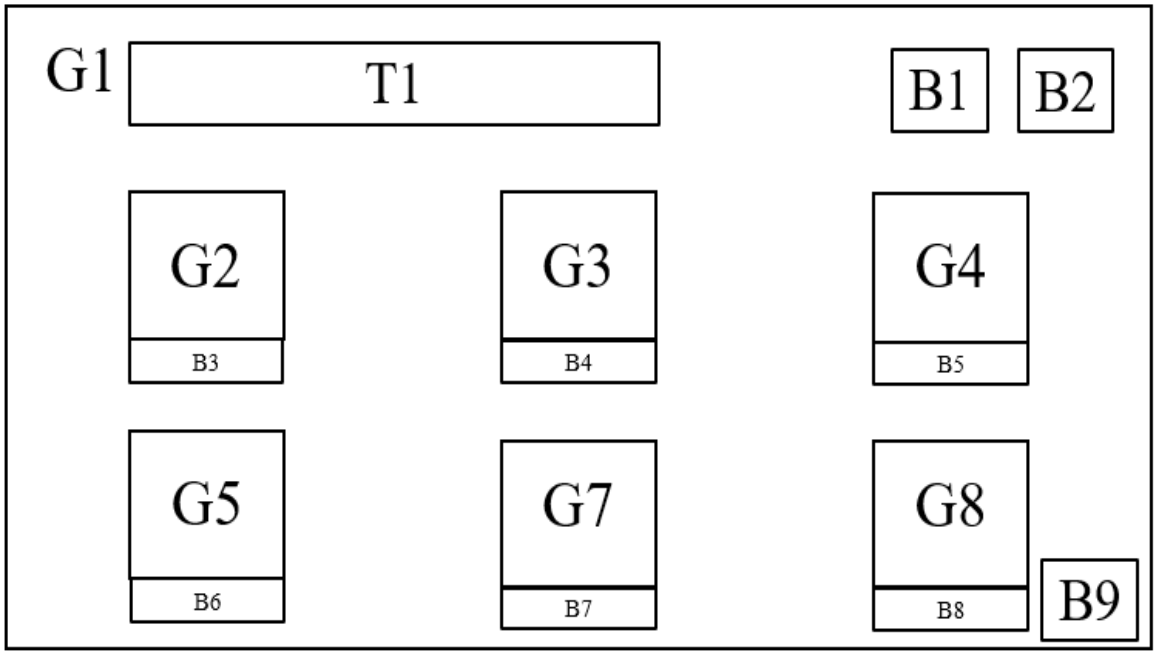


Figure 3-4 Storyboard design of Learning Module.

Label	Description	Attribute
T1	This text element will show the title of this scene which is “Learning Module”.	Font: Snap ITC Text Size: 50pt Text Colour: #FFFFFF Frame Rate: 30fps
G1	This graphic element represents as background image of the scene.	Size: 1024 x 768 Image Type: .png

		Frame Rate: 30fps
G2	This graphic element shows a group of numbers and operations.	Image Type: .png Frame Rate: 30fps
G3	This graphic element shows a cake which divided in fraction format.	Image Type: .png Frame Rate: 30fps
G4	This graphic element shows a group of kids holding a card which contains numbers in different decimals.	Image Type: .png Frame Rate: 30fps
G5	This graphic element shows a percentage symbol.	Image Type: .png Frame Rate: 30fps
G7	This graphic element shows a monster throwing money.	Image Type: .gif Frame Rate: 30fps
G8	This graphic element shows a clock.	Image type: .gif Frame Rate: 30fps
B1	Home button that will link to the Main Menu Interface.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B2	Exit button that let users to quit the system.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B3	This text element represents as a button that will link to Whole Numbers and Operations.	Button Type: Text button Font: Rockwell Extra Bold Text Size: 20pt Text Colour: #FFFFCC Frame Rate: 30fps
B4	This text element represents as a button that will link to Fractions.	Button Type: Text button Font: Rockwell Extra Bold Text Size: 20pt Text Colour: #FFFFCC

		Frame Rate: 30fps
B5	This text element represents as a button that will link to Decimals.	Button Type: Text button Font: Rockwell Extra Bold Text Size: 20pt Text Colour: #FFFFCC Frame Rate: 30fps
B6	This text element represents as a button that will link to Percentage.	Button Type: Text button Font: Rockwell Extra Bold Text Size: 20pt Text Colour: #FFFFCC Frame Rate: 30fps
B7	This text element represents as a button that will link to Money.	Button Type: Text button Font: Rockwell Extra Bold Text Size: 20pt Text Colour: #FFFFCC Frame Rate: 30fps
B8	This text element represents as a button that will link to Time.	Button Type: Text button Font: Rockwell Extra Bold Text Size: 20pt Text Colour: #FFFFCC Frame Rate: 30fps
B9	This text element represents as a button that will link to the option of Topic 7 to Topic 12.	Button Type: Rounded Rectangle Font: Stencil Text Size: 25pt Text Colour: #000000 Frame Rate 30fps

Table 3-3 Storyboard design of Learning Module.

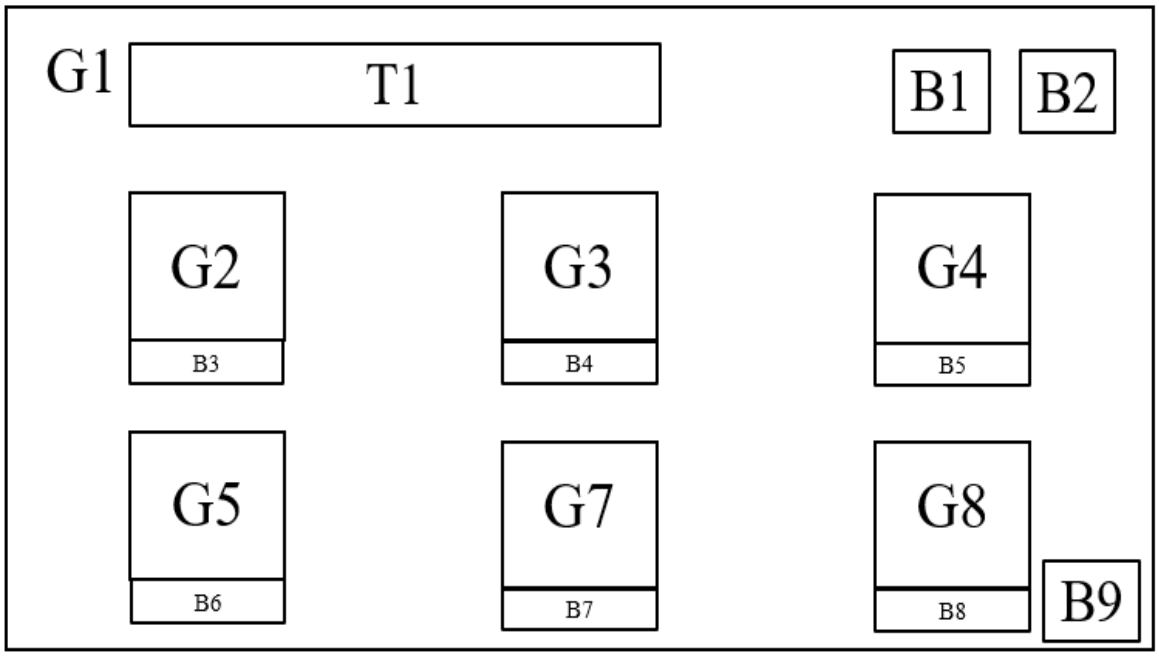


Figure 3-5 Storyboard design of Practical Module.

Label	Description	Attribute
T1	This text element will show the title of this scene which is “Practical Module”.	Font: Snap ITC Text Size: 50pt Text Colour: #FFFFFF Frame Rate: 30fps
G1	This graphic element represents as background image of the scene.	Size: 1024 x 768 Image Type: .png Frame Rate: 30fps
G2	This graphic element shows a group of numbers and operations.	Image Type: .png Frame Rate: 30fps
G3	This graphic element shows a cake which divided in fraction format.	Image Type: .png Frame Rate: 30fps
G4	This graphic element shows a group of kids holding a card which contains numbers in different decimals.	Image Type: .png Frame Rate: 30fps

G5	This graphic element shows a percentage symbol.	Image Type: .png Frame Rate: 30fps
G7	This graphic element shows a monster throwing money.	Image Type: .gif Frame Rate: 30fps
G8	This graphic element shows a clock.	Image type: .gif Frame Rate: 30fps
B1	Home button that will link to the Main Menu Interface.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B2	Exit button that let users to quit the system.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B3	This text element represents as a button that will link to Whole Numbers and Operations.	Button Type: Text button Font: Rockwell Extra Bold Text Size: 20pt Text Colour: #FFFFCC Frame Rate: 30fps
B4	This text element represents as a button that will link to Fractions.	Button Type: Text button Font: Rockwell Extra Bold Text Size: 20pt Text Colour: #FFFFCC Frame Rate: 30fps
B5	This text element represents as a button that will link to Decimals.	Button Type: Text button Font: Rockwell Extra Bold Text Size: 20pt Text Colour: #FFFFCC Frame Rate: 30fps
B6	This text element represents as a button that will link to Percentage.	Button Type: Text button Font: Rockwell Extra Bold

		Text Size: 20pt Text Colour: #FFFFCC Frame Rate: 30fps
B7	This text element represents as a button that will link to Money.	Button Type: Text button Font: Rockwell Extra Bold Text Size: 20pt Text Colour: #FFFFCC Frame Rate: 30fps
B8	This text element represents as a button that will link to Time.	Button Type: Text button Font: Rockwell Extra Bold Text Size: 20pt Text Colour: #FFFFCC Frame Rate: 30fps
B9	This text element represents as a button that will link to the option of Topic 7 to Topic 12.	Button Type: Rounded Rectangle Font: Stencil Text Size: 25pt Text Colour: #000000 Frame Rate 30fps

Table 3-4 Storyboard design of Practical Module.

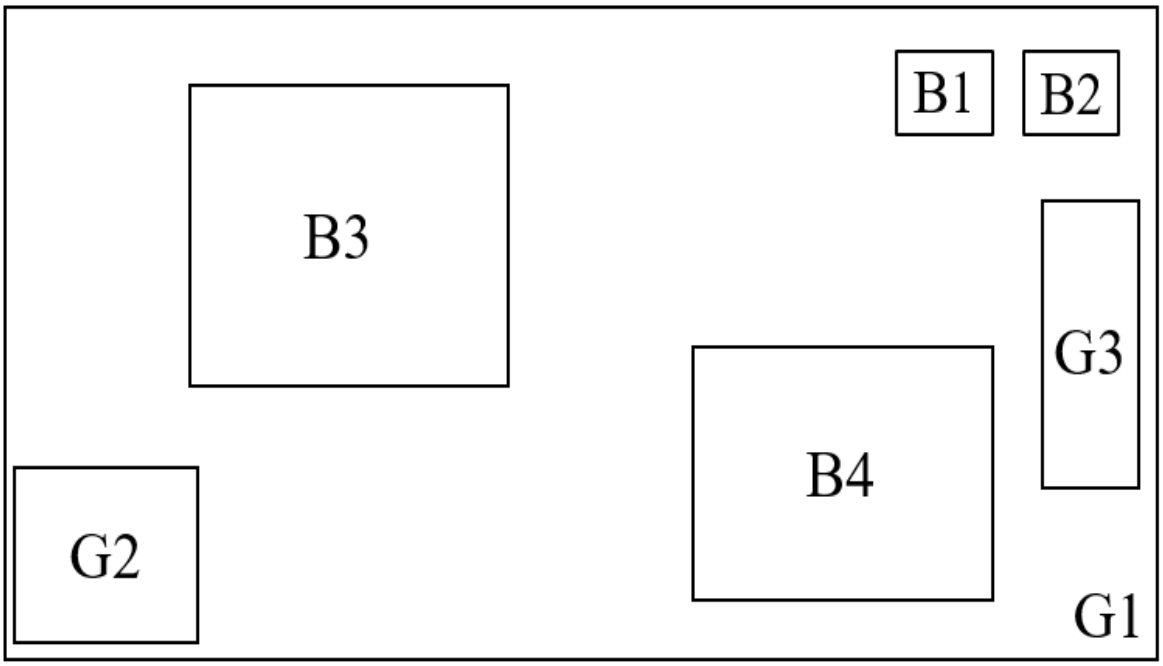


Figure 3-6 Storyboard design of Game Module.

Label	Description	Attribute
G1	This graphic element represents as the background of this scene.	Size: 1024 x 768 Image Type: .png Frame Rate: 30fps
G2	This graphic element shows an astronaut.	Size: 404 x 280 Image Type: .png Frame Rate: 30fps
G3	This graphic element shows an UFO.	Size: 144 x 284 Image Type: .gif Frame Rate: 30fps
B1	Home button that will link to the Main Menu Interface.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B2	Exit button that let users to quit the system.	Button type: Image button

		Image type: .png Size: 100 x 100 Frame Rate: 30fps
B3	Button that will link to menu of Memory Game.	Button Type: Image button Image Type: .gif Size: 447 x 442 Frame Rate: 30fps
B4	Button that will link to menu of Matching Game.	Button Type: Image button Image Type: .png Size: 532 x 410 Frame Rate: 30fps

Table 3-5 Storyboard design of Game Module.

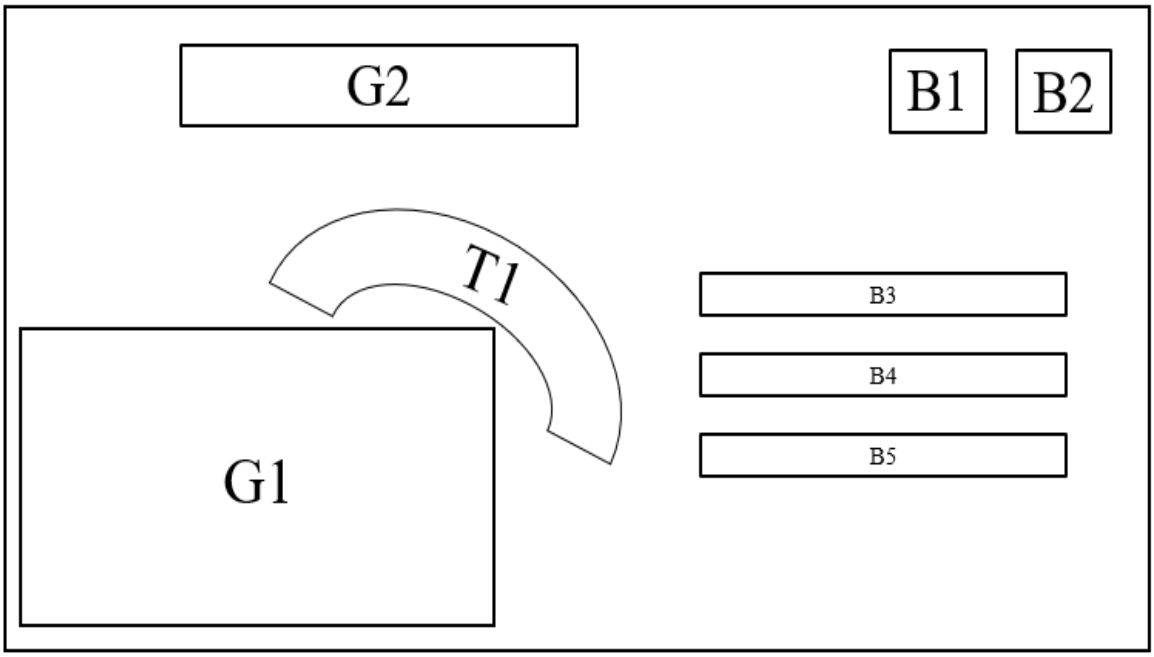


Figure 3-7 Storyboard design of Quiz Module.

Label	Description	Attribute
G1	This graphic element shows a monster drawing on a piece of paper.	Size: 480 x 480 Image Type: .gif Frame Rate: 30fps
G2	This graphic element shows the word "QUIZ" which act as the title of this scene.	Size: 692 x 270 Image Type: .png Frame Rate: 30fps
B1	Home button that will link to the Main Menu Interface.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B2	Exit button that let users to quit the system.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B3	This text element represents as a button that will link to easy mode of quiz.	Button Type: Rounded Rectangle Font: Kristen ITC Text Size: 25pt Text Colour: #FFFFFF Button Colour: #00CC00 Frame Rate: 30fps
B4	This text element represents as a button that will link to medium mode of quiz.	Button Type: Rounded Rectangle Font: Kristen ITC Text Size: 25pt Text Colour: #FFFFFF Button Colour: #00CC00 Frame Rate: 30fps
B5	This text element represents as a button that will link to hard mode of quiz.	Button Type: Rounded Rectangle

		Font: Kristen ITC Text Size: 25pt Text Colour: #FFFFFF Button Colour: #00CC00 Frame Rate: 30fps
T1	This text elements shows the sentence “It’s time to TEST yourself!!!”.	Font: Lucida Calligraphy Text Size: 25pt Text Colour: #000000 Frame Rate: 30fps

Table 3-6 Storyboard design of Quiz Module.

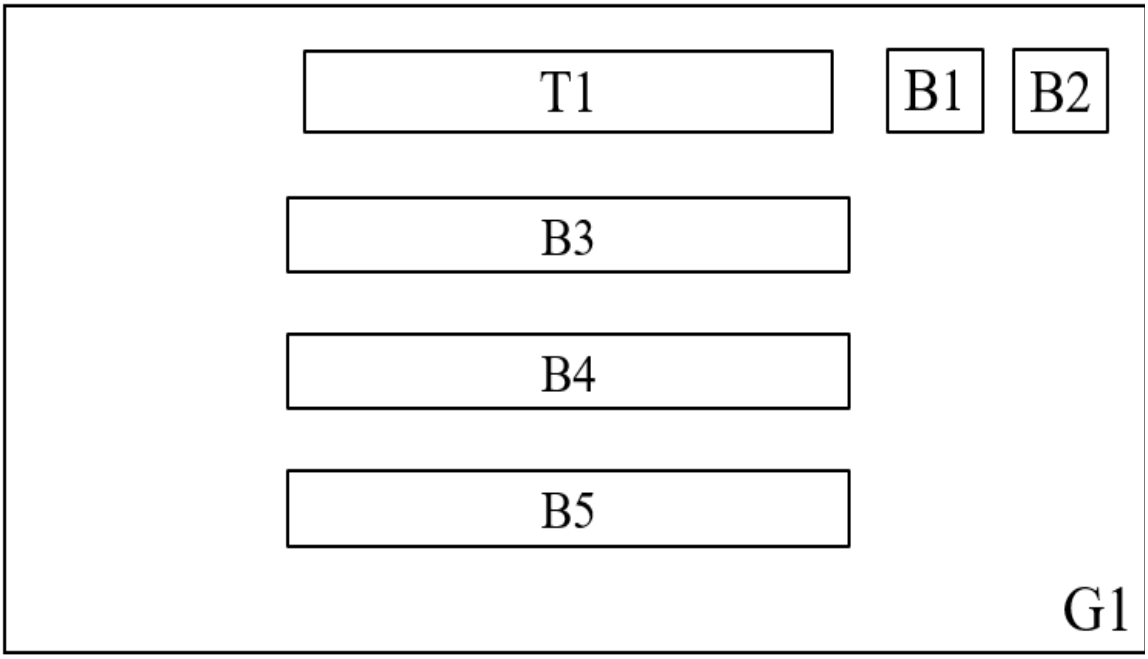


Figure 3-8 Storyboard Design of Sub-menu of Learning Module.

Label	Description	Attribute
G1	This graphic element represents as the background image of this scene.	Size: 1024 x 768 Image Type: .jpg Frame Rate: 30fps

T1	This text element shows the title of the topic.	Font: Bernard MT Condensed Text Size: 45pt Text Colour: #FFFFFF Frame Rate: 30fps
B1	Back button that will link to the menu of the module.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B2	Exit button that let users to quit the system.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B3	This text element represents as a button that will link to subtopic of the topic.	Button Type: Rounded Rectangle Font: Berlin Sans FB Text Size: 25pt Text Style: Regular Text Colour: #00FFFF Frame Rate: 30fps
B4	This text element represents as a button that will link to subtopic of the topic.	Button Type: Rounded Rectangle Font: Berlin Sans FB Text Size: 25pt Text Style: Regular Text Colour: #00FFFF Frame Rate: 30fps
B5	This text element represents as a button that will link to subtopic of the topic.	Button Type: Rounded Rectangle Font: Berlin Sans FB Text Size: 25pt

		Text Style: Regular Text Colour: #00FFFF Frame Rate: 30fps

Table 3-7 Storyboard design of Sub-menu of Learning Module.

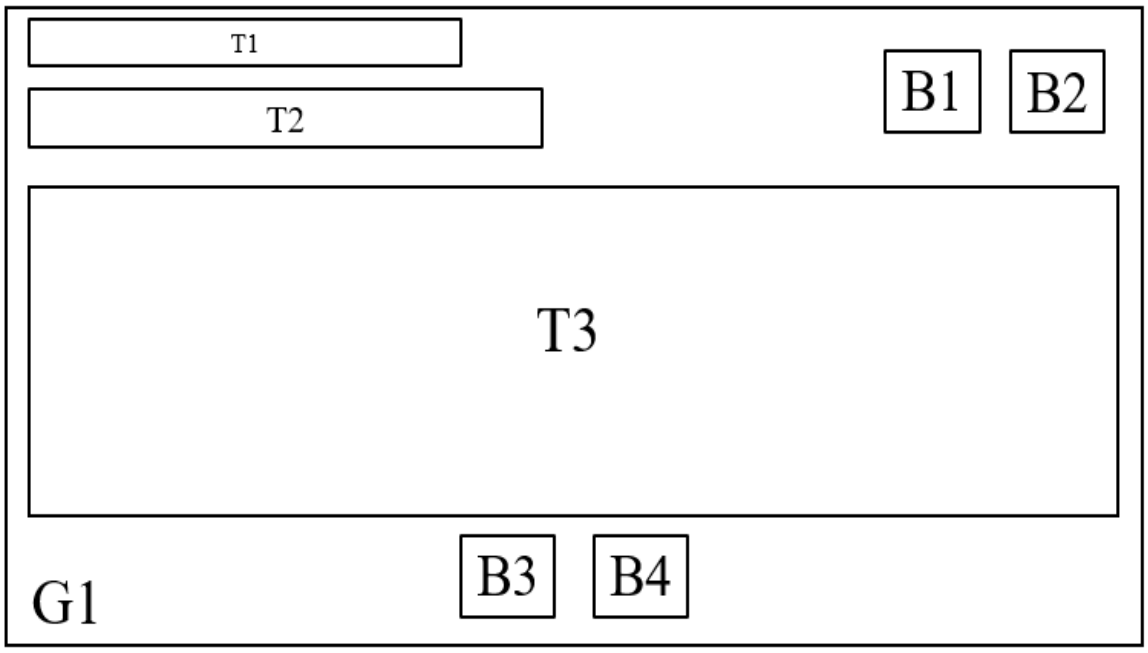


Figure 3-9 Storyboard design of Content of Learning Module.

Label	Description	Attribute
G1	This graphic element represents as the background image of this scene.	Size: 1024 x 768 Image Type: .png Frame Rate: 30fps
T1	This text element shows the title of the topic.	Font: Britannic Bold Text Size: 25pt Text Colour: #000000 Frame Rate: 30fps
T2	This text element shows the title of the subtopic.	Font: Cooper Black Text Size: 28pt Text Colour: #000000

		Frame Rate: 30fps
T3	This text element shows the content of the topic.	Font: Franklin Gothic Medium Text Size: 26pt Text Colour: #333333 Frame Rate: 30fps
B1	Back button which will link to the subtopic menu.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B2	Exit button that let users to quit the system.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B3	Previous button which will link to the last page.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B4	Next button which will link to the next page.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps

Table 3-8 Storyboard design of Content of Learning Module.

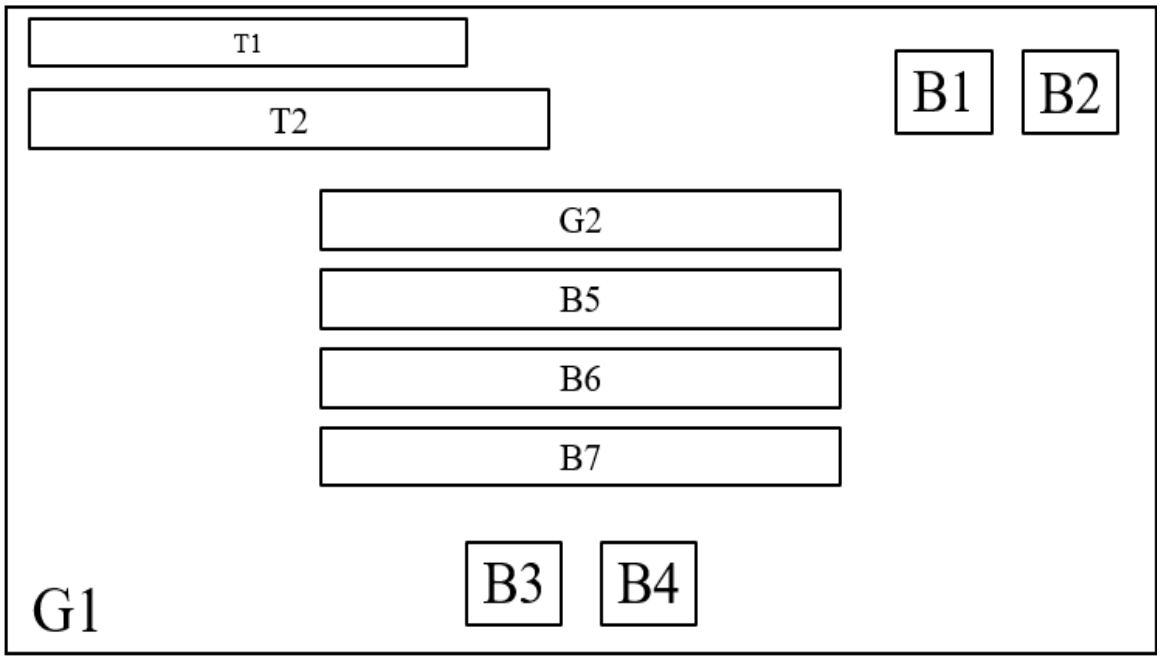


Figure 3-10 Storyboard design of Video Menu.

Label	Description	Attribute
G1	This graphic element represents as the background image of this scene.	Size: 1024 x 768 Image Type: .png Frame Rate: 30fps
G2	This graphic element shows the text "Watch a Video to Learn More!".	Size: 551 x 51 Image Type: .gif Frame Rate: 30fps
T1	This text element shows the title of the topic.	Font: Britannic Bold Text Size: 25pt Text Colour: #000000 Frame Rate: 30fps
T2	This text element shows the title of the subtopic.	Font: Cooper Black Text Size: 28pt Text Colour: #000000 Frame Rate: 30fps
B1	Back button which will link to the subtopic	Button type: Image button

	menu.	Image type: .png Size: 100 x 100 Frame Rate: 30fps
B2	Exit button that let users to quit the system.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B3	Previous button which will link to the last page.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B4	Next button which will link to the next page.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B5	This text element represents as a button that will play the video.	Button Type: Text button Font: Gill Sans Ultra Bold Text Size: 26pt Text Colour: #333333 Frame Rate: 30fps
B6	This text element represents as a button that will play the video.	Button Type: Text button Font: Gill Sans Ultra Bold Text Size: 26pt Text Colour: #333333 Frame Rate: 30fps
B7	This text element represents as a button that will play the video.	Button Type: Text button Font: Gill Sans Ultra Bold Text Size: 26pt Text Colour: #333333 Frame Rate: 30fps

Table 3-9 Storyboard design of Video Menu.

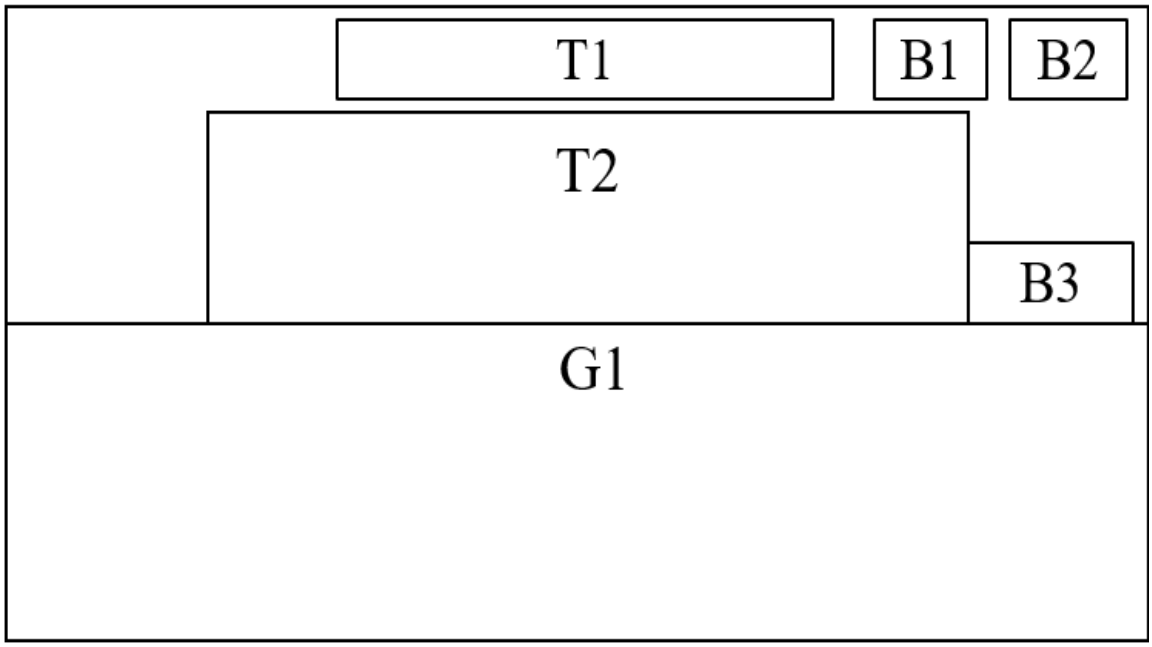


Figure 3-11 Storyboard design of Practical Instruction.

Label	Description	Attribute
G1	This graphic element shows a monster looking all around from the spaceship.	Size: 1024 x 552 Image Type: .gif Frame Rate: 30fps
G2	This graphic element shows the title of the topic.	Size: 675 x 445 Image Type: .png Frame Rate: 30fps
T1	This text element shows instruction of the module.	Font: Gill Sans Ultra Bold Text Size: 24pt Text Colour: #FFFFFF Frame Rate: 30fps
B1	Back button which will link to the menu of Practical Module.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps

B2	Exit button that let users to quit the system.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B3	Next button which the users will start the practical.	Button type: Image button Image type: .png Size: 182 x 57 Frame Rate: 30fps

Table 3-10 Storyboard of Practical Instruction.

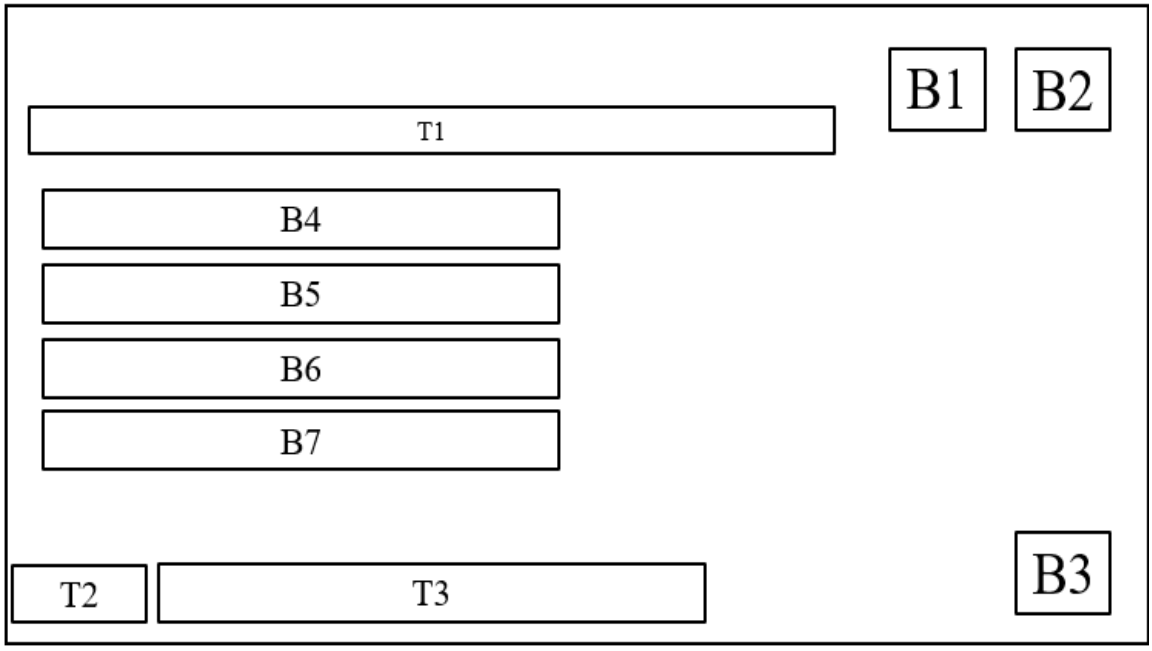


Figure 3-12 Storyboard design of Practical Question.

Label	Description	Attribute
T1	This text element shows question.	Font: Eras Demi ITC Text Size: 32pt Text Colour: #000000 Frame Rate: 30fps
T2	This text element shows the word	Size: 190 x 113

	"Answer:".	Frame Rate: 30fps
T3	This text element will show the correct answer of the question after the user selected the answer.	Font: Ink Free Text Size: 50pt Text Colour: #CCFF00 Frame Rate: 30fps
B1	Back button which will link to the menu of Practical Module.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B2	Exit button that let users to quit the system.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B3	Next button which the users can proceed to next question.	Button type: Image button Image type: .png Size: 182 x 57 Frame Rate: 30fps
B4	This text element represents one of the options.	Button type: Text button Font: Eras Demi ITC Text Size: 32pt Text Colour: #000000 Frame Rate: 30fps
B5	This text element represents one of the options.	Button type: Text button Font: Eras Demi ITC Text Size: 32pt Text Colour: #000000 Frame Rate: 30fps
B6	This text element represents one of the options.	Button type: Text button Font: Eras Demi ITC Text Size: 32pt Text Colour: #000000

		Frame Rate: 30fps
B7	This text element represents one of the options.	Button type: Text button Font: Eras Demi ITC Text Size: 32pt Text Colour: #000000 Frame Rate: 30fps

Table 3-11 Storyboard of Practical Question.

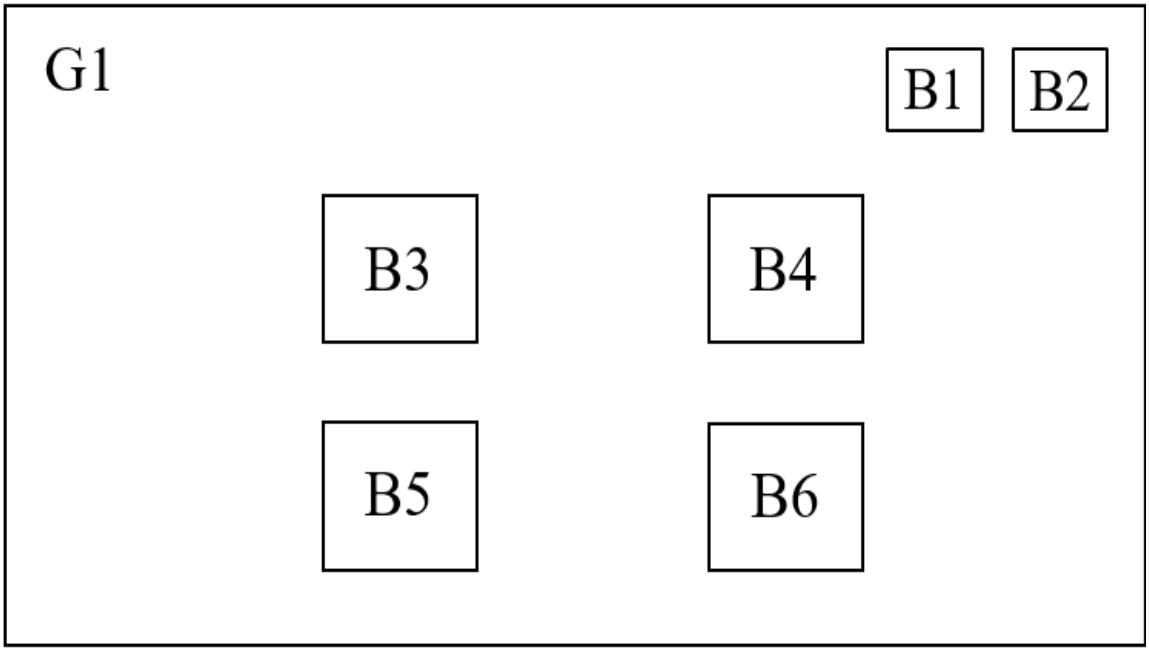


Figure 3-13 Storyboard design of Sub-menu of Game Module.

Label	Description	Attribute
G1	This graphic element represents as the background image of this scene.	Size: 1024 x 768 Image Type: .png Frame Rate: 30fps
B1	Back button which will link to the menu of Game Module.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps

B2	Exit button that let users to quit the system.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B3	Button that link to the instruction of game.	Button type: Image button Image type: .png / .gif Size: 325 x 284 Frame Rate: 30fps
B4	Button that link to the instruction of game.	Button type: Image button Image type: .png / .gif Size: 325 x 284 Frame Rate: 30fps
B5	Button that link to the instruction of game.	Button type: Image button Image type: .png / .gif Size: 325 x 284 Frame Rate: 30fps
B6	Button that link to the instruction of game.	Button type: Image button Image type: .png / .gif Size: 325 x 284 Frame Rate: 30fps

Table 3-12 Storyboard of Sub-menu of Game Module.

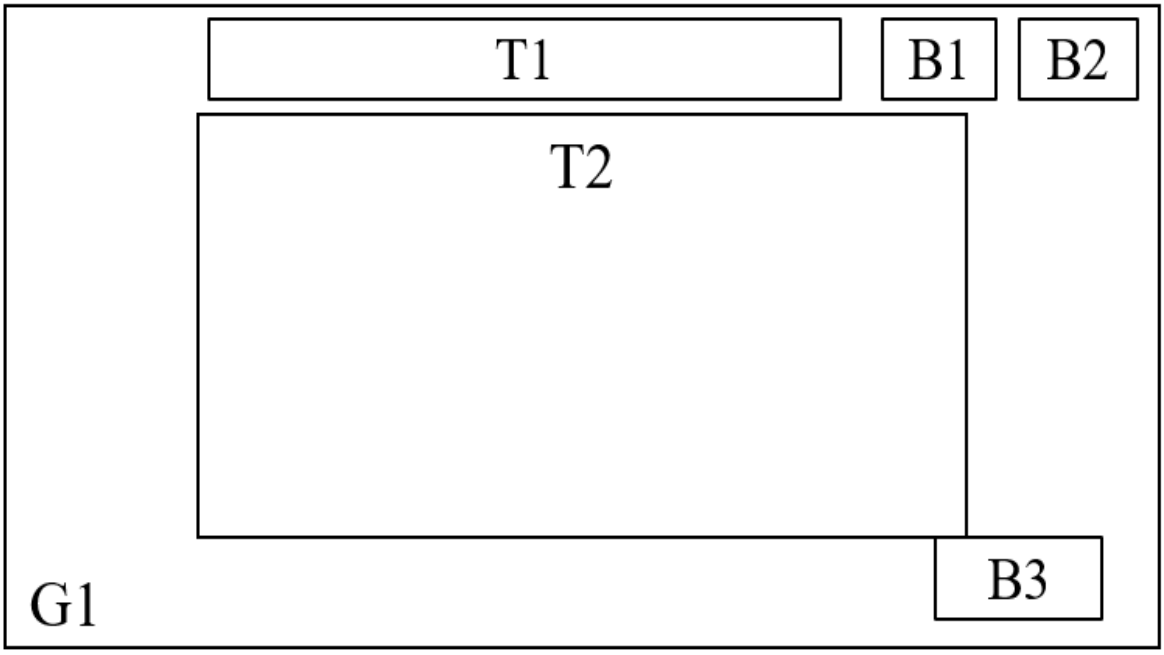


Figure 3-14 Storyboard design of Game Instruction.

Label	Description	Attribute
G1	This graphic element represents as the background image of this scene.	Size: 1024 x 768 Image Type: .png Frame Rate: 30fps
T1	This text element shows the word "Instruction".	Image type: .png Size: 723 x 162 Frame Rate: 30fps
T2	This text element shows the instruction of the game.	Font: Kristen ITC Text Size: 34pt Text Colour: #006666 Frame Rate: 30fps
B1	Back button which will link to the menu of Game Module.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B2	Exit button that let users to quit the system.	Button type: Image button

		Image type: .png Size: 100 x 100 Frame Rate: 30fps
B3	Button that start the game.	Button type: Image button Image type: .png Size: 300 x 150 Frame Rate: 30fps

Table 3-13 Storyboard of Game Instruction.

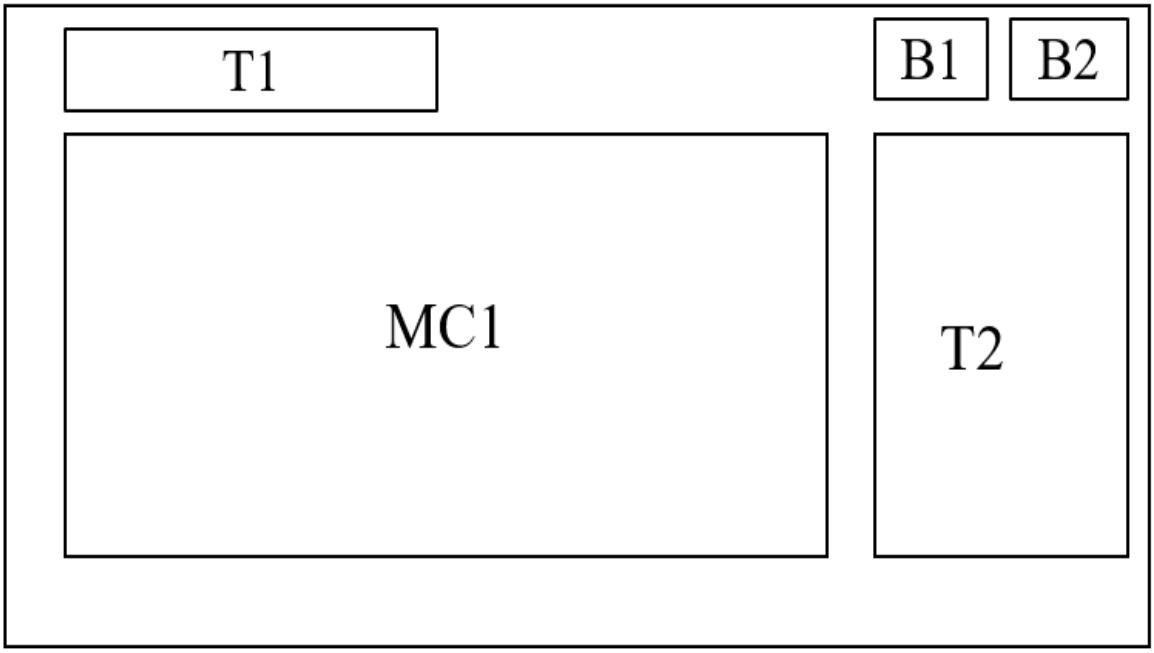


Figure 3-15 Storyboard design of Memory Game.

Label	Description	Attribute
T1	This text element shows the title of the game.	Font: Gill Sans Ultra Bold Condensed Text Size: 50pt Text Colour: #00FF99 Frame Rate: 30fps
T2	This text element shows the description of	Font: Lucida Bright

	the topic.	Text Size: 26pt Text Colour: #003333 Frame Rate: 30fps
B1	Back button which will link to the sub-menu of Game Module.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B2	Exit button that let users to quit the system.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
MC1	Movie clip that shows the memory game.	Size: 630 x 635 Frame Rate: 30fps

Table 3-14 Storyboard of Memory Game.

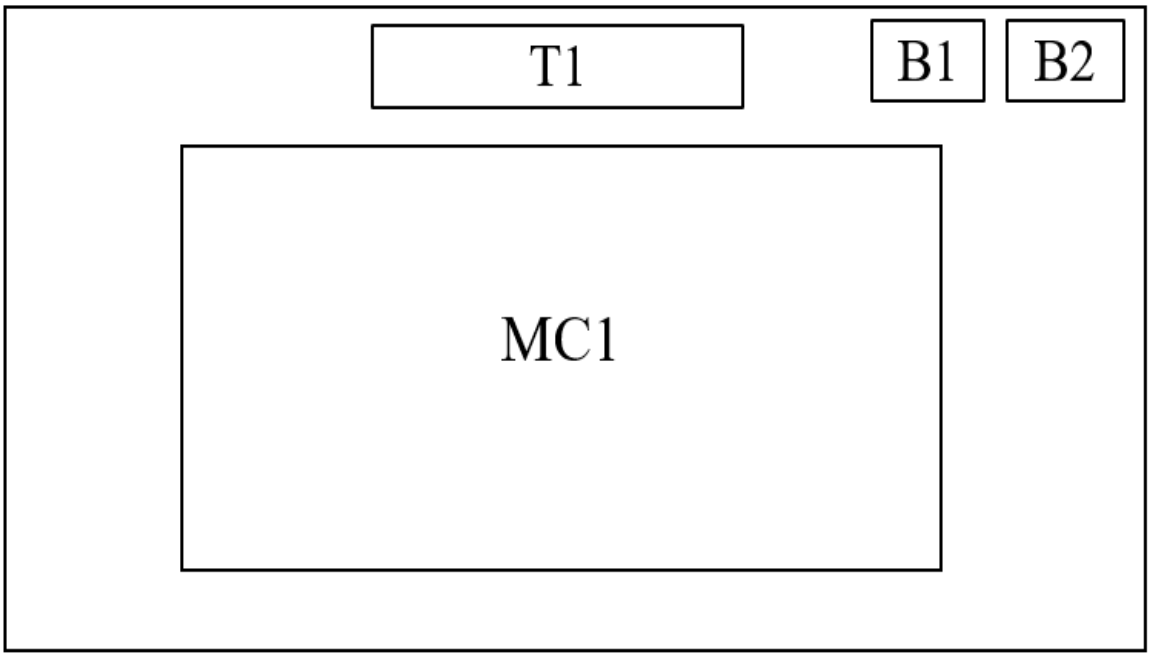


Figure 3-16 Storyboard design of Matching Game.

Label	Description	Attribute
T1	This text element shows the title of the game.	Font: Gill Sans Ultra Bold Condensed Text Size: 50pt Text Colour: #00FF99 Frame Rate: 30fps
B1	Back button which will link to the sub-menu of Game Module.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B2	Exit button that let users to quit the system.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
MC1	Movie clip that shows the memory game.	Size: 630 x 635 Frame Rate: 30fps

Table 3-15 Storyboard of Matching Game.

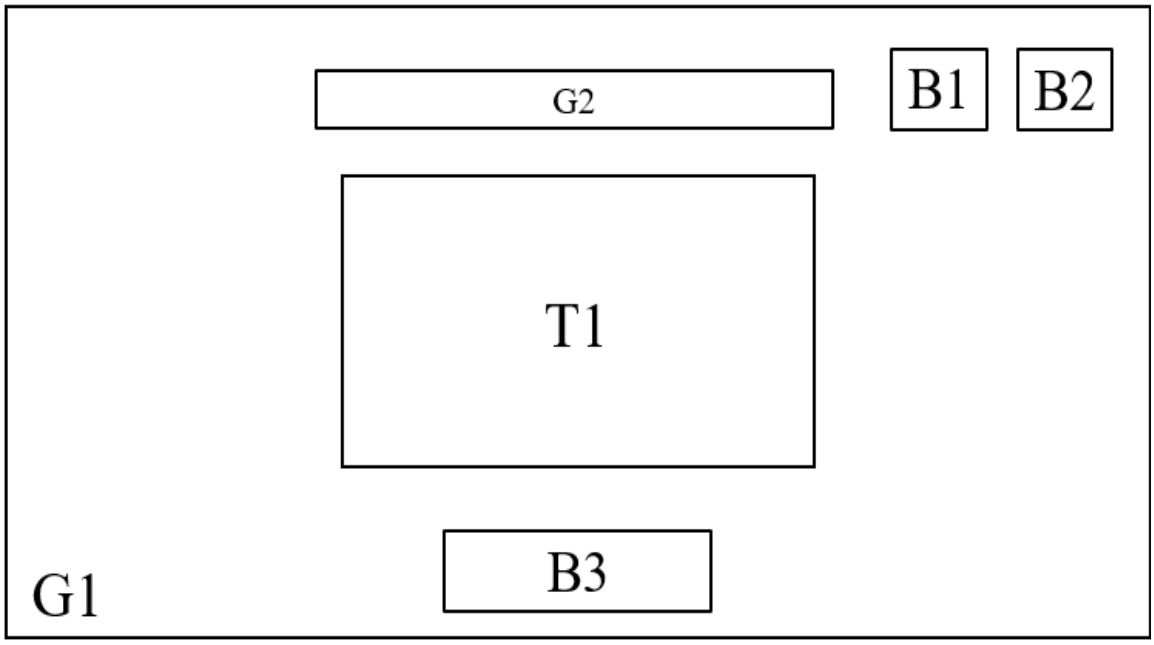


Figure 3-17 Storyboard design of Quiz Instruction.

Label	Description	Attribute
G1	This graphic element represents as the background image of this scene.	Size: 1024 x 768 Image Type: .png Frame Rate: 30fps
G2	This graphic element shows the text "Instruction".	Size: 560 x 170 Image Type: .png Frame Rate: 30fps
T1	This text element shows instruction of the module.	Font: Gill Sans Ultra Bold Text Size: 26pt Text Colour: #000000 Frame Rate: 30fps
B1	Back button which will link to the particular module menu.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B2	Exit button that let users to quit the system.	Button type: Image button Image type: .png Size: 100 x 100 Frame Rate: 30fps
B3	Start button to start answering the practical or quiz.	Button type: Rounded Rectangle Font: Impact Text Size: 40pt Text Colour: #000000 Frame Rate: 30fps

Table 3-16 Storyboard of Quiz Instruction.

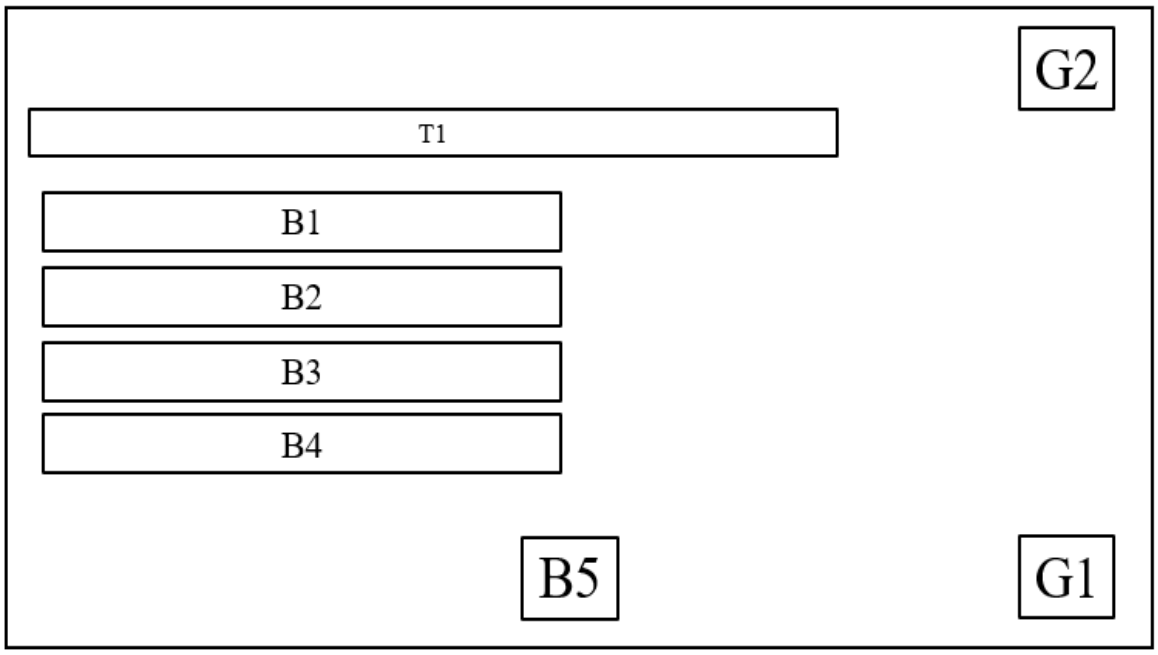


Figure 3-18 Storyboard of Quiz Question.

Label	Description	Attribute
G1	This graphic element shows a group of mathematical tools.	Size: 280 x 330 Image Type: .png Frame Rate: 30fps
G2	This graphic element shows the word "QUIZ".	Size: 180 x 110 Image Type: .png Frame Rate: 30fps
T1	This text element shows question.	Font: Eras Demi ITC Text Size: 32pt Text Colour: #000000 Frame Rate: 30fps
B1	This text element represents one of the options.	Button type: Text button Font: Eras Demi ITC Text Size: 32pt Text Colour: #000000 Frame Rate: 30fps

B2	This text element represents one of the options.	Button type: Text button Font: Eras Demi ITC Text Size: 32pt Text Colour: #000000 Frame Rate: 30fps
B3	This text element represents one of the options.	Button type: Text button Font: Eras Demi ITC Text Size: 32pt Text Colour: #000000 Frame Rate: 30fps
B4	This text element represents one of the options.	Button type: Text button Font: Eras Demi ITC Text Size: 32pt Text Colour: #000000 Frame Rate: 30fps
B5	Close button which let the users to quit the quiz.	Button Type: Image button Image Type: .png Size: 100 x 100 Frame Rate: 30fps

Table 3-17 Storyboard of Quiz Question.

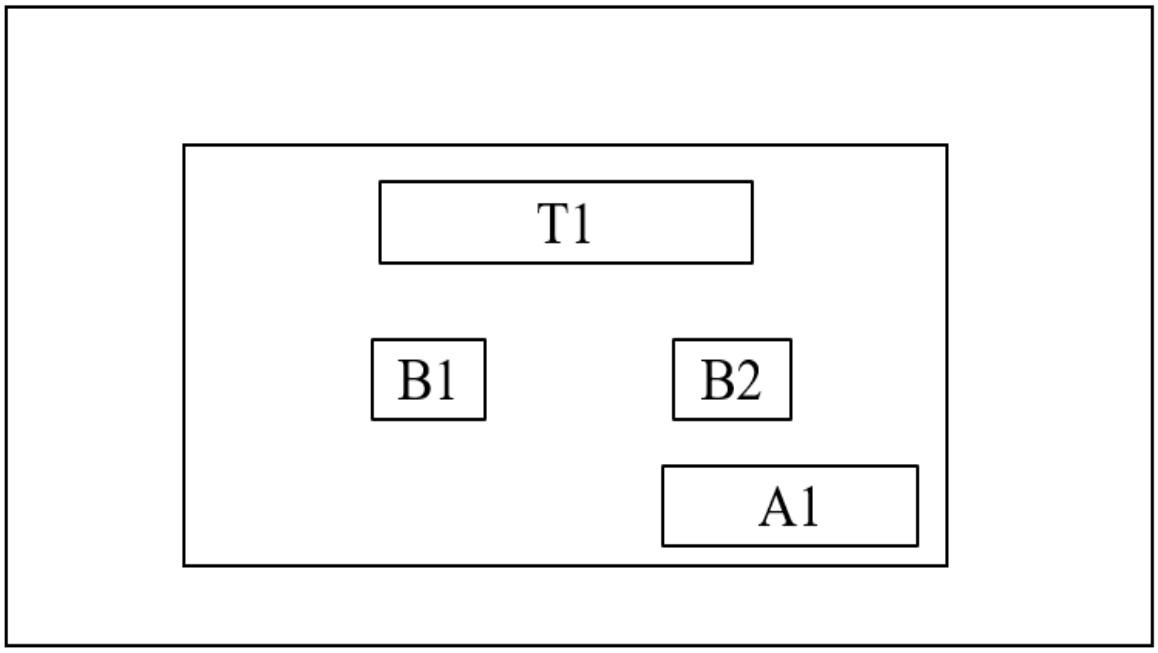


Figure 3-19 Storyboard of Exit Interface.

Label	Description	Attribute
A1	This graphic element shows a monster looking around.	Size: 278 x 195 Image Type: .gif Frame Rate: 30fps
T1	This text element is asking the users whether they want to exit the system or not.	Font: Franklin Gothic Heavy Text Size: 55pt Text Colour: #FFFFFF Frame Rate: 30fps
B1	Yes button to exit the system.	Button type: Text button Font: Lucida Calligraphy Text Size: 60pt Text Colour: #6666FF Frame Rate: 30fps
B2	No button to return back the last scene.	Button type: Text button Font: Lucida Calligraphy

		Text Size: 60pt Text Colour: #FF66FF Frame Rate: 30fps

Table 3-18 Storyboard of Exit Interface.

Chapter 4: Methodology and Tools

Implementation methodology is an adaptable process system for managing the creation of an application project. It is important that a project can match with a framework for implementation so that developers can easily identify and execute the application's objectives. In this chapter, methodology and tools that used in developing this project had been clearly stated.

ADDIE Model and AGILE were the methodology that the author considered to use in developing this project. ADDIE Model is a linear process while AGILE is a non-linear method. Although AGILE produces elements that can be noticed and commented on by users early in the process, users could not always see the whole picture because it takes each portion to completion until the process is replicated and the next course segment created.

The author at the end decided to use ADDIE Model as the development methodology because the completion times of using ADDIE Model are easier to gauge, since larger project sections are designed in advance.

4.1 Methodology

ADDIE Model is used as the development methodology of this project. Accoding to Shelton et al. (2007), ADDIE Model is a generic instructional design methodology that can help to provides an organized process for developing instructional materials. It consists of five-step cyclical processes, which are Analysis, Design, Develop, Implement and Evaluate. The reason for choosing ADDIE Model as a development methodology is because it provides a dynamic and flexible guideline for creating interactive multimedia courseware (Mc.Griff, 2000).

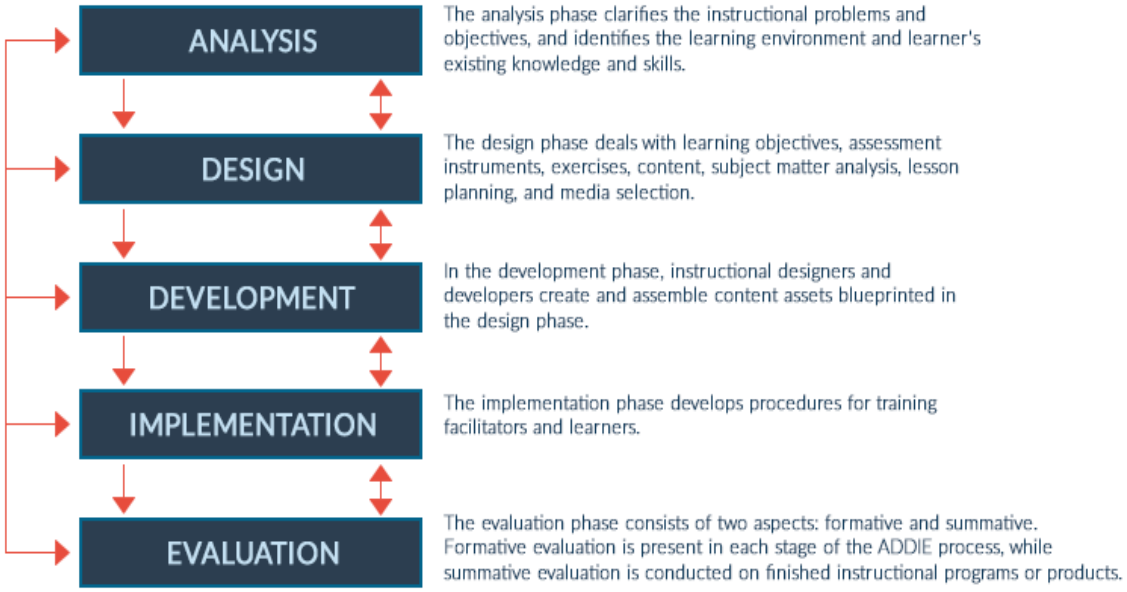


Figure 4-1 What Should E-Learning Designers Know About the ADDIE Model? #14- (Anderson, 2016)

4.1.1 Analysis

In this phase, the problems of traditional teaching method and problems of existing multimedia-based courseware have been clarified, which were students have different learning pace, students lack learning process in classroom and students loss of interest and attention in learning. Objectives and target audiences also have been identified in this phase to solve the existing problems.

4.1.2 Design

In this phase, a prototype of the multimedia-based courseware was developed based on the information and learning objective that defined in analysis phase. The content and design of the learning materials that will be used in the system was decided in this phase. The content of the system used more graphics to help the children to have a better understanding. The user interface design of the system was also focused more on animation and so that it can attract the children easily.

4.1.3 Development

In this phase, a courseware was developed based on the prototype in the design phase. The five multimedia elements (text, video, audio, graphics and animation) were using to create and produce the four modules that were included in the courseware. The courseware was designed to deal with the learning objective that clarified in analysis phase. Storyboard design was used in designing all the interfaces of the courseware.

4.1.4 Implementation

After the development phase, the proposed multimedia courseware was delivered to the target audiences. Feedback of the children was collected during this phase to measure the audience's reaction and identify the problems of this courseware. Errors or bugs that found by the target audiences will be fixed and solved to meet the users' satisfaction.

4.1.5 Evaluation

Evaluation can be divided into two aspects which are formative evaluation and summative evaluation. Formative evaluation was used in every phase of ADDIE Model to avoid error or bug in the previous phase before proceeding to the next phase. Summative evaluation was conducted after the implementation of the latest version of the system. The effectiveness of this courseware for the children to learn Mathematics was measured in this phase. Existing problems of this courseware will also be modified and improved to ensure that objectives are met.

4.2 Tools

4.2.1 Adobe Animate CC 2019

Figure 4-2 Adobe Animate CC 2019.

Adobe Animate CC 2019 was the major tool used to develop the multimedia courseware. It was used to publish an interactive multimedia-based courseware as it allowed to create animations, vector graphics and games that the audience can actively clicking on a mouse to perform different actions. ActionScript 3.0 is the scripting language that used in developing the courseware. ActionScript 3.0 was written with performance in mind, from the ground up. Its code running 10 times faster than its predecessors. That means that with ActionScript 3.0 the content runs much smoother. Moreover, Adobe Animate CC 2019 also used to combine modules.

4.2.2 Adobe Photoshop CC 2019

Figure 4-3 Adobe Photoshop CC 2019.

Adobe Photoshop CC 2019 was used to edit and enhance the image before import to Adobe Animate CC 2019 for further use. It was used to crop and resize image, remove image background and apply special effect to enhance the image.

4.2.3 BitDownloader

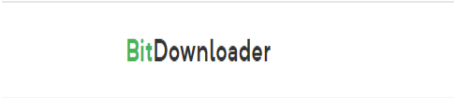


Figure 4-4 BitDownloader.

BitDownloader is a free online downloader tool that allows to download videos from different platforms such as YouTube, Facebook, TikTok, and many other services. It was used to download explanation video from YouTube.

4.2.4 FlamingText.com

Figure 4-5 FlamingText.com

FlamingText.com is a free online logo generator. It is dedicated to offering the finest and most user-friendly graphics on the site. It was used to generated text into graphics.

4.2.4 AudioTrimmer.com

Figure 4-6 AudioTrimmer.com

AudioTrimmer.com is a free online audio cutter. It was used to remove unwanted sections of the audio.

4.2.4 Soundoftext.com

Figure 4-7 SoundofText.com

Soundoftext.com is a free online tool that used to create MP3 audio file from text the using text to speech engine from Google Translate.

4.3 Requirement Specification

4.3.1 User Requirement

User requirement referred to as user specifications, define what the user is doing in the system, such as what tasks they need to be able to perform with the multimedia courseware. Firstly, the courseware should provide the children power to control the system so that they can learn Mathematics through the system with their own pace.

Secondly, should provide more ways in learning Mathematics for the children to prevent them taking on passive role in learning. Children not only allowed to learn Mathematics through theory, they can also learn Mathematics through game and practical or quiz that provided. Thirdly, the courseware should provide user interaction that can create interest among the students. Interactivity will transform the boring content into an engaging learning experience.

4.3.2 Functional Requirement

Functional requirement is a definition of the service the program is needed to provide. The function requirements for the interactive multimedia-based courseware for learning Mathematics are:

a. Users can learn Mathematics in Learning Module.
b. Users can do practice in the Practical Module to improve their Mathematics skills.
c. Users can learn Mathematics while playing game in Game Module.
d. Users can evaluate their understanding and standard of Mathematics in Quiz Module.

4.3.3 System Requirement

4.3.3.1 Hardware Requirement

Hardware / Software	**Specification**
Processor	1GB RAM or above
RAM	1GHz Processor or above
Graphic Card	32-bit or 64-bit graphic card
Sound Card	32-bit or 64-bit sound card
Free Space	1GB free space or above

Table 4-1 Hardware Requirement.

4.3.3.2 Software Requirement

Software	**Specification**

Operating System	32-bit or 64-bit Windows 7, 8 or 10
Adobe Flash Player	Adobe Flash Player 30.0 or above

Table 4-2 Software Requirement.

4.4 Verification Plan

Verification was done at the beginning of the process of development as to evaluate documents, plans, code, requirements and specifications of the courseware. There were four levels of testing that help the software testing to check the performance and behavior, which were unit testing, integration testing, system testing and acceptance testing.

Figure 4-8 Four Level of Testing.

4.4.1 Unit Testing

Unit testing was carried out to test the smallest testable portion of the system that can be compiled, loaded and run. This type of testing aids in testing each module separately. It checks whether or not component meets its functionalities against its specification (Umar, 2020). All the functions of the courseware were tested in this level of testing.

4.4.2 Integration Testing

Integration testing was defined as testing the combined parts of an application to ensure that the integrated system is ready for system testing. Integration testing verifies the flow of data from one module to another. It can be done in two ways which were bottom up integration testing and top down integration testing. User interface, use-case and interaction of the courseware were test in this phase (Umar, 2020).

4.4.3 System Testing

System testing is done on a comprehensive, integrated system. It enables compliance checking of the system according to the requirements. It includes tests on load, performance, reliability and safety. Most often, system testing verifies the overall component interaction to make sure that all modules and programs function unanimously without error (Umar, 2020). It is the final test to check that the system meets the specification. It assesses both functional and non-functional test needs.

4.4.4 Acceptance Testing

Acceptance testing was a test performed to find out whether the requirements of a specification or contract are fulfilled as per its delivery. The users basically perform acceptability testing. There were two types of acceptance testing which were alpha testing and beta testing (Umar, 2020). Alpha testing which used made-up data for testing by developer was used to test the acceptance criteria of this courseware.

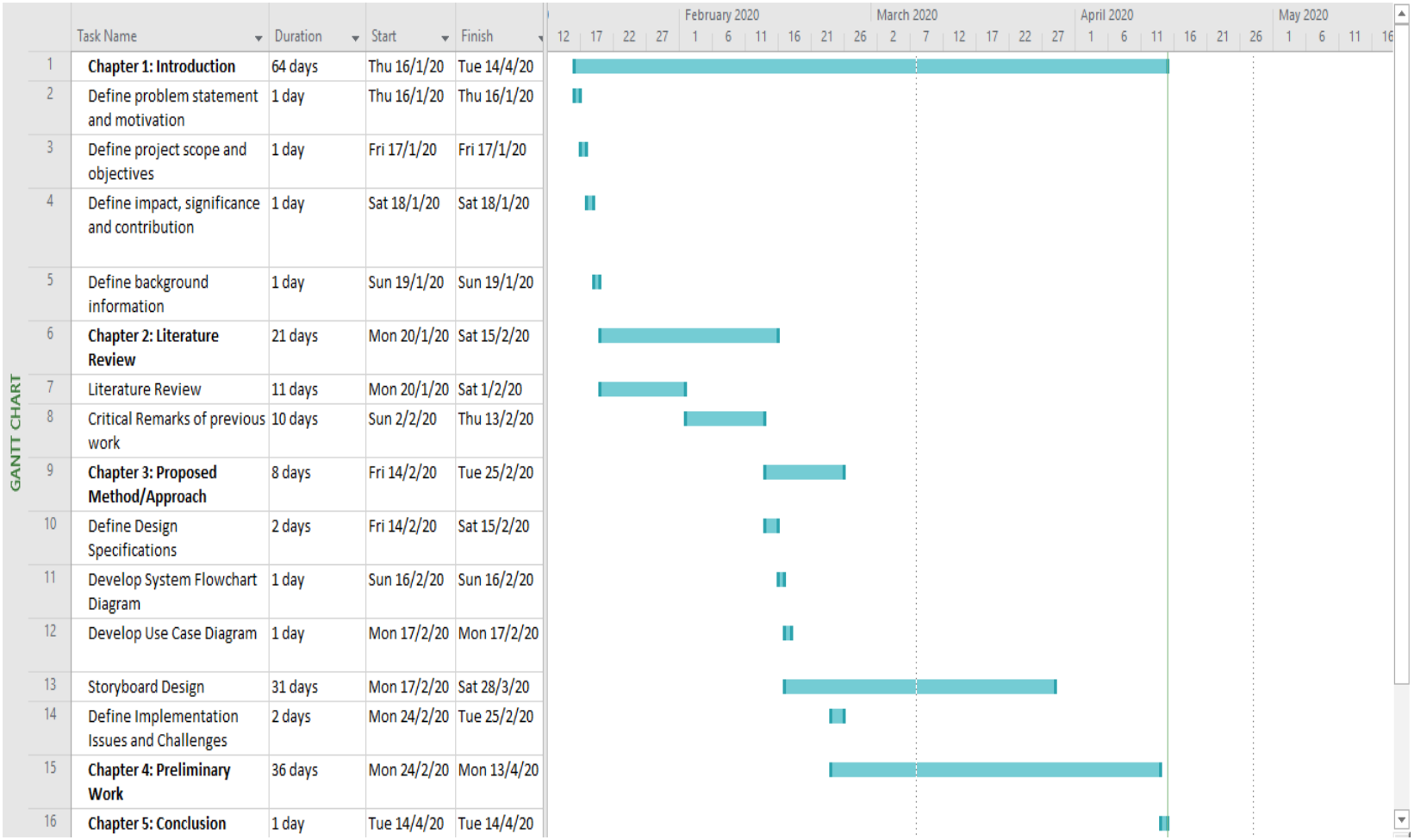
4.5 Implementation and Challenges

The main issue and challenge that the author faced in this project is the author was lacked of knowledge and experience in developing the proposed system by using Adobe Animate CC 2019. Since Adobe Animate CC 2019 has a lot of tools and functions, the author used few weeks for learning the basic usage of tools and functions, as well as the scripting language, ActionScript 3.0 for developing the proposed system.

Moreover, the user interface design is one of the challenges that the author faced in this project. The proposed system is designed for children who aged 12 years old, so that the user interface should be designed in a more colorful and interesting way to attract children for using it. Furthermore, the author had to develop the proposed system in such a way that is fun and entertaining. This is because children will lose their attraction and interest easily if the learning material are delivered in a boring way.

4.5 Project Timeline

4.5.1 Project Timeline of Final Year Project I



	Task Name	Duration	Start	Finish
1	**Chapter 1: Introduction**	64 days	Thu 16/1/20	Tue 14/4/20
2	Define problem statement and motivation	1 day	Thu 16/1/20	Thu 16/1/20
3	Define project scope and objectives	1 day	Fri 17/1/20	Fri 17/1/20
4	Define impact, significance and contribution	1 day	Sat 18/1/20	Sat 18/1/20
5	Define background information	1 day	Sun 19/1/20	Sun 19/1/20
6	**Chapter 2: Literature Review**	21 days	Mon 20/1/20	Sat 15/2/20
7	Literature Review	11 days	Mon 20/1/20	Sat 1/2/20
8	Critical Remarks of previous work	10 days	Sun 2/2/20	Thu 13/2/20
9	**Chapter 3: Proposed Method/Approach**	8 days	Fri 14/2/20	Tue 25/2/20
10	Define Design Specifications	2 days	Fri 14/2/20	Sat 15/2/20
11	Develop System Flowchart Diagram	1 day	Sun 16/2/20	Sun 16/2/20
12	Develop Use Case Diagram	1 day	Mon 17/2/20	Mon 17/2/20
13	Storyboard Design	31 days	Mon 17/2/20	Sat 28/3/20
14	Define Implementation Issues and Challenges	2 days	Mon 24/2/20	Tue 25/2/20
15	**Chapter 4: Preliminary Work**	36 days	Mon 24/2/20	Mon 13/4/20
16	**Chapter 5: Conclusion**	1 day	Tue 14/4/20	Tue 14/4/20

Figure 4-9 Project Timeline of Final Year Project I.

4.5.2 Project Timeline of Final Year Project II

Activity	Start	End	Days
Development Phase	15-06-20	26-08-20	74.0
Re-design the Previous ...	15-06-20	22-06-20	8.0
Develop Learning Module	23-06-20	17-07-20	25.0
Develop Quiz Module	18-07-20	24-07-20	7.0
Develop Practical Module	25-07-20	31-07-20	7.0
Test Modules	01-08-20	01-08-20	1.0
Fix Bugs	02-08-20	04-08-20	3.0
Integrate Learning, Quiz ...	05-08-20	09-08-20	5.0
Develop Game Module	09-08-20	26-08-20	18.0
Implementation Phase	27-08-20	06-09-20	12.0
Deliver to Children to Te...	27-08-20	02-09-20	7.0
Collect Feedback	03-09-20	03-09-20	1.0
Fix Bugs and Enhance Sy...	04-09-20	06-09-20	3.0
Testing the Courseware	05-09-20	05-09-20	1.0
Evaluation Phase	06-09-20	11-09-20	6.0
Evaluate the Courseware	06-09-20	07-09-20	2.0
Further Enhancement	08-09-20	10-09-20	3.0
Submission of the Cours...	11-09-20	11-09-20	1.0

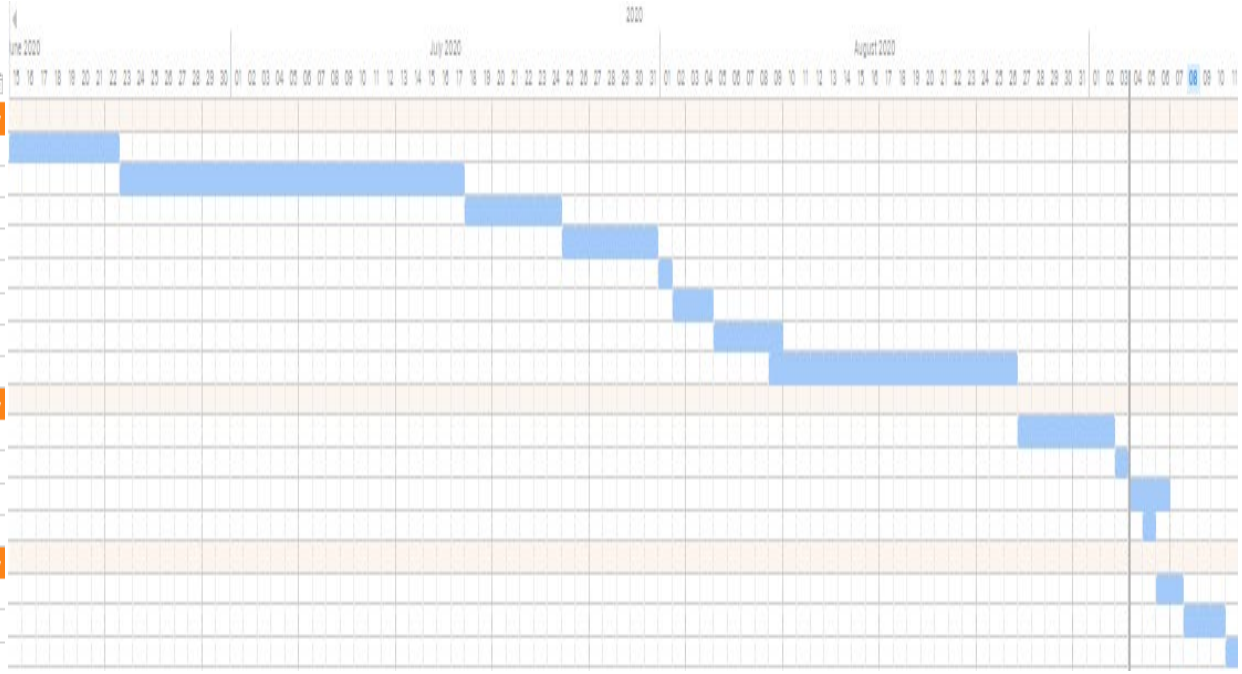


Figure 4-10 Project Timeline of Final Year Project II.

Chapter 5: System Implementation and Testing

Implementation process is undoubtedly the project's most crucial step, since it needs a tremendous commitment in terms of manpower and financial resources and can be very detrimental to the day-to-day operations. There were few ways of implementation methods which included Direct Implementation, Parallel Running, Phased Implementation, Pilot System and so on. Direct Implementation was used in implementation of this project because it was less costly in time and effort than other methods.

Besides that, software testing would also be being discussed in this chapter. Software testing is the method of running a program or device with the goal of discovering mistakes. The project testing stages can be included in three stages which were component or unit testing, system testing and acceptance testing.

5.1 Pre-Authoring Process

Pre-authoring process is the process of content creation before authoring. During this process, the multimedia elements such as text, image, animation and audio were designed and edited.

5.1.1 Image

Adobe Photoshop CC 2019 was used to edit and enhance the image.

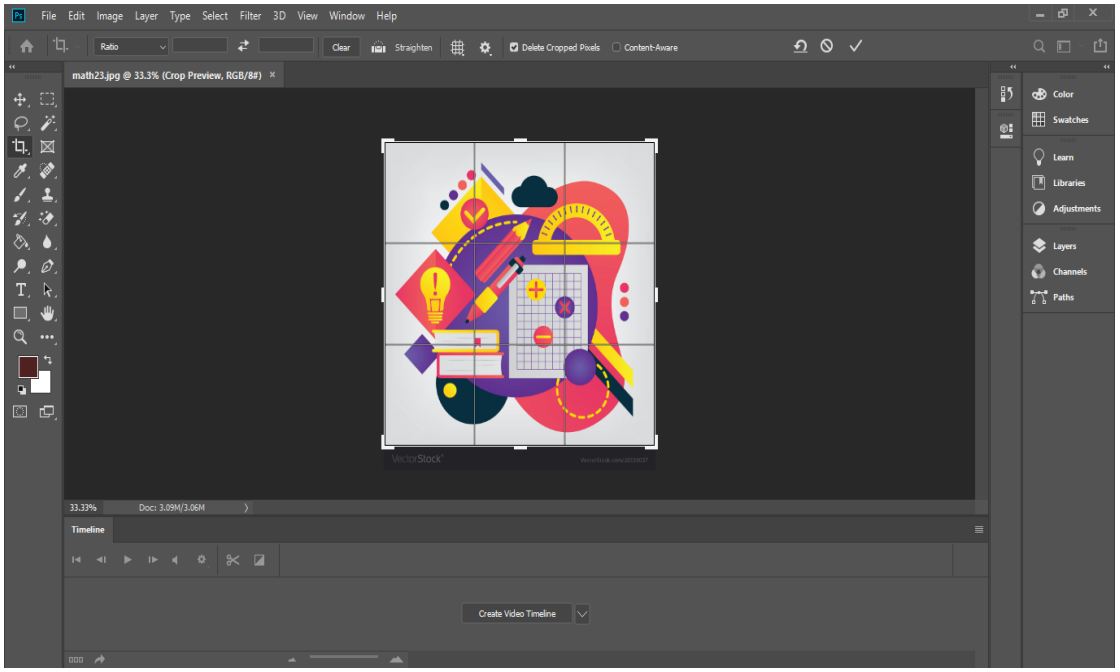


Figure 5-1 Resize or Crop the Image.

After opened the image file, the first step was to resize or crop the image if needed.

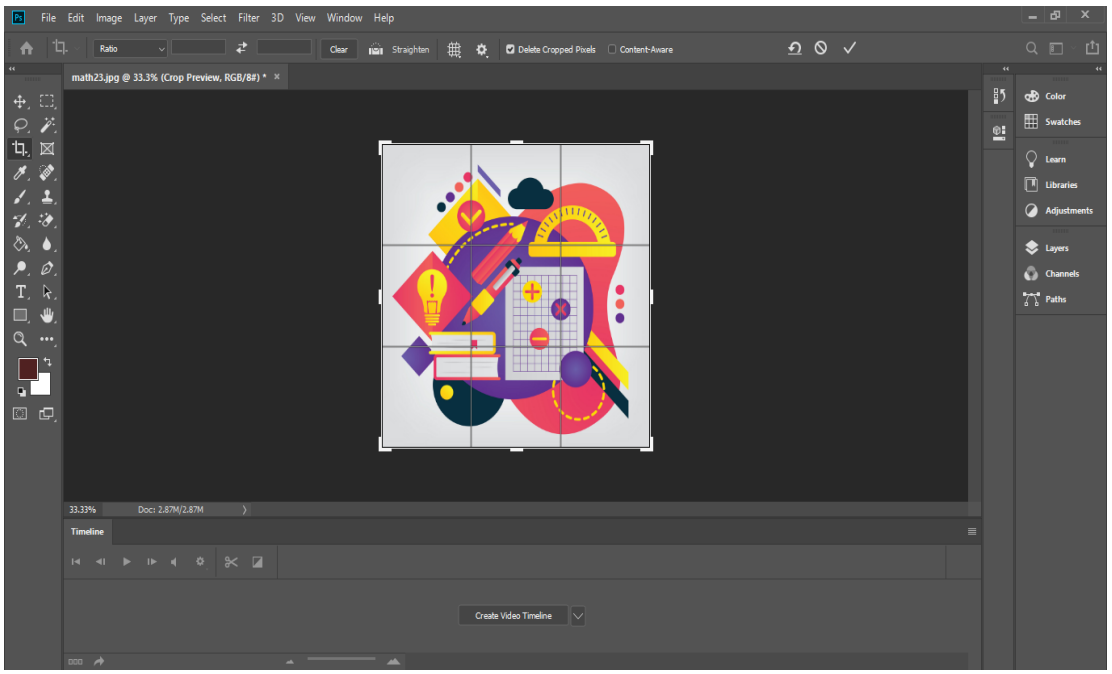


Figure 5-2 Image After Cropped.

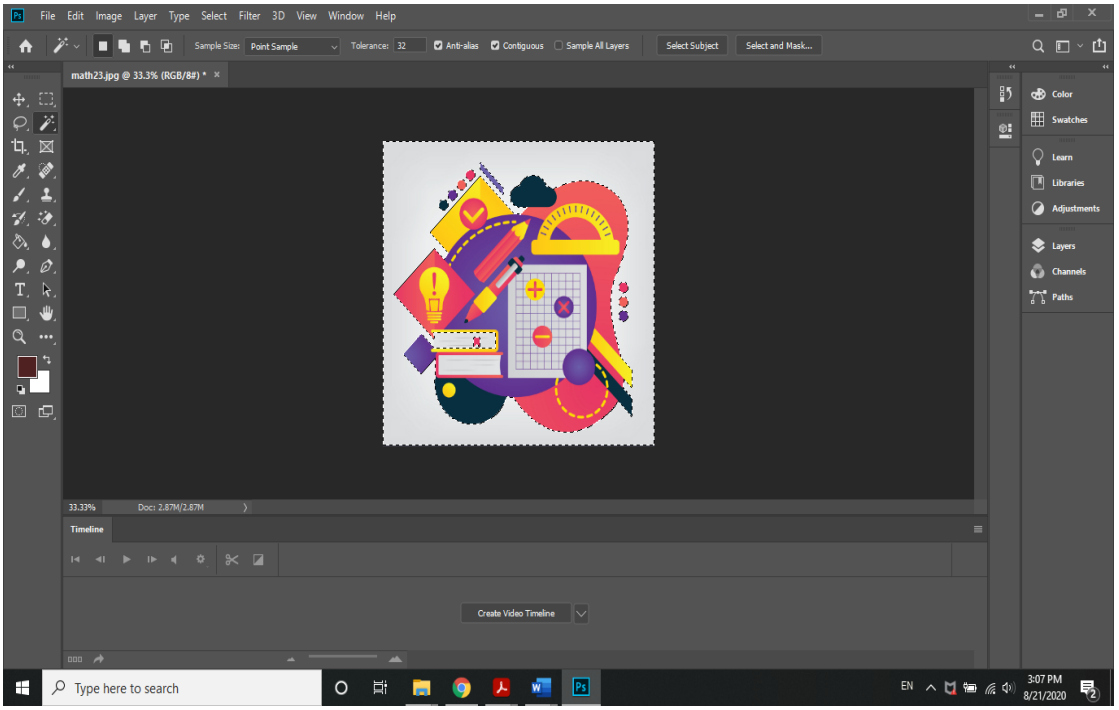


Figure 5-3 Select the Unwanted Places.

After cropping the image, selected the unwanted places with the selection tools in order to remove the background of the image.

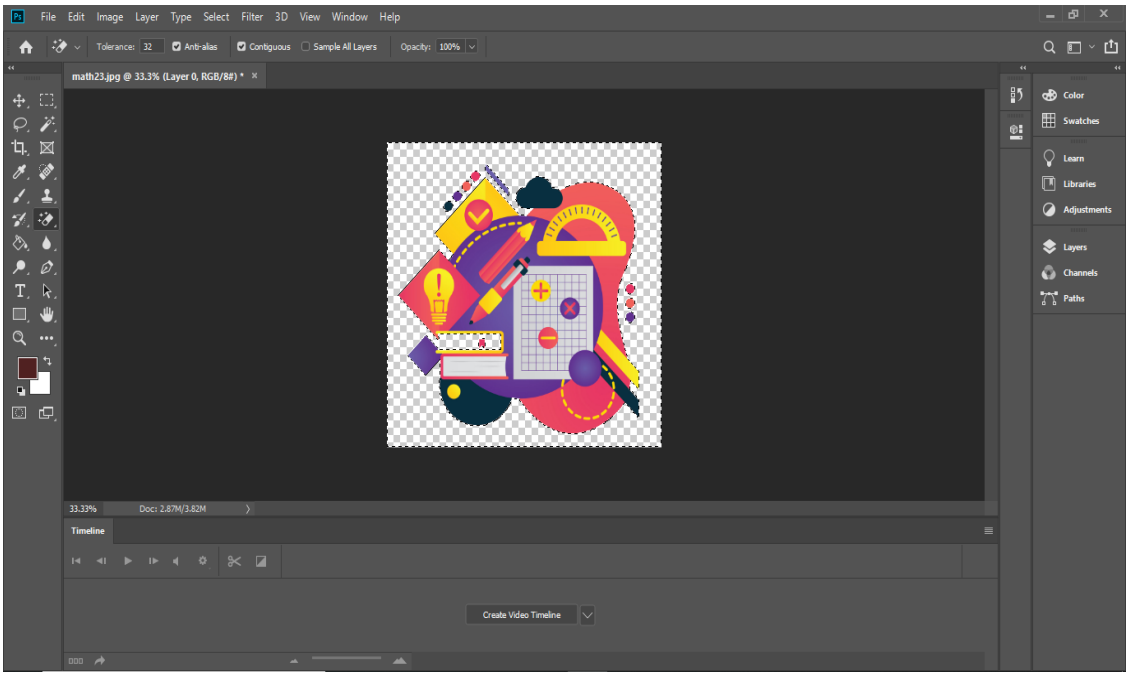


Figure 5-4 Remove Image Background.

The background of the image can be removed easily by only one click on the selected places with the eraser tool. After removed the image background, the image can be exported quickly as a PNG image file in the option panel.

5.1.2 Text

FlammingText.com is the free online text generator tool that used to generate text into graphic as to present in a more attractive way. These texts were used as the title of the scene in the system.

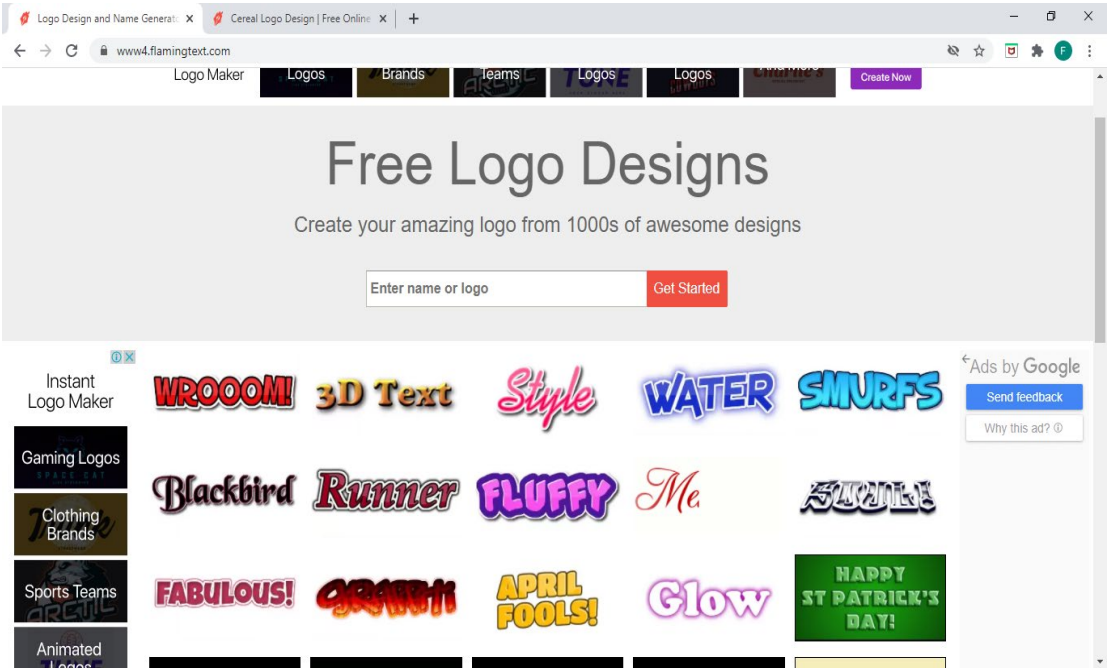


Figure 5-5 Choose a Design.

The first step was to choose a design of the text.

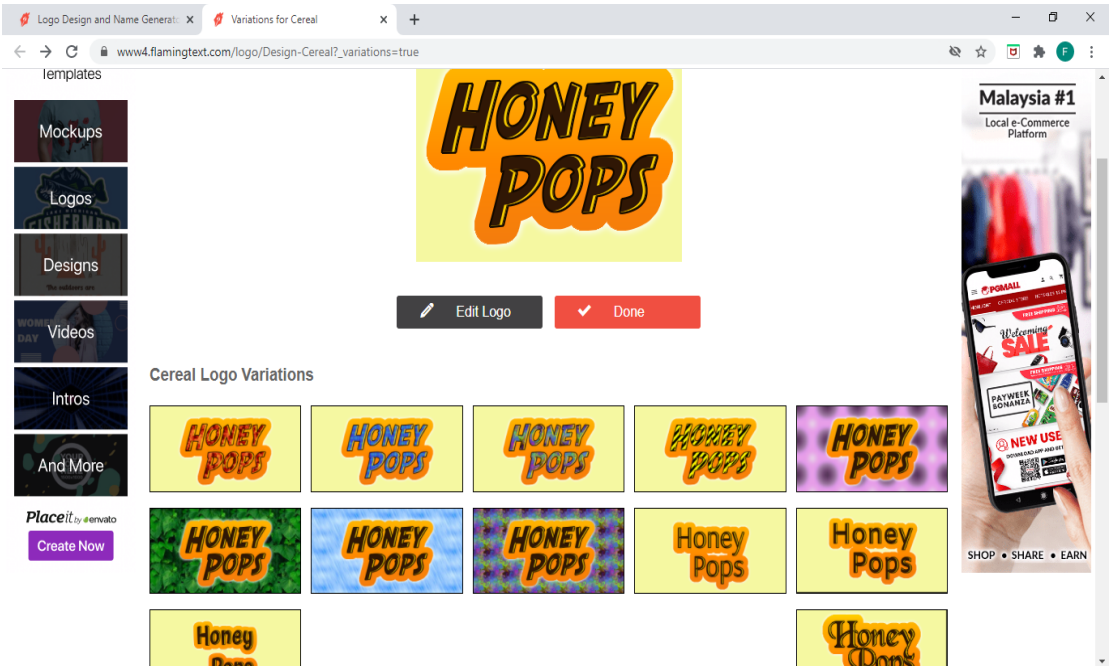


Figure 5-6 Select a Variation.

The second step was to choose the style from the variations that provided by the tool. After selected the variation, clicked on the "Edit Logo" to proceed to the next step.

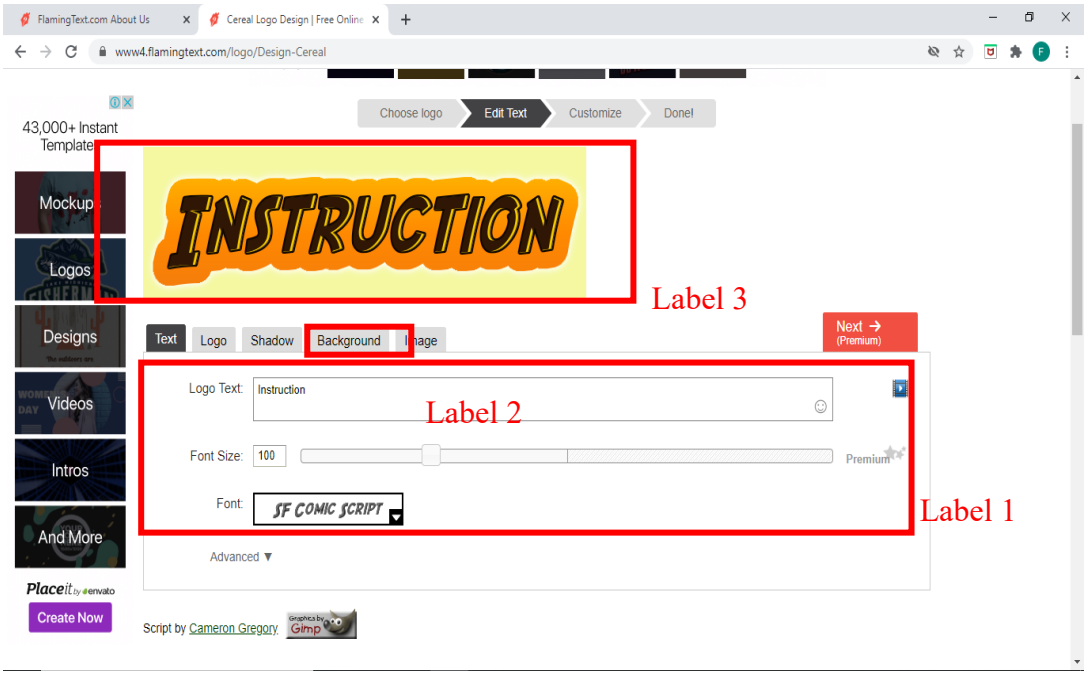


Figure 5-7 Edit the Text.

The third step was to edit the text. Enter the text in the "Logo Text" to change the content of text and adjust the font size and font at the control panel which labeled as "Label 1" if needed. To change the background color, click on the "Background" bar

which labeled as “Label 2” to make changes. The changes made will be shown at the preview pane which labeled as “Label 3”.

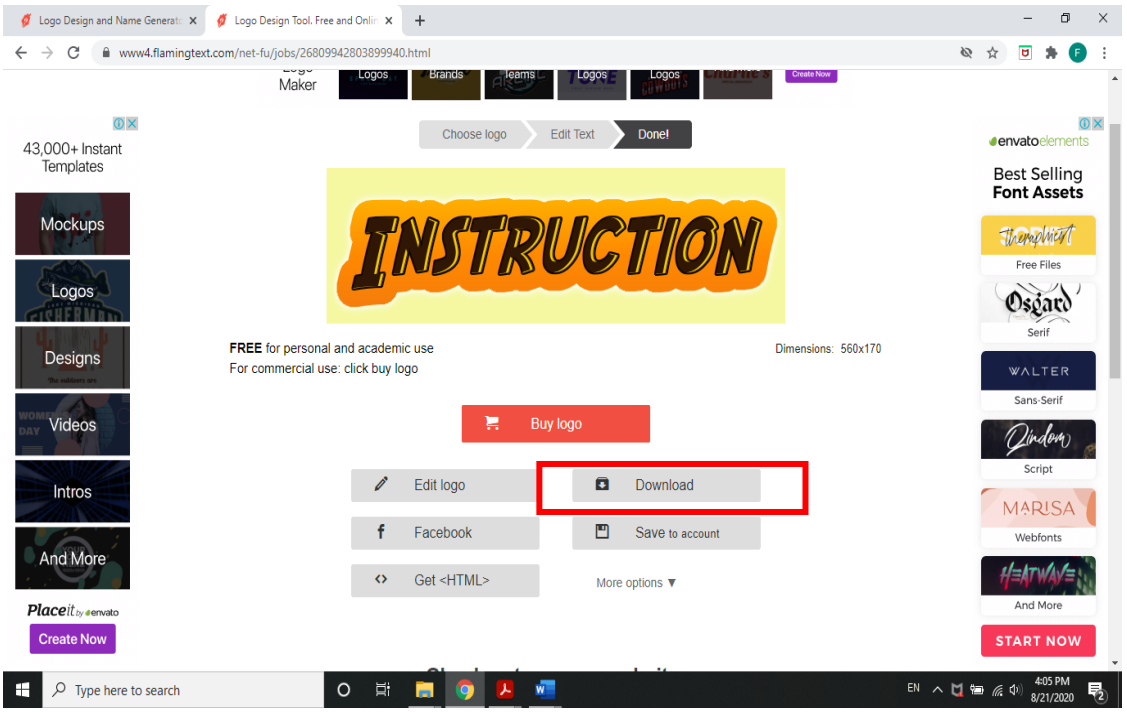


Figure 5-8 Download the Image.

Clicked on the Download button to download the image once the text generating process was done.

5.1.3 Animation

Adobe Animate CC 2019 was used to create animation that will be used in the courseware to make the courseware more attracting and interesting.

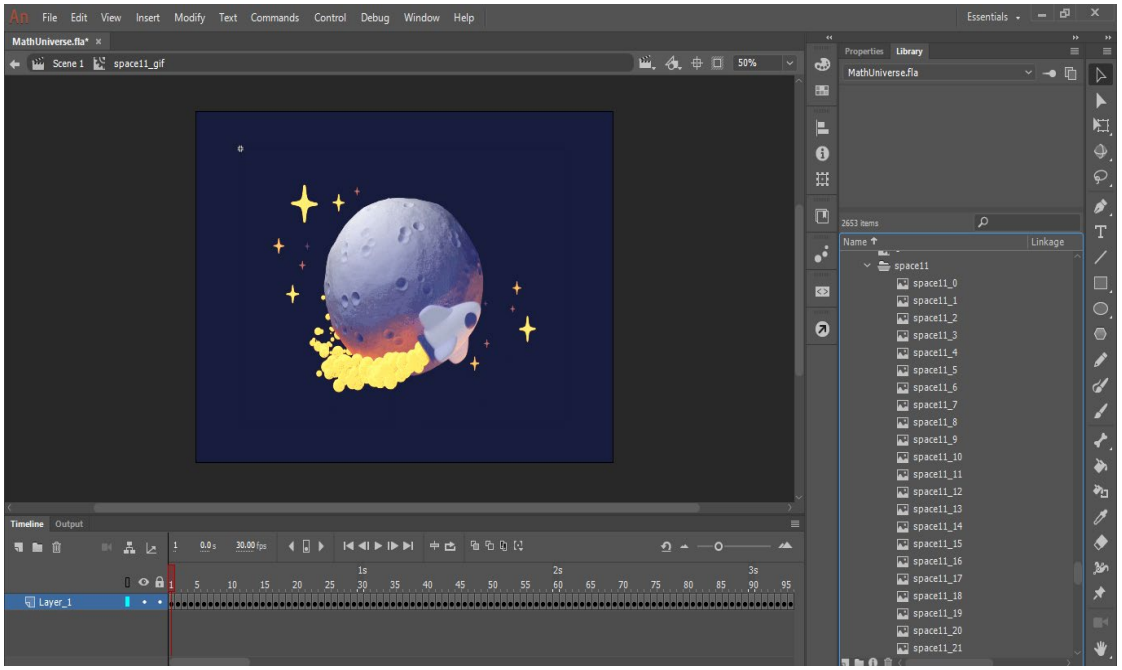


Figure 5-9 Create Animation.

Firstly, imported a series of static images to the library. Next, arranged all the images in order and inserted them frame by frame in the timeline as to ensure that it was moved smoothly. Once all the images were inserted completely, it became an animation.

5.1.4 Audio

5.1.4.1 Convert Text to Speech

Soundoftext.com was used to convert text to speech.

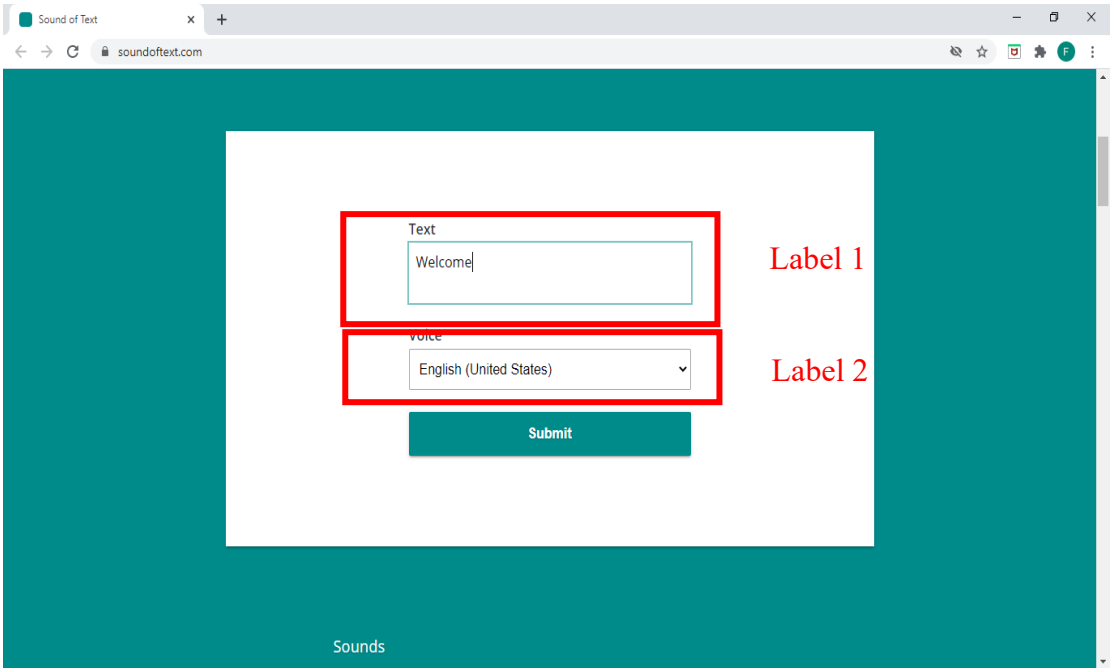


Figure 5-10 Convert Text to Speech.

In order to convert text to speech, enter the text in the text box which labeled as "Label 1". Then, change the language at the voice setting which labeled as "Label 2".

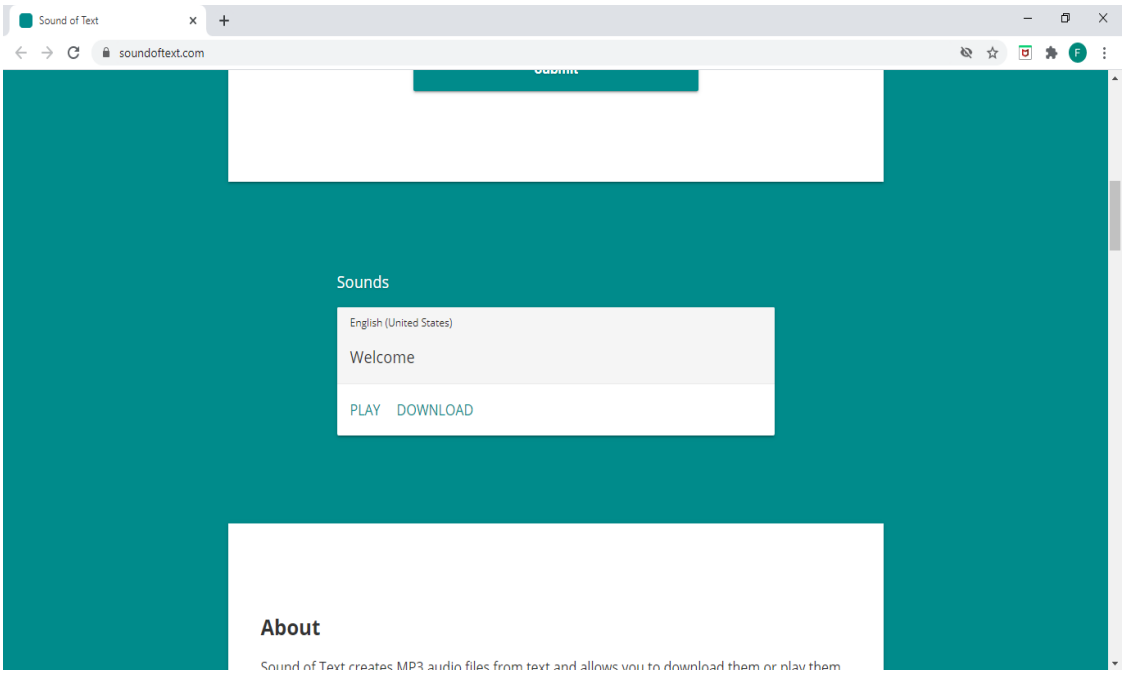


Figure 5-11 Conversion of Text to Speech Successfully.

After clicked on the submit button, the text was converted into speech and can be played and downloaded.

5.1.4.1 Audio Trimming

AudioTrimmer.com was used to cut and trim the unwanted part of audio.

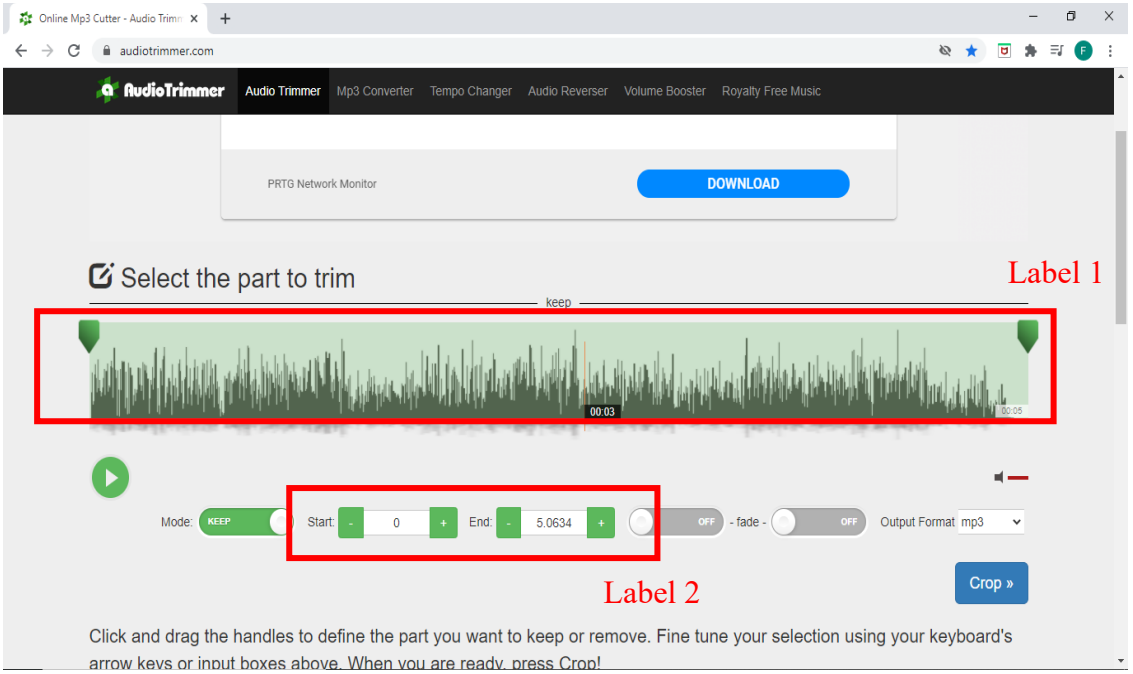


Figure 5-12 Trim Audio.

The first step to trim the audio is uploaded the audio from local disk. Next, the required part was selected by dragging the handles which labeled as “Label 1” or enter the starting time and ending time in the control panel which labeled as “Label 2”. Clicked on the crop button to remove the unwanted sections of the audio and saved the audio in MP3 format.

5.2 Authoring Process

Multimedia authoring process is to combine different forms of media content such as text, audio, image, animation and video as a single stream of information, using different software tools available on the market. Multimedia authoring tools provide an interactive framework for combining the various elements of a multimedia output together. It includes the basis for arranging and editing a multimedia project’s components. By integrating text, audio, video, graphics and animation, the developer can create interactive presentation.

5.2.1 Splash Screen

Figure 5-13 Splash Screen.

Label	Description
1	An animation which shows a space chase between a rocket and UFO.
2	An animation word that shows a swinging “WELCOME” message.

Table 5-1 Implementation of Splash Screen.

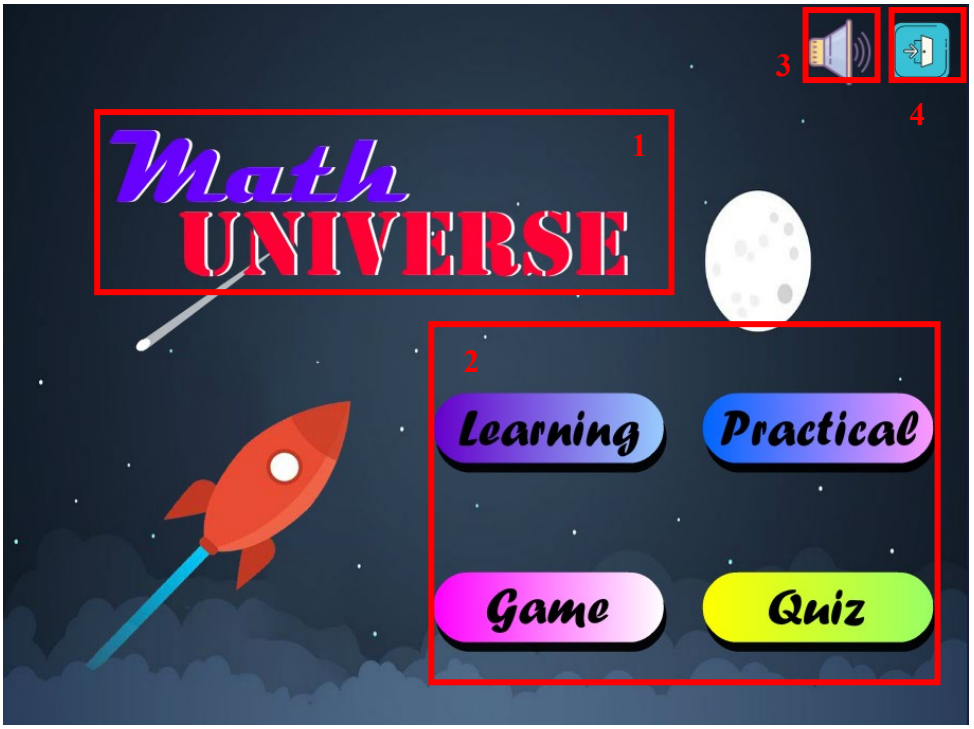


Figure 5-14 Main Menu.

Label	Description
1	The name of the interactive multimedia-based courseware.

2	Menu of the courseware. Users can choose what module they want to go.
	ActionScript 3.0 used:
	learning_btn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_186);
	
	function fl_ClickToGoToScene_186(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 3");
	}
	• When the users click on the Learning button, they are allowed to go to the Learning Module.
	• The code was used for the other three buttons by changing the instance name of the button.

3	Sound control button that the users can choose to mute or unmute the background music of the courseware.

	ActionScript 3.0 used:
	sound_btn.mute_btn.visible=false;
	
	function setVolume(vol){
	var volTransform:SoundTransform = new SoundTransform;
	volTransform.volume = vol;
	SoundMixer.soundTransform = volTransform;
	}
	var Mute:Boolean = false;
	sound_btn.addEventListener(MouseEvent.CLICK,toggleMuteBtn);
	
	function toggleMuteBtn(event:MouseEvent){if(Mute==true){Mute = false;setVolume(1);
	sound_btn.mute_btn.visible=false;}
	
	else{Mute = true;setVolume(0);
	sound_btn.mute_btn.visible=true;}
	}

4.	Exit button that the users can click to quit the system.

Table 5-2 Implementation of Main Menu.

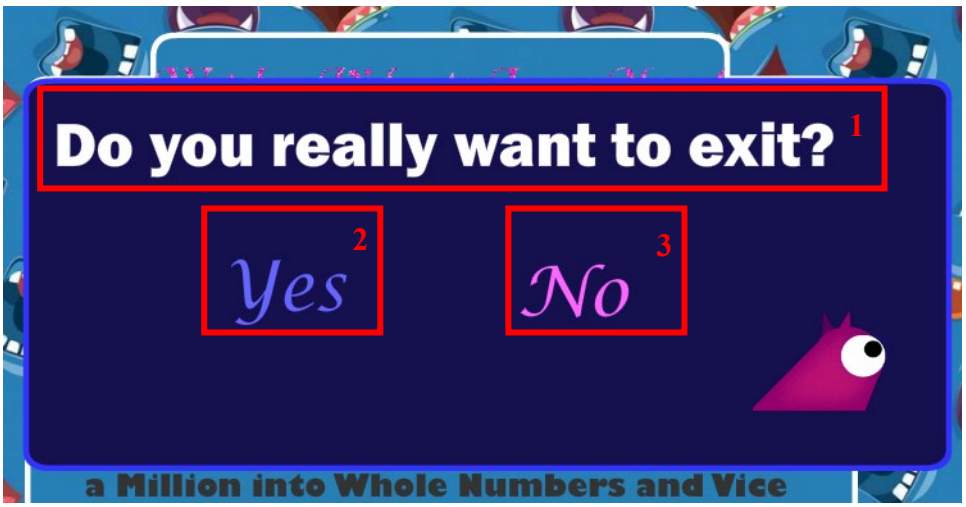


Figure 5-15 Exit Interface.

Label	Description

1	Text element that asking the users whether they want to exit the system or not. This is to prevent the system exit immediately as the users click on the exit button accidentally.

2	Yes button that will close the system.
	ActionScript 3.0 used:
	function quit(event:MouseEvent):void{
	fscommand("quit");
	}
	yes_btn.addEventListener(MouseEvent.MOUSE_DOWN,quit);

3	No button that will close the exit window and return to the last page that the users stop.
	ActionScript 3.0 used:
	no_btn.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToAndPlayFromFrame);
	function
	fl_ClickToGoToAndPlayFromFrame(event:MouseEvent):void
	{
	gotoAndPlay(1);
	}

Table 5-3 Implementation of Exit Interface.

Figure 5-16 Menu of Learning Module (1).

Label	Description
1	The name of the module.

2	Menu of the Learning Module which the users can choose to the topic that they want to go.
	ActionScript 3.0 used:
	c1_1.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_173);
	
	function fl_ClickToGoToScene_173(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 7");
	}
	• When users click on the topic 1 button, they are allowed to go to sub-topic interface of Topic 1: Whole Numbers and Operations.
	• The code was used for the other five buttons by changing the instance name of the button.

3	A button that will link to the menu of Topic 7 to Topic 12.

	ActionScript 3.0 used:
	t7_12.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToAndPlayFromFrame_93);
	
	function
	fl_ClickToGoToAndPlayFromFrame_93(event:MouseEvent):void
	{
	gotoAndPlay(2);
	}

4	Home button that will return to the Main Menu.
	ActionScript 3.0 used:
	home_btn.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene);
	
	function fl_ClickToGoToScene(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 2");
	}

5	Exit button that the users can click to quit the system.

Table 5-4 Implementation of Menu of Learning Module (1).

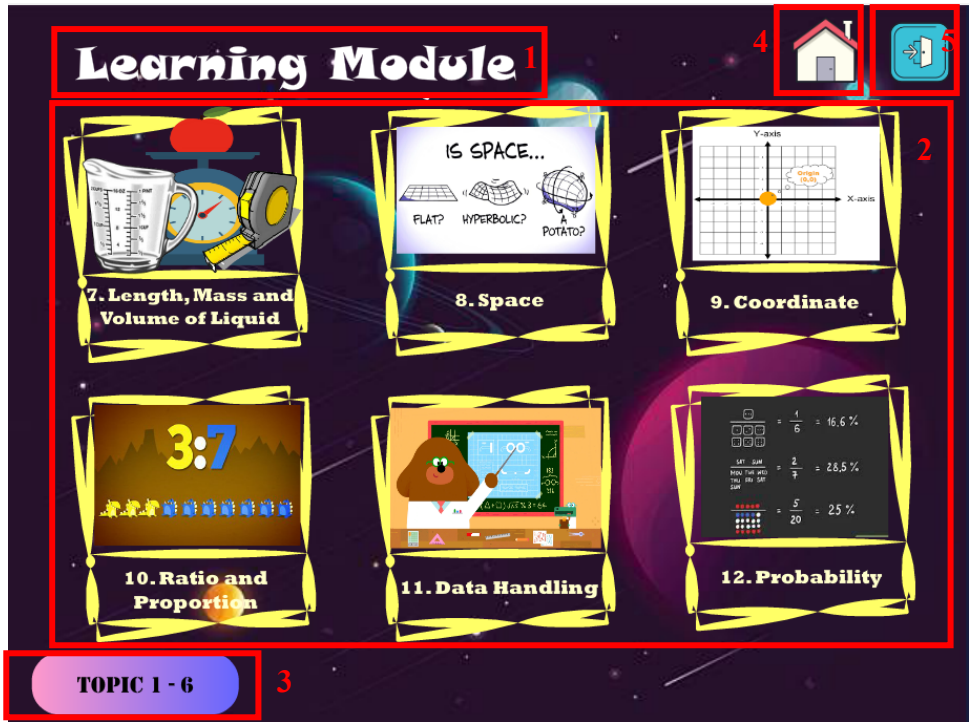


Figure 5-17 Menu of Learning Module (2).

Label	Description
1	The name of the module.

2	Menu of the Learning Module which the users can choose to the topic that they want to go.
	ActionScript 3.0 used:
	c7_1.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_179);
	
	function fl_ClickToGoToScene_179(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(7, "Scene 7");
	}
	• When users click on the topic 7 button, they are allowed to go to sub-topic interface of Topic 7: Length, Mass and Volume of Liquid.
	• The code was used for the other five buttons by changing the instance name of the button.

3	A button that will link to the menu of Topic 1 to Topic 6.

	ActionScript 3.0 used:
	t1_6.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToAndPlayFromFrame_94);
	
	function
	fl_ClickToGoToAndPlayFromFrame_94(event:MouseEvent):void
	{
	gotoAndPlay(1);
	}

4	Home button that will return to the Main Menu.
	ActionScript 3.0 used:
	home_btn.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene);
	
	function fl_ClickToGoToScene(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 2");
	}

5	Exit button that the users can click to quit the system.

Table 5-5 Implementation of Menu of Learning Module (2).

Figure 5-18 Menu of Practical Module (1).

Label	Description
1	The name of the module.

2	Menu of the Practical Module which the users can choose to the topic that they want to go.
	ActionScript 3.0 used:
	c1_2.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_110);
	
	function fl_ClickToGoToScene_110(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(4, "Scene 12");
	}
	• When users click on the topic 1 button, they are allowed to go to the instruction interface of Practical 1: Whole Numbers and Operations.
	• The code was used for the other five buttons by changing the instance name of the button.

3	A button that will link to the menu of Topic 7 to Topic 12.

	ActionScript 3.0 used:
	t7_12.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToAndPlayFromFrame_95);
	
	function
	fl_ClickToGoToAndPlayFromFrame_95(event:MouseEvent):void
	{
	gotoAndPlay(2);
	}

4	Home button that will return to the Main Menu.
	ActionScript 3.0 used:
	home_btn.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene);
	
	function fl_ClickToGoToScene(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 2");
	}

5	Exit button that the users can click to quit the system.

Table 5-6 Implementation of Menu of Practical Module (1).

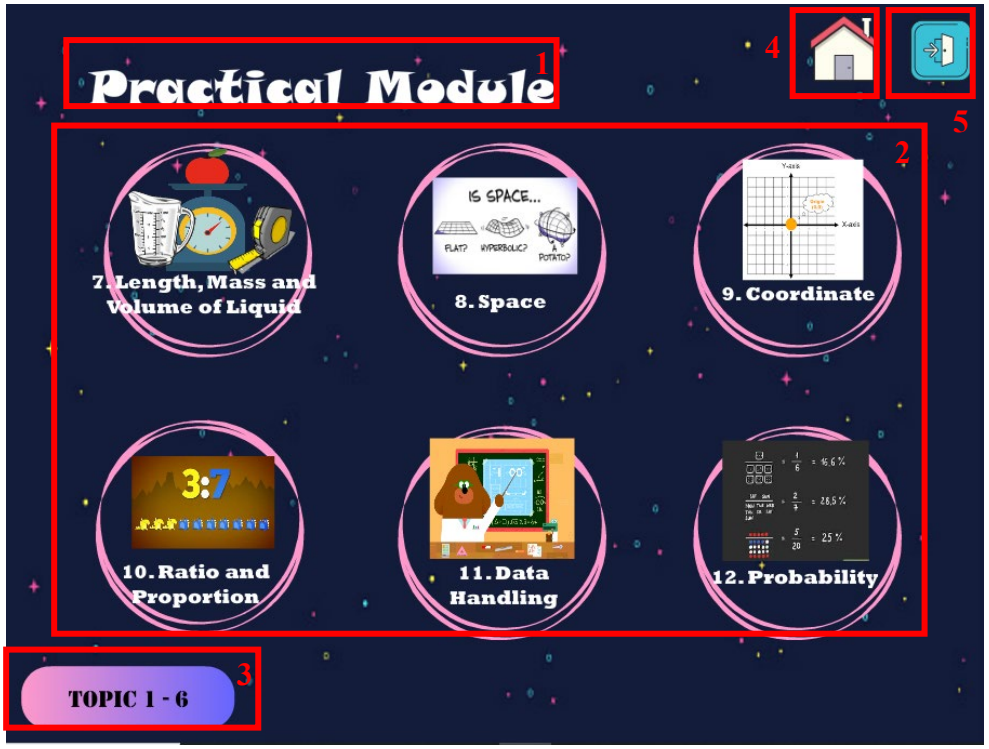


Figure 5-19 Menu of Practical Module (2).

Label	Description
1	The name of the module.

2	Menu of the Practical Module which the users can choose to the topic that they want to go.
	ActionScript 3.0 used:
	c7_2.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_116);
	
	function fl_ClickToGoToScene_116(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(10, "Scene 12");
	}
	• When users click on the topic 1 button, they are allowed to go to instruction interface of Practical 7: Length, Mass and Volume of Liquid.
	• The code was used for the other five buttons by changing the instance name of the button.

3	A button that will link to the menu of Topic 1 to Topic 6.

	ActionScript 3.0 used:
	t1_6.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToAndPlayFromFrame_96);
	
	function
	fl_ClickToGoToAndPlayFromFrame_96(event:MouseEvent):void
	{
	gotoAndPlay(1);
	}

4	Home button that will return to the Main Menu.
	ActionScript 3.0 used:
	home_btn.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene);
	
	function fl_ClickToGoToScene(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 2");
	}

5	Exit button that the users can click to quit the system.

Table 5-7 Implementation of Menu of Practical Module (2).

Figure 5-20 Menu of Game Module.

Label	Description
1	Button that will link to the menu of Memory Game. ActionScript 3.0 used:
2	Button that will link to menu of Matching Game. ActionScript 3.0 used:

3	Home button that will return to the Main Menu.
	ActionScript 3.0 used:
	home_btn.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene_152);
	
	function fl_ClickToGoToScene_152(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 2");
	}

4	Exit button that the users can click to quit the system.
5	Animation of a floating astronaut.

6	Animation of a UFO.

Table 5-8 Implementation of Menu of Game Module.

Figure 5-21 Menu of Quiz Module.

Label	Description
1	The name of the module.

2	Menu of the Quiz Module which the users can choose to the level of difficulty of quiz that they want to go.
	ActionScript 3.0 used:
	easy_mode.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_278);
	
	function fl_ClickToGoToScene_278(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 12");
	}
	• When users click on the Easy button, the system will bring the users to the instruction interface before the quiz start.

	• The code was used for the other two buttons by changing the instance name of the button.

3	Home button that will return to the Main Menu.
	ActionScript 3.0 used:
	home_btn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_10);
	
	function fl_ClickToGoToScene_10(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 2");
	}

4	Exit button that the users can click to quit the system.
5	Animation of a monster drawing on a piece of paper.

Table 5-9 Implementation of Menu of Quiz Module.

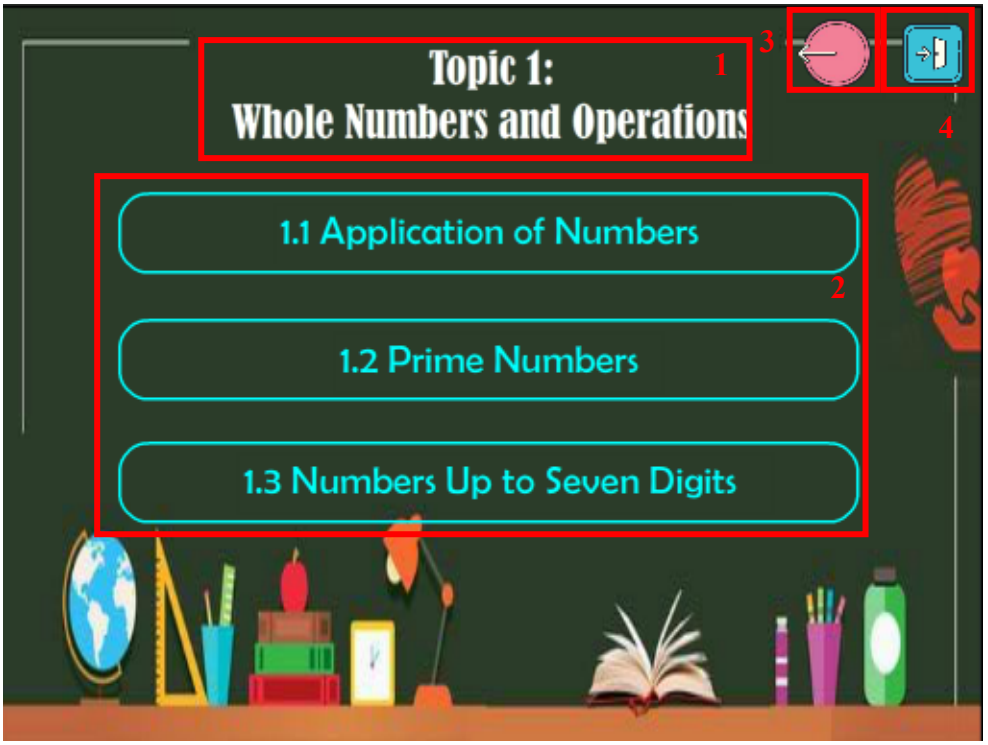


Figure 5-22 Sub-Topic Menu of Topic 1: Whole Numbers and Operations.

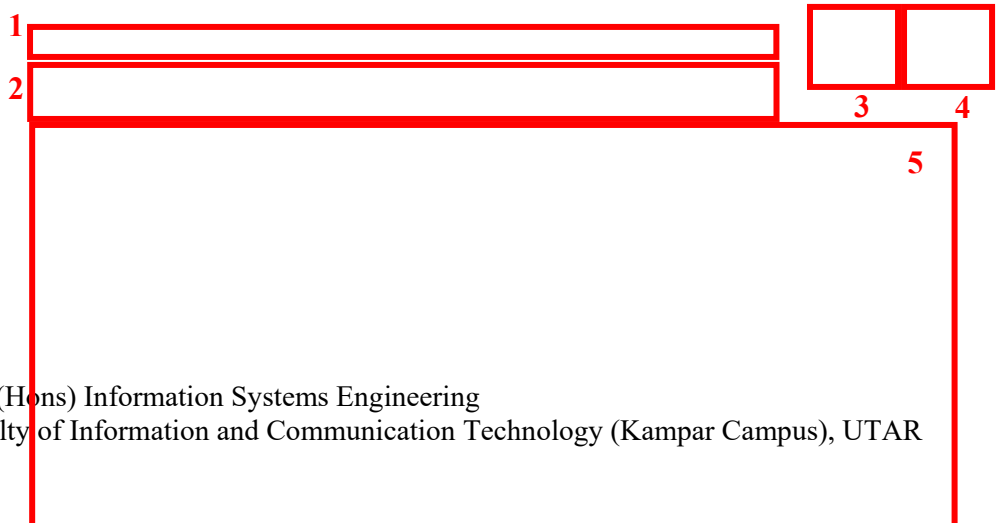
Label	Description
1	The name of the module.

2	Menu of the sub-topic of Topic 1: Whole Numbers and Operations which the users can choose the sub-topic that they want to go.
	ActionScript 3.0 used:
	c1_st1_1.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_84);
	
	function fl_ClickToGoToScene_84(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 11");
	}
	• When users click on the sub-topic 1 button, the system will bring the users to the Topic 1.1 Applications of Numbers.
	• The code was used for the other two buttons by changing the instance name of the button.
	• The design of the remaining eleven topics were the same.

3	Back button that will return to the Menu of Learning Module.
	ActionScript 3.0 used:
	back_btn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_12);
	
	function fl_ClickToGoToScene_12(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 3");
	}

4	Exit button that the users can click to quit the system.

Table 5-10 Implementation of Sub-topic Menu of Topic 1: Whole Numbers and Operations.



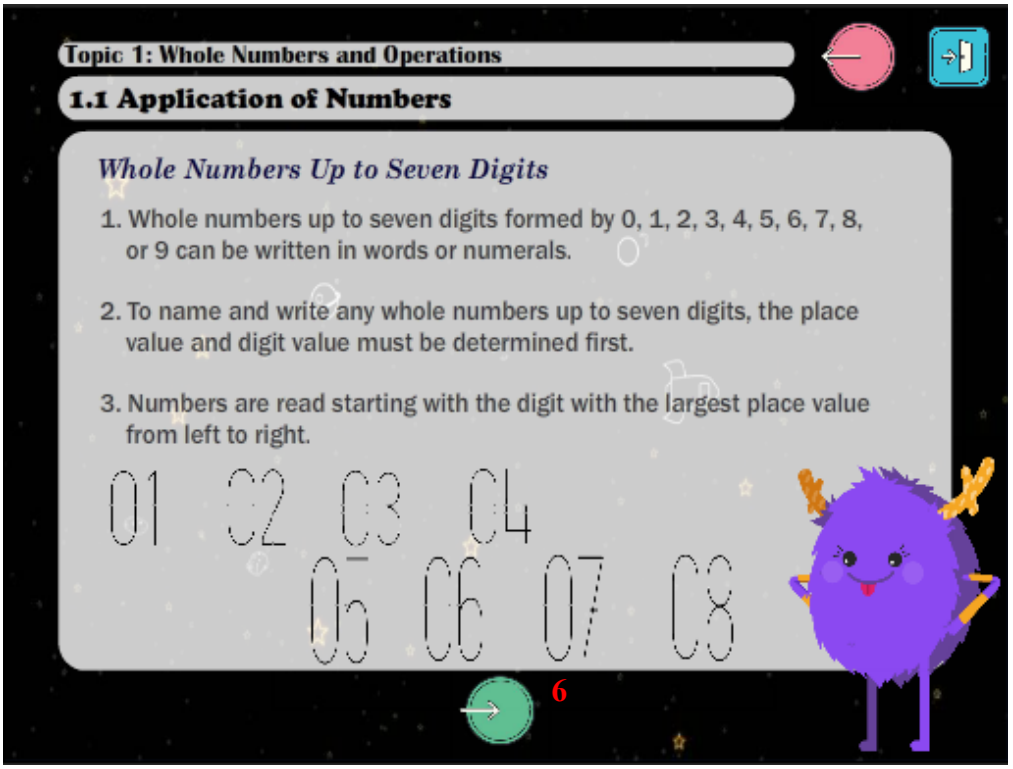


Figure 5-23 Content of Learning Module (Topic 1) (1).

Label	Description
1	The title of the topic.
2	The title of the sub-topic.

3	Back button that will return to the Sub-topic Menu of Learning Module.
	ActionScript 3.0 used:
	back1.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_124);
	
	function fl_ClickToGoToScene_124(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 7");
	}

4	Exit button that the users can click to quit the system.
5	Content of the topic.
6	Next button to proceed to the next page to continue learning. ActionScript 3.0 used:

	next1.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToAndPlayFromFrame_97);
	
	function
	fl_ClickToGoToAndPlayFromFrame_97(event:MouseEvent):void
	{
	gotoAndPlay(2);
	}

Table 5-11 Implementation of Content of Learning Module (Topic 1) (1).

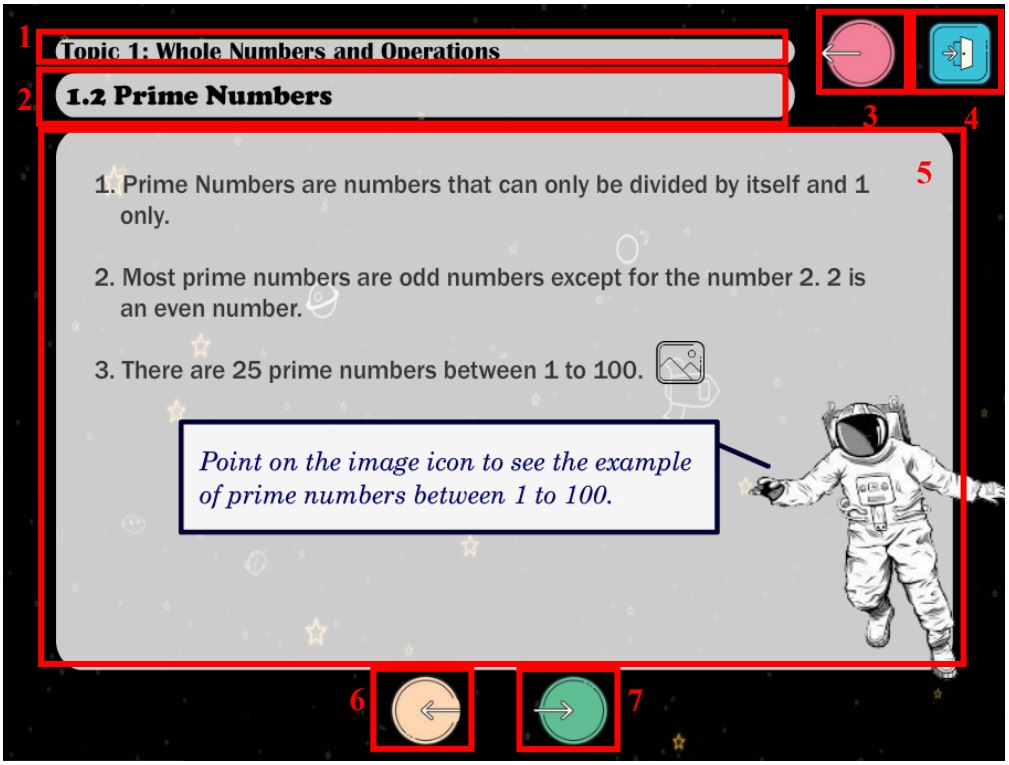


Figure 5-24 Content of Learning Module (Topic 1) (2).

Label	Description
1	The title of the topic.
2	The title of the sub-topic.
3	Back button that will return to the Sub-topic Menu of Learning Module. ActionScript 3.0 used: back1.addEventListener(MouseEvent.CLICK,

	fl_ClickToGoToScene_124);
	
	function fl_ClickToGoToScene_124(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 7");
	}

4	Exit button that the users can click to quit the system.
5	Content of the topic.

6	Previous button to bring the users back to the previous page..
	ActionScript 3.0 used:
	prev1.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToAndPlayFromFrame_98);
	
	function
	fl_ClickToGoToAndPlayFromFrame_98(event:MouseEvent):void
	{
	gotoAndPlay(1);
	}

7	Next button to proceed to the next page to continue learning.
	ActionScript 3.0 used:
	next2.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToAndPlayFromFrame_99);
	
	function
	fl_ClickToGoToAndPlayFromFrame_99(event:MouseEvent):void
	{
	gotoAndPlay(2);
	}

Table 5-12 Implementation of Content of Learning Module (Topic 1) (2).

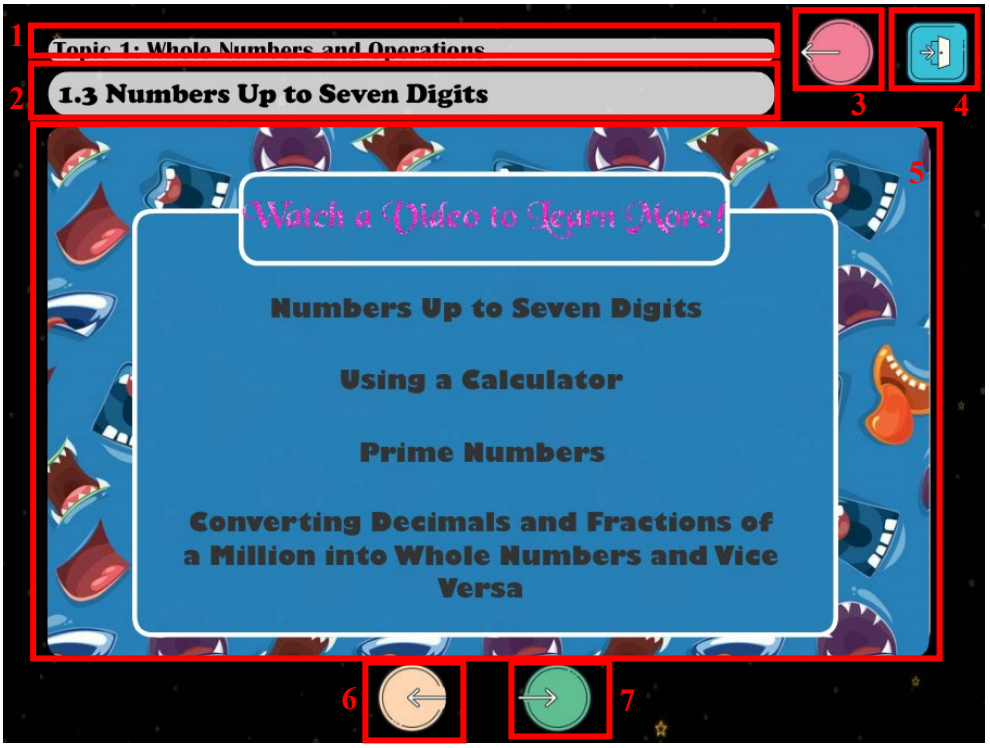


Figure 5-25 Video Menu of Learning Module (Topic 1).

Label	Description
1	The title of the topic.
2	The title of the sub-topic.

3	Back button that will return to the Sub-topic Menu of Learning Module.
	ActionScript 3.0 used:
	back1.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene_124);
	
	function fl_ClickToGoToScene_124(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 7");
	}

4	Exit button that the users can click to quit the system.
5	Video options that the users can choose to watch. ActionScript 3.0 used: video1.addEventListener(MouseEvent.CLICK, fl_ClickToGoToAndPlayFromFrame_253);

	function fl_ClickToGoToAndPlayFromFrame_253(event:MouseEvent):void
	{
	gotoAndPlay(2);
	}
	• Click on the button to go to the frame which the video located.
	video1.addEventListener(MouseEvent.CLICK, fl_ClickToPlayVideo_23);
	
	function fl_ClickToPlayVideo_23(event:MouseEvent):void
	{
	v1.play();
	}
	• Play the video.

6	Previous button to bring the users back to the previous page.
	ActionScript 3.0 used:
	prev1.addEventListener(MouseEvent.CLICK, fl_ClickToGoToAndPlayFromFrame_98);
	
	function fl_ClickToGoToAndPlayFromFrame_98(event:MouseEvent):void
	{
	gotoAndPlay(1);
	}

7	Next button to proceed to the next page to continue learning.
	ActionScript 3.0 used:
	next2.addEventListener(MouseEvent.CLICK, fl_ClickToGoToAndPlayFromFrame_99);
	
	function fl_ClickToGoToAndPlayFromFrame_99(event:MouseEvent):void
	{
	gotoAndPlay(2);

	}

Table 5-11 Implementation of Video Menu of Learning Module (Topic 1).

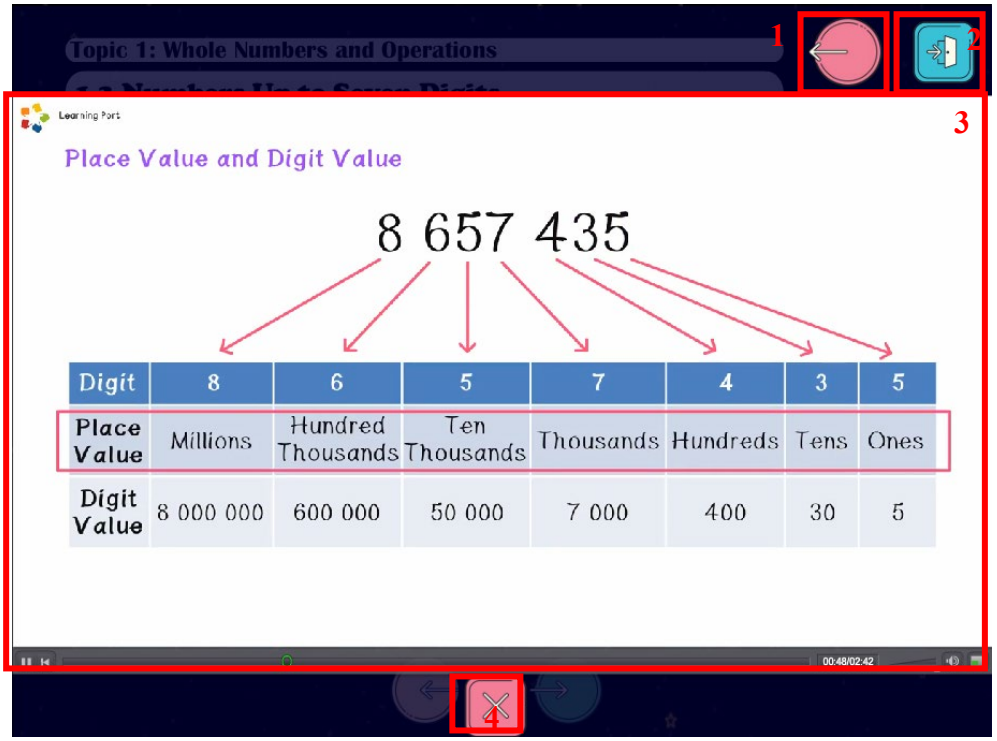


Figure 5-26 Playing Video of Learning Module (Topic 1).

Label	Description

1	Back button that will return to the Sub-topic Menu of Learning Module.
	ActionScript 3.0 used:
	back1.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_124);
	
	function fl_ClickToGoToScene_124(event:MouseEvent):void
	{

	MovieClip(this.root).gotoAndPlay(1, "Scene 7"); }
2	Exit button that the users can click to quit the system.
3	Playing the video with the video player that contains all the control features such as pause, play and volume control.
4	Close button to stop the video and bring users back to the Video Menu.

Table 5-14 Implementation of Playing Video of Learning Module (Topic 1).

Figure 5-27 Option Menu of Learning Module (Topic 12).

Label	Description

1	Back button that will return to the Sub-topic Menu of Learning Module.
	ActionScript 3.0 used:
	back21.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_148);
	
	function fl_ClickToGoToScene_148(event:MouseEvent):void
	{

	MovieClip(this.root).gotoAndPlay(12, "Scene 7"); }
2	Exit button that the users can click to quit the system.

3	Once the users completed all the twelve topics, a pop-up box with greetings will be shown and there are two options for users to choose for: (1) Back to home,
	(2) Go to Practical.
	ActionScript 3.0 used:
	home2.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_195);
	
	function fl_ClickToGoToScene_195(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 2");
	}
	• Back to Main Menu.
	t12_p.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_448);
	
	function fl_ClickToGoToScene_448(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 4");}
	• Go to Menu of Practical.

Table 5-15 Implementation of Option Menu of Learning Module (Topic 12).

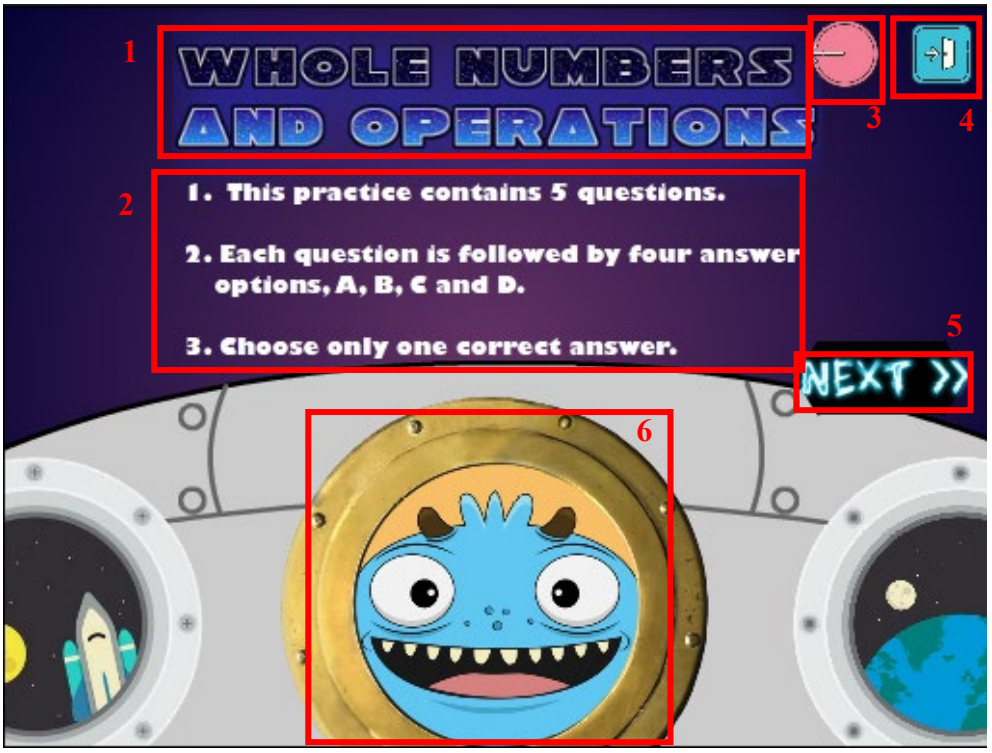


Figure 5-28 Instruction Interface of Practical 1.

Label	Description
1	The title of the topic.
2	The instruction of the practical.

3	Back button that will return to the Menu of Practical Module.
	ActionScript 3.0 used:
	back_btn2.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene_262);
	
	function fl_ClickToGoToScene_262(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 4");
	}

4	Exit button that the users can click to quit the system.
5	Next button to start the practical. ActionScript 3.0 used: next1.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_263);

	function fl_ClickToGoToScene_263(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 10");
	}

6	Animation of a monster staring out the spaceship.

Table 5-16 Implementation of Instruction Interface of Practical 1.

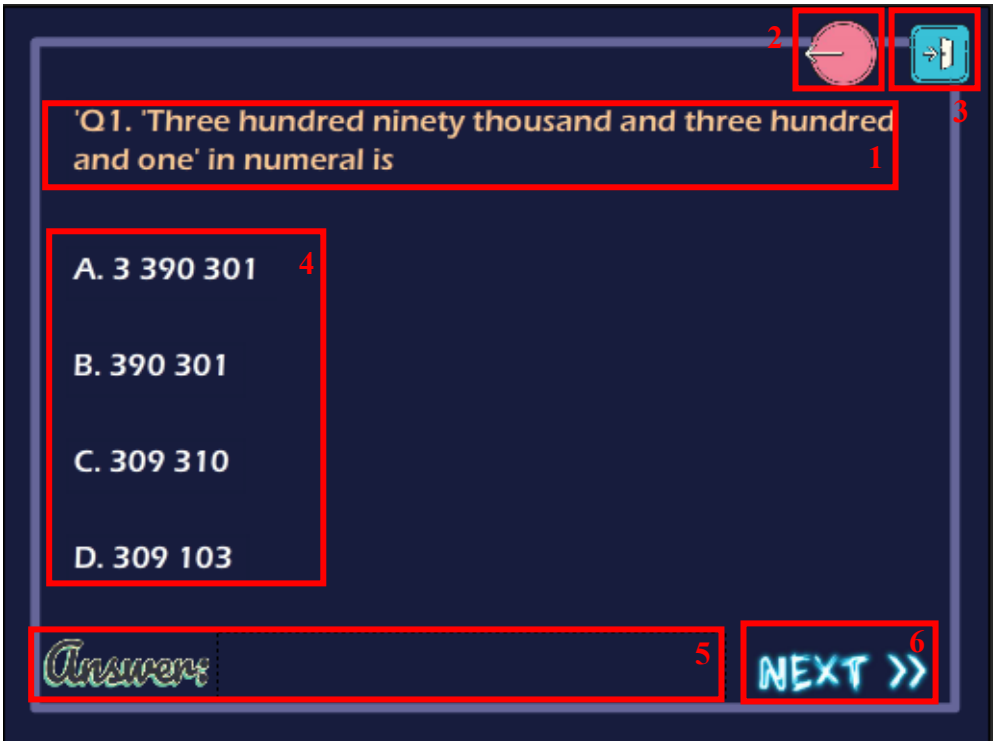


Figure 5-29 Question of Practical Module.

Label	Description
1	Text element that shows the question.
2	Back button that will return to the Instruction Interface of Practical 1. ActionScript 3.0 used: back_btn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_277); function fl_ClickToGoToScene_277(event:MouseEvent):void { MovieClip(this.root).gotoAndPlay(4, "Scene 12");

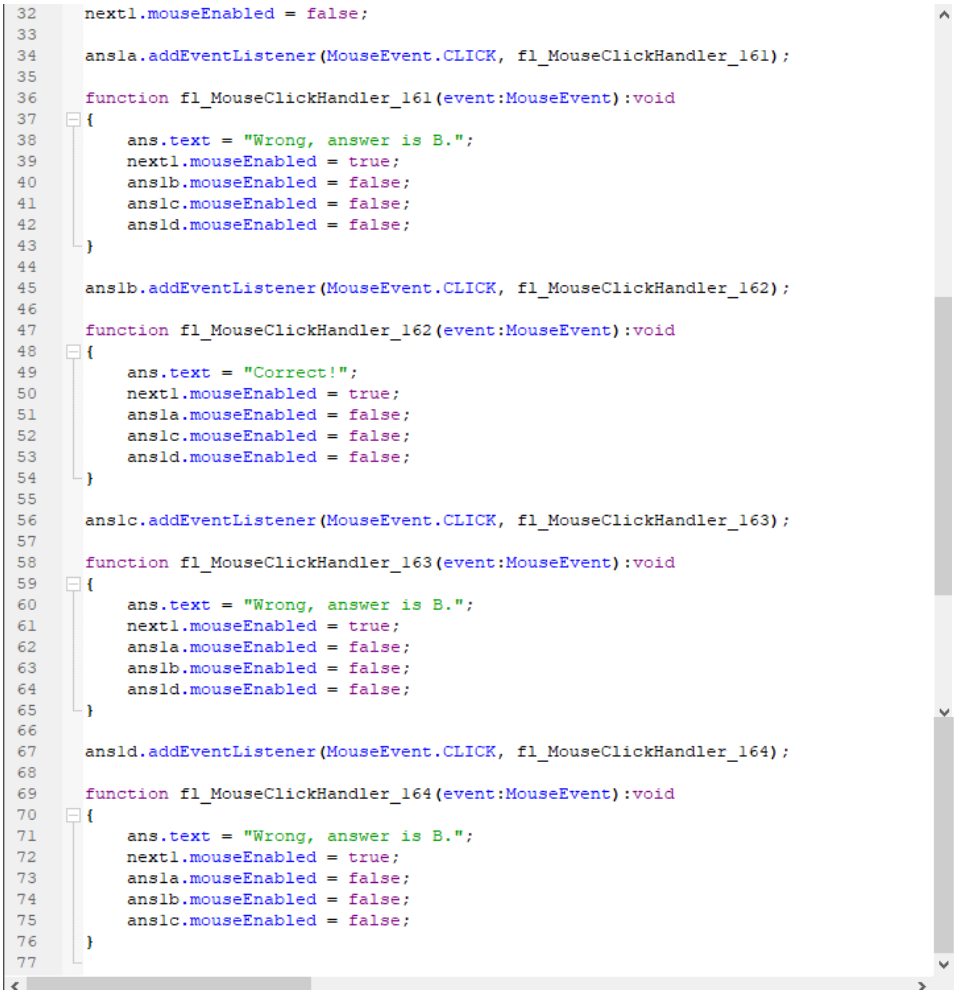
<table>
<tr><td></td><td>}</td></tr>
<tr><td>3</td><td>Exit button that the users can click to quit the system.</td></tr>
<tr><td>4</td><td>Option buttons of the question.
ActionScript 3.0 used:
 

Figure 2-29-1 AS3 for Option Button.
• Once the users selected an answer, they are not allowed to select another answer.
• When they selected a wrong answer, wrong answer message will be shown in the answer box.
• When the users selected a correct answer, right answer message will be shown in the answer box.</td></tr>
<tr><td>5</td><td>Answer box which will show the right or wrong answer message.
For example, when users select a right answer, “Correct!” message will be shown in the box. If the users select a wrong answer, “Wrong, answer is X.” message will be shown.</td></tr>
</table>

	'X' represents the correct option of the question.

6	Next button to go to the next question.
	ActionScript 3.0 used:
	next1.mouseEnabled = false;
	• Users are not allowed to click on the next button before answering the question.
	next1.addEventListener(MouseEvent.CLICK, fl_ClickToGoToAndPlayFromFrame_356);
	
	function fl_ClickToGoToAndPlayFromFrame_356(event:MouseEvent):void
	{
	gotoAndPlay(2);
	}
	• After the users answering the question, they are allowed to proceed to the next question.

Table 5-17 Implementation of Question of Practical 1.

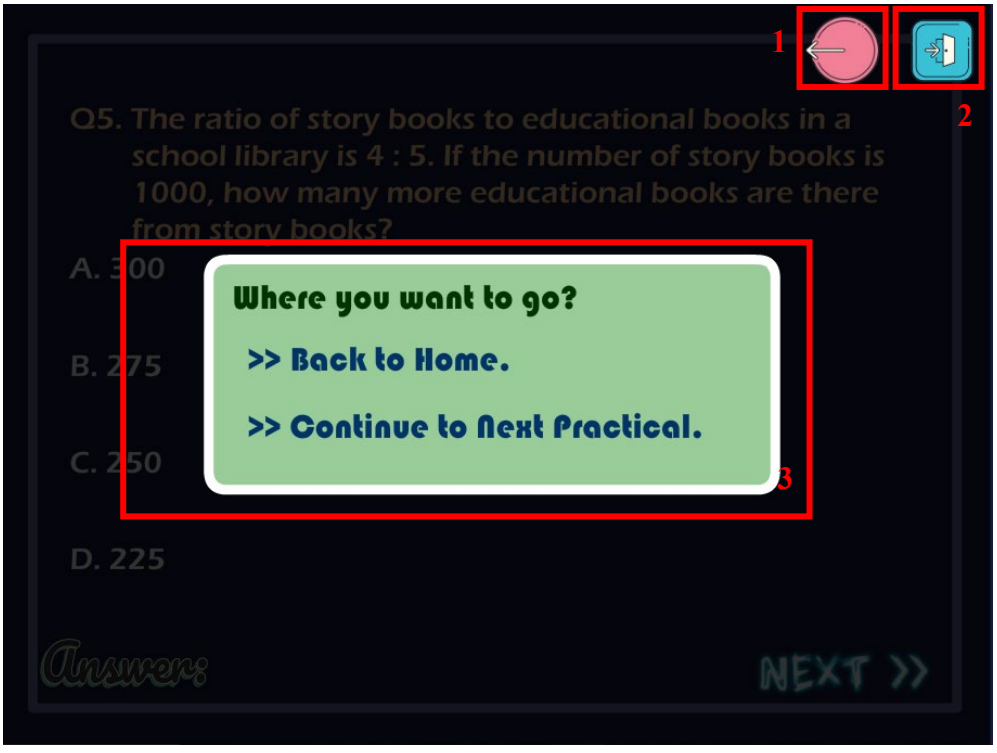


Figure 5-30 Option Menu of Practical 1.

Label	Description

1	Back button that will return to the Sub-topic Menu of Learning Module.
	ActionScript 3.0 used:
	back5.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene_290);
	
	function fl_ClickToGoToScene_290(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 4");
	}

2	Exit button that the users can click to quit the system.

3	Once the users completed one practical, a pop-up box will be shown and there are two options for users to choose for:
	(1) Back to home,
	(2) Continue to next practical.
	ActionScript 3.0 used:
	home1.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene_283);
	
	function fl_ClickToGoToScene_283(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 2");
	}
	• Back to Main Menu.
	t12_p.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene_448);
	
	function fl_ClickToGoToScene_448(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 4");
	}
	• Continue to next practical.

	• For Practical 12, there are only one option “Back to Home” provided for users to choose for because Practical 12 is the last practical in the module.

Table 5-18 Implementation of Option Menu of Practical 1.

Figure 5-31 Sub-menu of Memory Game.

Label	Description

1	Back button that will return to the Sub-topic Menu of Memory Game.
	ActionScript 3.0 used:
	back_btn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_399);
	
	function fl_ClickToGoToScene_399(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 2");
	}

2	Exit button that the users can click to quit the system.
3	There are four topics of memory game provided in the system. Users

	can choose their preferred topics to start the game.
	ActionScript 3.0 used:
	mg1_btn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_400);
	
	function fl_ClickToGoToScene_400(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 16");
	}
	• Users only need to click on the topic, and they will be directed to the game.

Table 5-19 Implementation of Sub-menu of Memory Game.

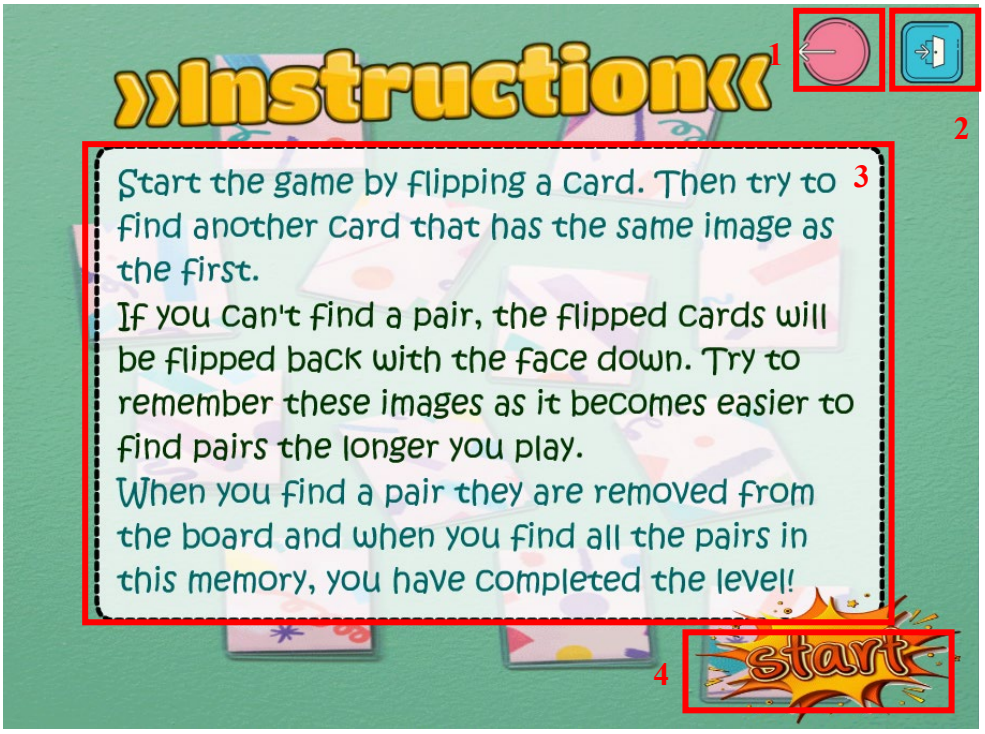


Figure 5-32 Instruction of Memory Game.

Label	Description

1	Back button that will return to the Sub-topic Menu of Memory Game.
	ActionScript 3.0 used:
	back1.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene_396);
	
	function fl_ClickToGoToScene_396(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 8");
	}

2	Exit button that the users can click to quit the system.
3	Users can read through the instruction before starting the game.

4	Start button that allows users to start the game.
	ActionScript 3.0 used:
	start1.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene_397);
	
	function fl_ClickToGoToScene_397(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 25");
	}

Table 5-20 Implementation of Instruction of Memory Game.

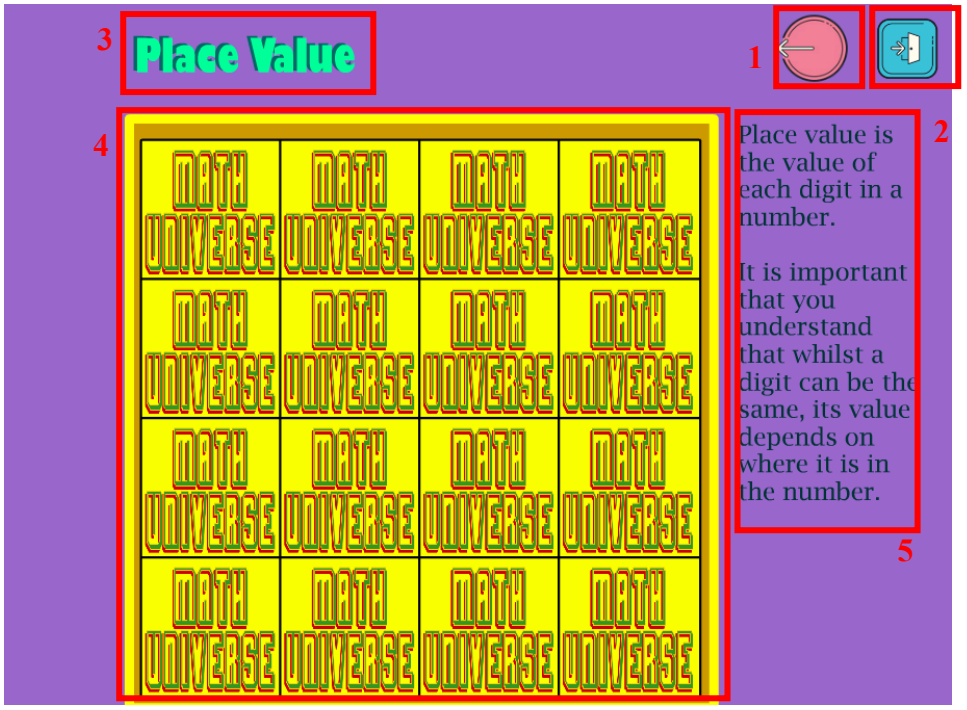


Figure 5-33 Memory Game (1).

Label	Description

1	Back button that will return to the Sub-topic Menu of Learning Module.
	ActionScript 3.0 used:
	back_btn.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene_430);
	
	function fl_ClickToGoToScene_430(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 8");
	removeChild(loader);
	}

2	Exit button that the users can click to quit the system.
3	Topic of the game.
4	Users can start the game by flipping the cards. When they match a pair of cards, both cards will disappear otherwise they need to find and match again the cards. ActionScript 3.0 used: import flash.display.Loader; import flash.net.URLRequest;

```
var loader:Loader = new Loader();
var url:URLRequest = new URLRequest();
addChild(loader);

loader.load(new URLRequest("MatchingGamePlaceValue.swf"));
stop();
```

- The memory game was created in another .FLA file and published as .SWF file so that it can be loaded into the project.
- ActionScript 3.0 used to develop the memory game:

```
Target: MatchingGame...
1  package  {
2
3      import flash.display.MovieClip;
4      import flash.events.Event;
5      import flash.events.MouseEvent;
6      import flash.events.TimerEvent;
7      import flash.utils.Timer;
8
9      public class MatchingGame extends MovieClip {
10         var fClip:Logo
11         var sClip:Logo
12         var myTimer:Timer
13         var frames:Array = new Array(1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8);
14
15         public function MatchingGame() {
16             // constructor code
17             for (var i:Number = 1; i <= 4; i++){
18                 for (var j:Number = 1; j <= 4; j++){
19                     var myLogo:Logo = new Logo();
20                     var index = Math.floor(Math.random() * frames.length);
21
22                     myLogo.frameNo = frames[index];
23                     frames.splice(index, 1);
24
25                     addChild(myLogo);
26                     myLogo.x = j * 150;
27                     myLogo.y = i * 150;
28
29                     myLogo.gotoAndStop(9);
```

```
                    myLogo.addEventListener(MouseEvent.CLICK, openLogo);
                }
            }
        }
        private function openLogo(e:MouseEvent){
            var clickObj:Logo = Logo(e.target);

            if (fClip == null){
                fClip = clickObj;
                fClip.gotoAndStop(fClip.frameNo);
            } else if (sClip == null && fClip != clickObj){
                sClip = clickObj;
                sClip.gotoAndStop(sClip.frameNo);

                if (fClip.frameNo == sClip.frameNo){
                    myTimer = new Timer(1000, 1);
                    myTimer.start();
                    myTimer.addEventListener(TimerEvent.TIMER_COMPLETE, removeLogos);
                } else{
                    myTimer = new Timer (1000, 1);
                    myTimer.start();
                    myTimer.addEventListener(TimerEvent.TIMER_COMPLETE, resetLogos);
                }
            }
        }
        private function removeLogos(e:TimerEvent){
            removeChild(fClip);
            removeChild(sClip);
            myTimer.removeEventListener(TimerEvent.TIMER_COMPLETE, removeLogos);
            fClip = null;
            sClip = null;
        }
        private function resetLogos(e:TimerEvent){
            fClip.gotoAndStop(9);
            sClip.gotoAndStop(9);
            myTimer.removeEventListener(TimerEvent.TIMER_COMPLETE, resetLogos);
            fClip = null;
            sClip = null;
        }
    }

}
```

Figure 5-33-1 MatchingGame.as.

5	A brief description of the topic.

Table 5-21 Implementation of Memory Game (1).

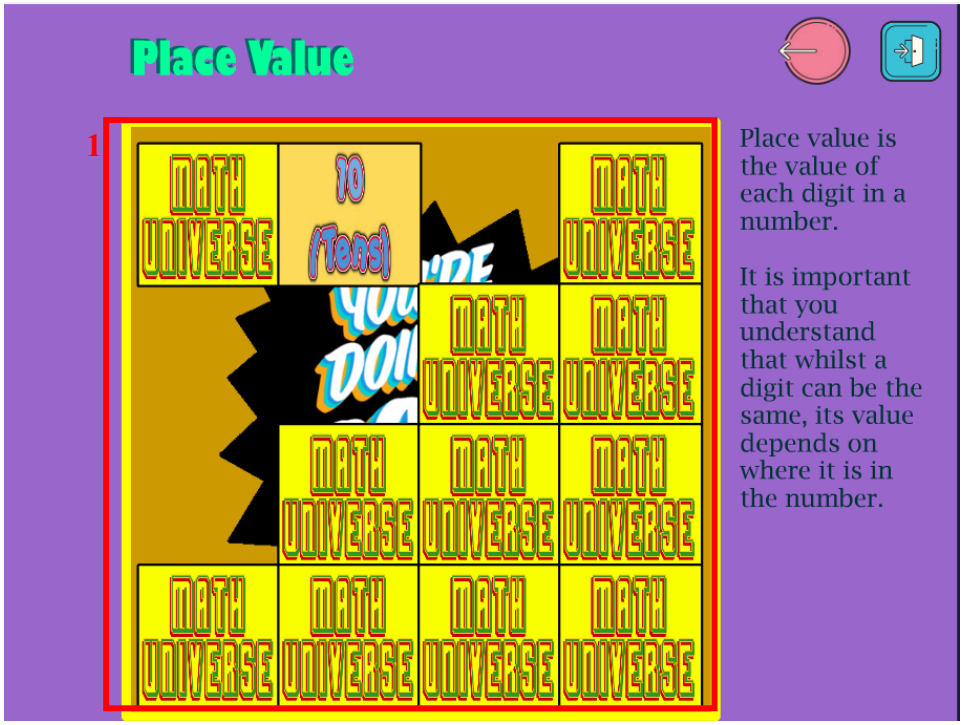


Figure 5-34 Memory Game (2).

Label	Description
1	When the users match a pair of cards, both cards will disappear and the hidden word under the cards will be shown.

Table 5-22 Implementation of Memory Game (2).

Figure 5-35 Sub-menu of Matching Game.

Label	Description

1	Back button that will return to the Sub-topic Menu of Memory Game.
	ActionScript 3.0 used:
	back_btn2.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene_404);
	
	function fl_ClickToGoToScene_404(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 2");
	}

2	Exit button that the users can click to quit the system.

3	There are four topics of memory game provided in the system. Users can choose their preferred topics to start the game.
	ActionScript 3.0 used:
	match1.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene_405);
	
	function fl_ClickToGoToScene_405(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(5, "Scene 16");
	}
	• Users only need to click on the topic, and they will be directed to the game.

Table 5-23 Implementation of Sub-menu of Matching Game.

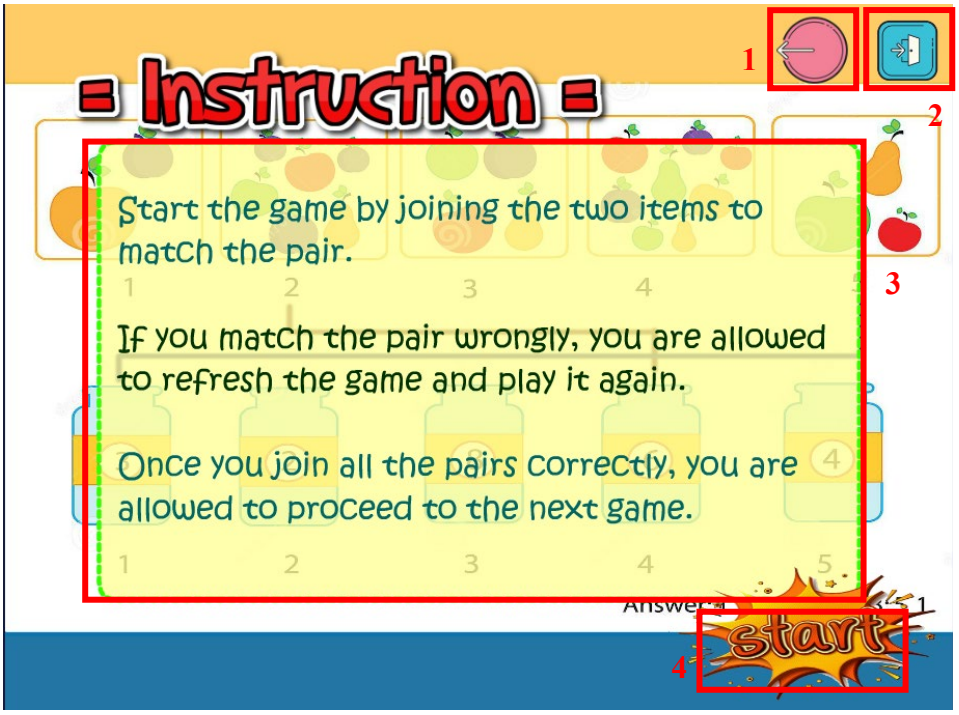


Figure 5-36 Instruction of Matching Game.

Label	Description

1	Back button that will return to the Sub-topic Menu of Game Module.
	ActionScript 3.0 used:
	back5.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene_440);
	
	function fl_ClickToGoToScene_440(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(2, "Scene 8");
	}

2	Exit button that the users can click to quit the system.
3	Users can read through the instruction before starting the game.
4	Start button that allows users to start the game. ActionScript 3.0 used: start5.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_414); function fl_ClickToGoToScene_414(event:MouseEvent):void

	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 17");
	}

Table 5-24 Implementation of Instruction of Matching Game.

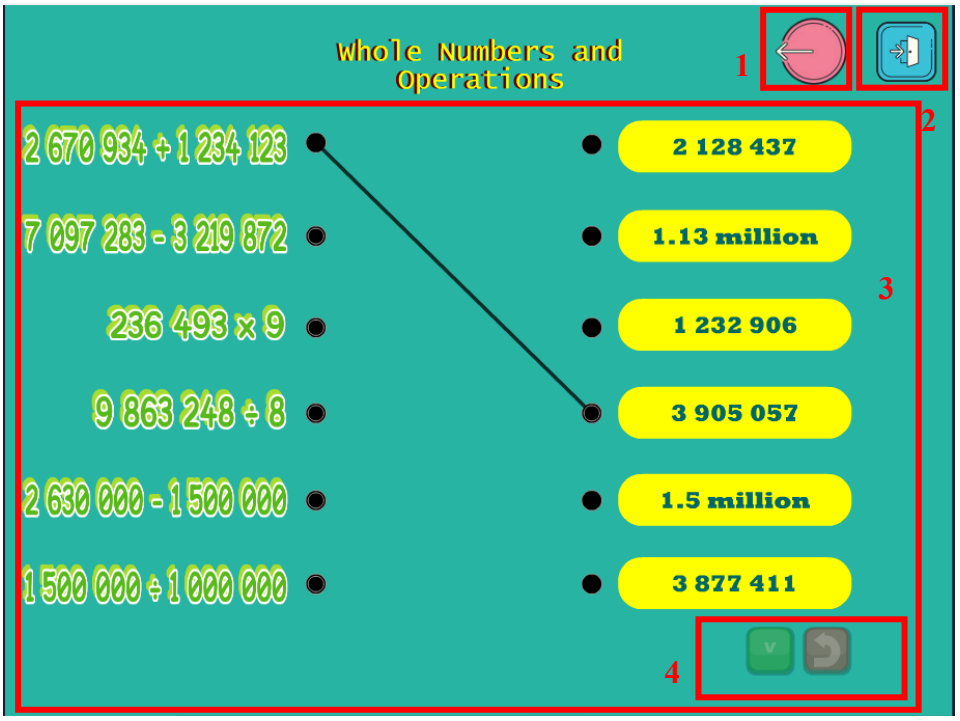


Figure 5-37 Matching Game (1).

Label	Description
1	Back button that will return to the Sub-topic Menu of Memory Game. ActionScript 3.0 used: back_btn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_422);

<table>
<tr><td></td><td>

```
function fl_ClickToGoToScene_422(event:MouseEvent):void
{
        MovieClip(this.root).gotoAndPlay(2, "Scene 8");


}
```

</td></tr>
<tr><td>2</td><td>Exit button that the users can click to quit the system.</td></tr>
<tr><td>3</td><td>Users can join both side of items by clicking the dots on left to drag a line to the dots on left. When the users complete the game, they are allowed to click on the submit button to check the correct answer. If they join a wrong answer, they can click on the red button to refresh the question. ActionScript 3.0 used.

```
import flash.display.MovieClip;
import flash.events.MouseEvent;

var num_linked:Number = 6;

var stat_line:Boolean = false;
var _stloop:Boolean = false;
var _stdone:Boolean = false;
var num_fra:Number = 0;
var num_loop:Number = 0;
var num_true:Number = 0;
var num_step:Number = 0;

var _loop:MovieClip = new MovieClip();
_loop.addEventListener(Event.ENTER_FRAME,enterLoop);

function start_linked():void
{
        var ar_link:Array = [];
        for (var i:Number = 1; i <= num_linked; i++)
        {
                ar_link[i] = true;
                if (i >= num_linked)
                {
                        ar_link[0] = false;
                        set_linked(ar_link);
                }
        }

        var _check:MovieClip = getChildByName("bt_check") as MovieClip;
        _check.buttonMode = true;
        _check.st = false;
        _check.alpha = .2;
        _check.addEventListener(MouseEvent.CLICK,clickCheck);

        var _refresh:MovieClip = getChildByName("bt_refresh") as MovieClip;
        _refresh.buttonMode = true;
        _refresh.st = false;
        _refresh.alpha = .2;
        _refresh.addEventListener(MouseEvent.CLICK,clickRefresh);
}

function randomNumber(_ar:Array):Number
{
        var _num:Number = 0;
        do
```

</td></tr>
</table>

```
        {
                _num = Math.floor(Math.random() * (num_linked + 1));
        } while (_ar[_num] == false);
        return _num;
}

function set_linked(_ar:Array):void
{
        var _num:Number;

        var _linked:MovieClip;
        var _lefted:MovieClip;
        var left_drag:MovieClip;
        var _righte:MovieClip;
        var _express:MovieClip;
        for (var i:Number = 1; i <= num_linked; i++)
        {
                _num = randomNumber(_ar);
                _ar[_num] = false;
                _linked = getChildByName("link_text"+i) as MovieClip;
                _linked.gotoAndStop(_num);

                _righte = getChildByName("right"+i) as MovieClip;
                _righte.tgt = 0;
                _righte.inm = _num;

                _lefted = getChildByName("left"+i) as MovieClip;
                left_drag = new point_mc();
                left_drag.name = "drag" + i;
                left_drag.x = _lefted.x;
                left_drag.y = _lefted.y;
                left_drag.stat = true;
                left_drag.icd = i;
                left_drag.drg = false;
                addChild(left_drag);
                left_drag.addEventListener(MouseEvent.MOUSE_DOWN,start_drag);
                left_drag.addEventListener(MouseEvent.MOUSE_MOVE,move_drag);
                left_drag.addEventListener(MouseEvent.CLICK,click_drag);

                _express = new mv_exp();
                _express.name = "exp" + i;
                _express.gotoAndStop(1);
                _express.x = _righte.x + (_righte.width / 2);
                _express.y = _righte.y;
                _express.visible = false;
                addChild(_express);

        }
}

function start_drag(e:MouseEvent):void
{
        if (e.currentTarget.stat)
        {
                e.currentTarget.startDrag(true);
                stat_line = false;
                start_line(e.currentTarget.icd,true);

                e.currentTarget.drg = true;
        }
}

function start_line(a:Number,b:Boolean):void
{
        var _line:MovieClip;
        if (stat_line)
        {
                _line = getChildByName("line"+a) as MovieClip;
                removeChild(_line);
                stat_line = false;
        }
        if (b)
        {
                _line = new MovieClip();
                _line.name = "line" + a;
                addChild(_line);

                var _left:MovieClip = getChildByName("left"+a) as MovieClip;
                var left_drag:MovieClip = getChildByName("drag"+a) as MovieClip;
                setChildIndex(left_drag,numChildren-1);

                _line.graphics.lineStyle(4, 0x000000, .75);
                _line.graphics.moveTo(_left.x,_left.y);
                _line.graphics.lineTo(left_drag.x,left_drag.y);
                stat_line = true;
        }
}

function move_drag(e:MouseEvent):void
{
        if (e.currentTarget.stat && e.currentTarget.drg)
        {
                start line(e.currentTarget.icd,true);
```

```
function click_drag(e:MouseEvent):void
{
	if (e.currentTarget.stat)
	{
		e.currentTarget.stopDrag();
		e.currentTarget.drg = false;

		var left:MovieClip = getChildByName("left"+e.currentTarget.icd) as MovieClip;
		var _line:MovieClip;
		for (var i:Number = 1; i <= num_linked; i++)
		{
			var _right:MovieClip = getChildByName("right"+i) as MovieClip;
			if (e.currentTarget.hitTestObject(_right))
			{
				if (_right.tgt == 0)
				{
					_right.tgt = e.currentTarget.icd;
					e.currentTarget.x = _right.x;
					e.currentTarget.y = _right.y;
					e.currentTarget.stat = false;
					start_line(e.currentTarget.icd,true);
					check_placed();
					break;
				}
			}
			if (i >= num_linked)
			{
				e.currentTarget.x = left.x;
				e.currentTarget.y = left.y;
				start_line(e.currentTarget.icd,false);
				break;
			}
		}
	}
}

function check_placed():void
{
	var _num:Number = 0;

	var _right:MovieClip;
	for (var i:Number = 1; i <= num_linked; i++)
	{
		_right = getChildByName("right"+i) as MovieClip;
		if ( right.tgt != 0)

			_num++;
		}
		if (i >= num_linked)
		{
			var _check:MovieClip = getChildByName("bt_check") as MovieClip;
			_check.st = false;
			_check.alpha = .2;
			if (_num >= num_linked)
			{
				_check.st = true;
				_check.alpha = 1;
			}
			break;
		}
	}
}

function clickCheck(e:MouseEvent):void
{
	if (e.currentTarget.st)
	{
		e.currentTarget.st = false;
		e.currentTarget.alpha = .2;
		e.currentTarget.gotoAndStop(1);

		num_true = 0;

		var _right:MovieClip;
		for (var i:Number = 1; i <= num_linked; i++)
		{
			_right = getChildByName("right"+i) as MovieClip;

			var _express:MovieClip = getChildByName("exp"+i) as MovieClip;
			setChildIndex(_express,numChildren - 1);
			trace(_right.tgt+" - "+_right.inm);
			if (_right.tgt == _right.inm)
			{
				_express.gotoAndStop(1);
				num_true++;
			}
			else
			{
				_express.gotoAndStop(20);
			}
			if (i >= num_linked)
			{
```

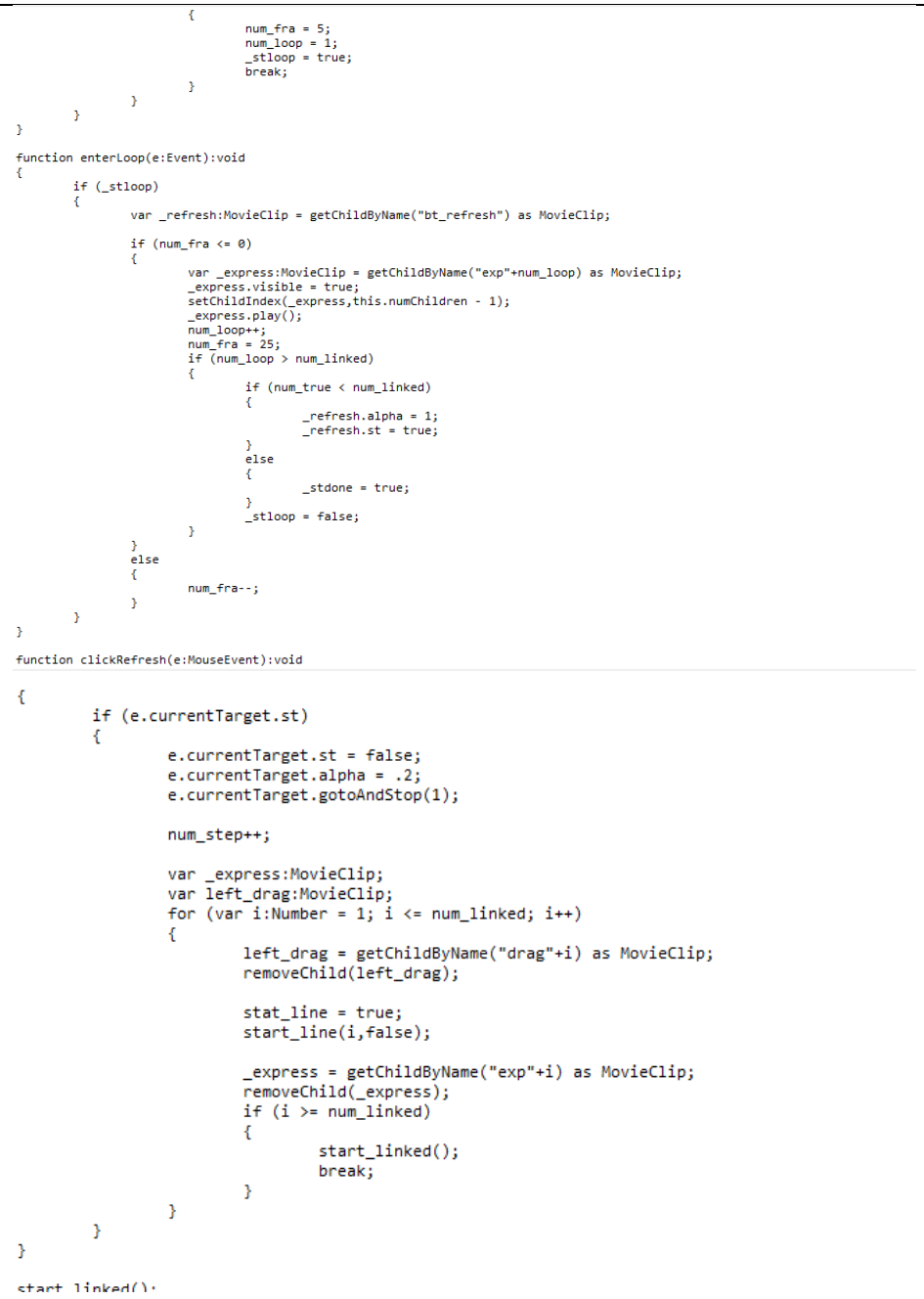
	 Figure 5-37-1 Matching Game. • Users can only click on the submit button after they done the match.
4	Green button is a submit button that the users click to check the answer. The red button is a refresh button that allow users to re-play the game.

Table 5-25 Implementation of Matching Game (1).

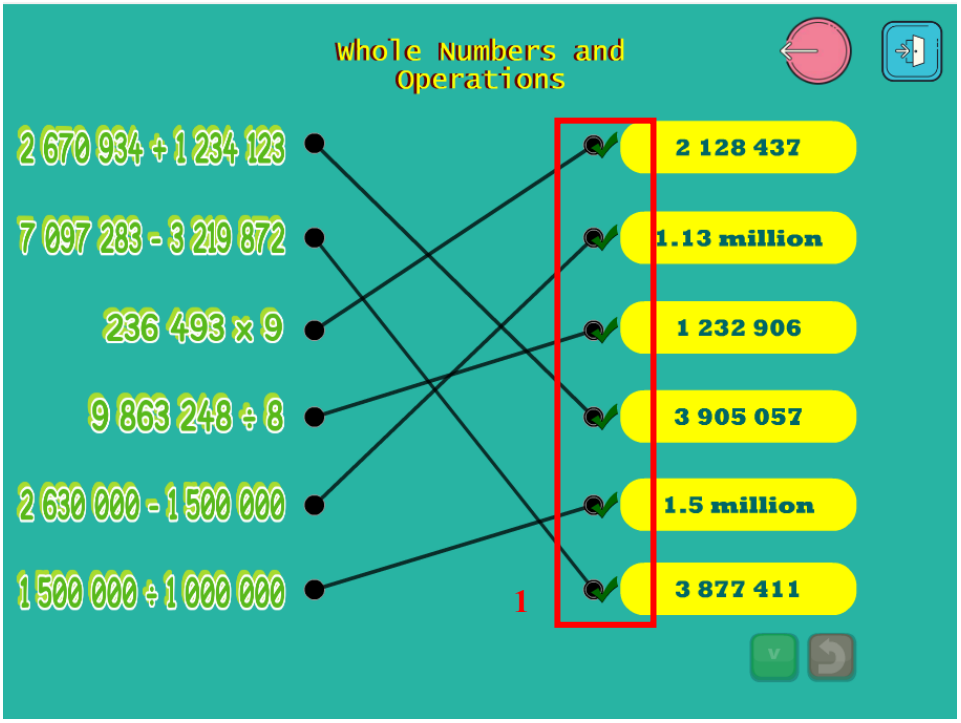


Figure 5-38 Matching Game (2).

Label	Description
1	A green tick will appear for every correct answer after the users click on the submit button.

Table 5-26 Implementation of Matching Game (2).

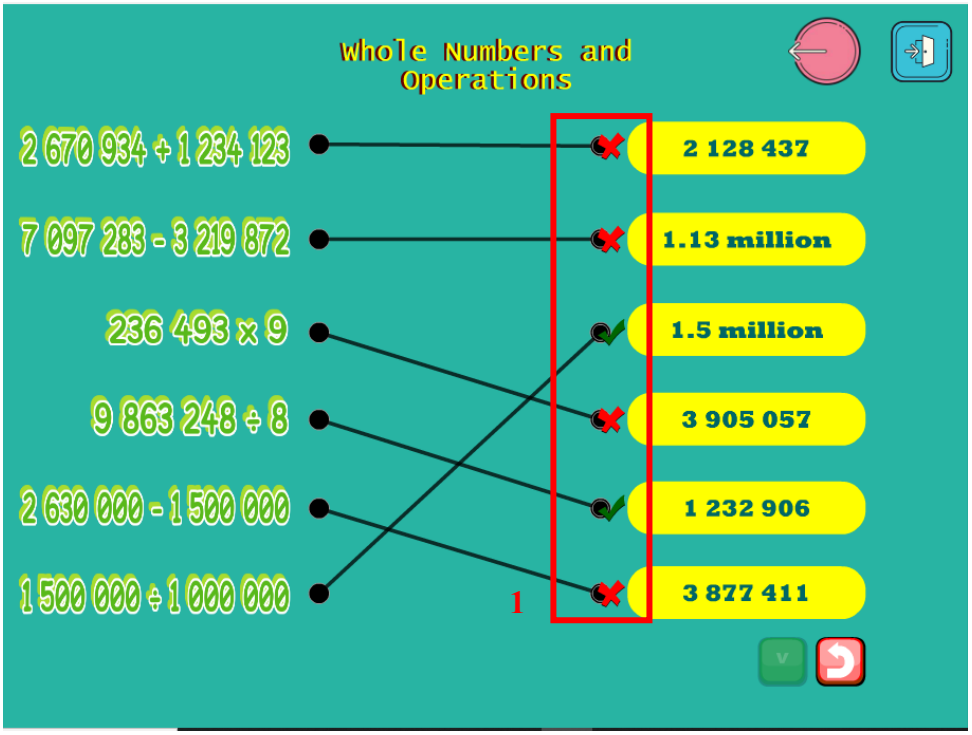


Figure 5-39 Matching Game (3).

Label	Description
1	A red cross will appear for wrong answer and users can click on the refresh button to play again the game.

Table 5-27 Implementation of Matching Game (3).

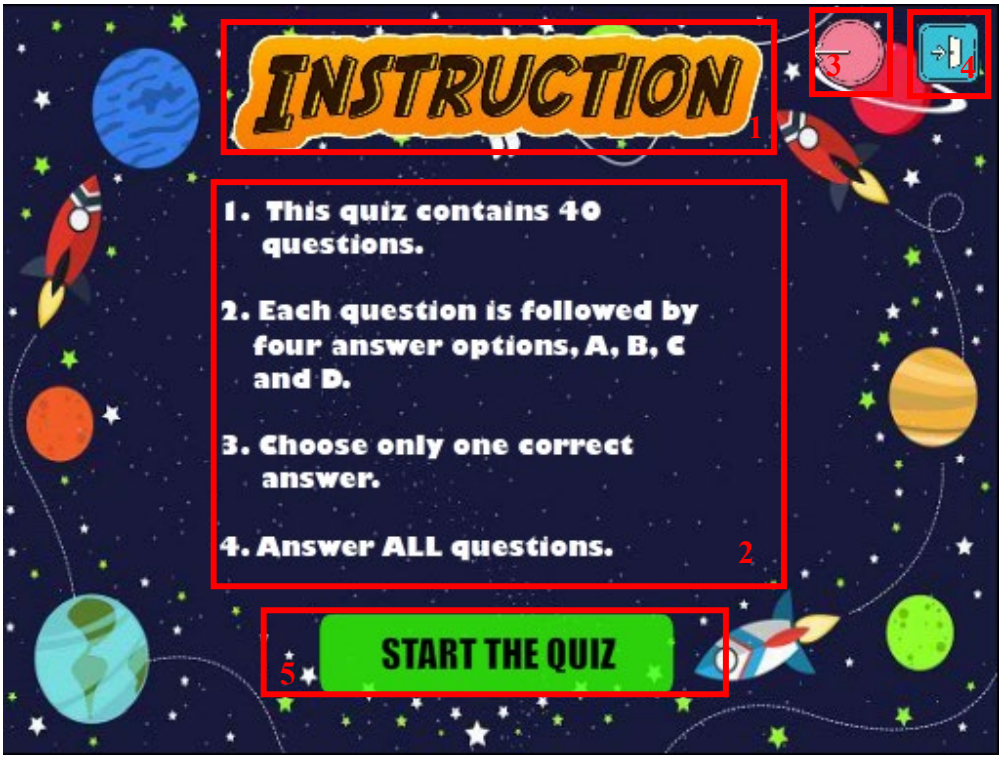


Figure 5-40 Instruction Interface of Quiz.

Label	Description
1	The title of the interface.
2	The instruction of the quiz.

3	Back button that will return to the Menu of Quiz Module.
	ActionScript 3.0 used:
	back_btn.addEventListener(MouseEvent.CLICK,
	fl_ClickToGoToScene_261);
	
	function fl_ClickToGoToScene_261(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 6");
	}

4	Exit button that the users can click to quit the system.
5	Start button to begin the quiz. ActionScript 3.0 used: sq1.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_258);

	function fl_ClickToGoToScene_258(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 13");
	}

Table 5-28 Implementation of Instruction Interface of Quiz.

Figure 5-41 Question of Quiz Module.

Label	Description
1	Text element that shows the question.
2	Option buttons of the question. ActionScript 3.0 used:

<table>
<tr>
<td></td>
<td>

```
*/
var Mark2:int = 0;

ansla.addEventListener(MouseEvent.CLICK, fl_MouseClickHandler_401);

function fl_MouseClickHandler_401(event:MouseEvent):void
{
    anslb.mouseEnabled=false;
    anslc.mouseEnabled=false;
    ansld.mouseEnabled=false;
    gotoAndStop(5);
}

anslb.addEventListener(MouseEvent.CLICK, fl_MouseClickHandler_402);

function fl_MouseClickHandler_402(event:MouseEvent):void
{
    Mark2++;
    ansla.mouseEnabled=false;
    anslc.mouseEnabled=false;
    ansld.mouseEnabled=false;
    gotoAndStop(5);
}

anslc.addEventListener(MouseEvent.CLICK, fl_MouseClickHandler_403);

function fl_MouseClickHandler_403(event:MouseEvent):void
{
    ansla.mouseEnabled=false;
    anslb.mouseEnabled=false;
    ansld.mouseEnabled=false;
    gotoAndStop(5);
}

ansld.addEventListener(MouseEvent.CLICK, fl_MouseClickHandler_404);

function fl_MouseClickHandler_404(event:MouseEvent):void
{
    ansla.mouseEnabled=false;
    anslb.mouseEnabled=false;
    anslc.mouseEnabled=false;
    gotoAndStop(5);
}
```

Figure 5-41-1 ASC for Quiz Question.

- Once the users selected an answer, they will directly proceed to the next question.
- Mark will be added when users selected a correct answer.
- If the users select a wrong answer, mark will not be counted.

</td>
</tr>
<tr>
<td>3</td>
<td>Close button that bring the users back to the instruction interface.
ActionScript 3.0 used:
end_quiz.addEventListener(MouseEvent.CLICK,
fl_ClickToGoToScene_260);

function fl_ClickToGoToScene_260(event:MouseEvent):void
{
MovieClip(this.root).gotoAndPlay(1, "Scene 12");
}</td>
</tr>
</table>

Table 5-29 Implementation of Question of Quiz

.

Figure 5-42 Score Interface of Quiz Module.

Label	Description
1	Text element that shows the total score that users obtained from the quiz. ActionScript 3.0 used: mark.text=Mark.toString();

2	Close button that bring the users back to the instruction interface.
	ActionScript 3.0 used:
	end_quiz.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_260);
	
	function fl_ClickToGoToScene_260(event:MouseEvent):void
	{
	MovieClip(this.root).gotoAndPlay(1, "Scene 12");
	}

Table 5-30 Implementation of Score Interface of Quiz Module.

5.3 Post-Authoring Process

Post authoring process was to execute and deliver the multimedia-based courseware to the target audience. The courseware was published in .exe format which the users can install to their computer.

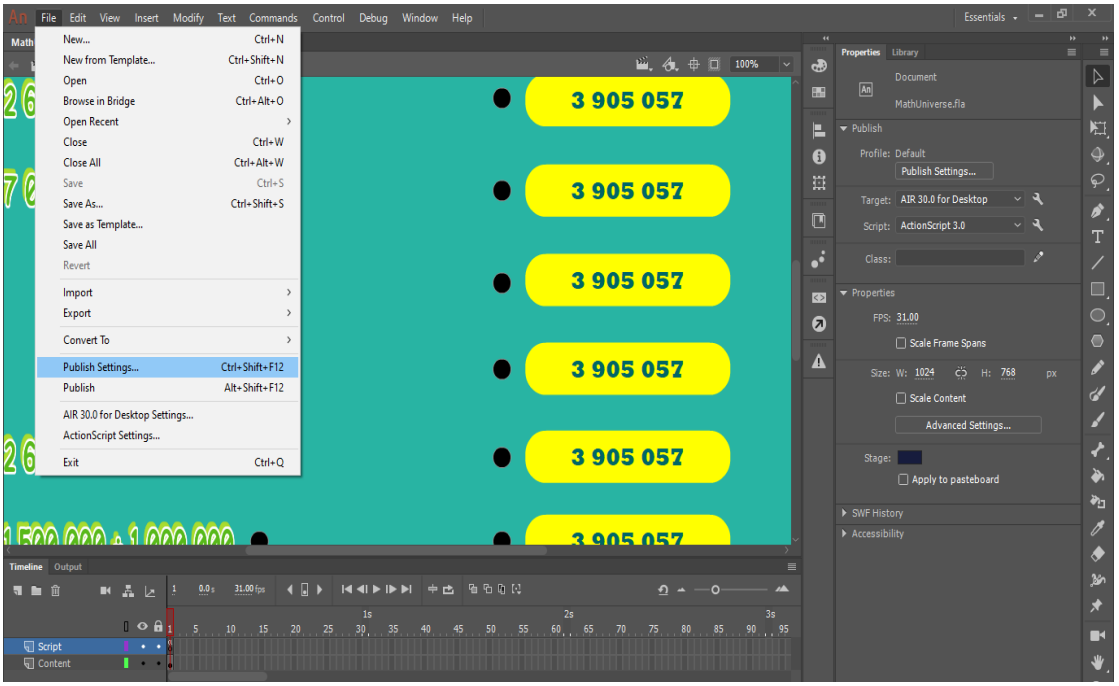


Figure 5-43 Publish the Courseware (1).

After completed the project, click on the publish setting to publish the courseware.

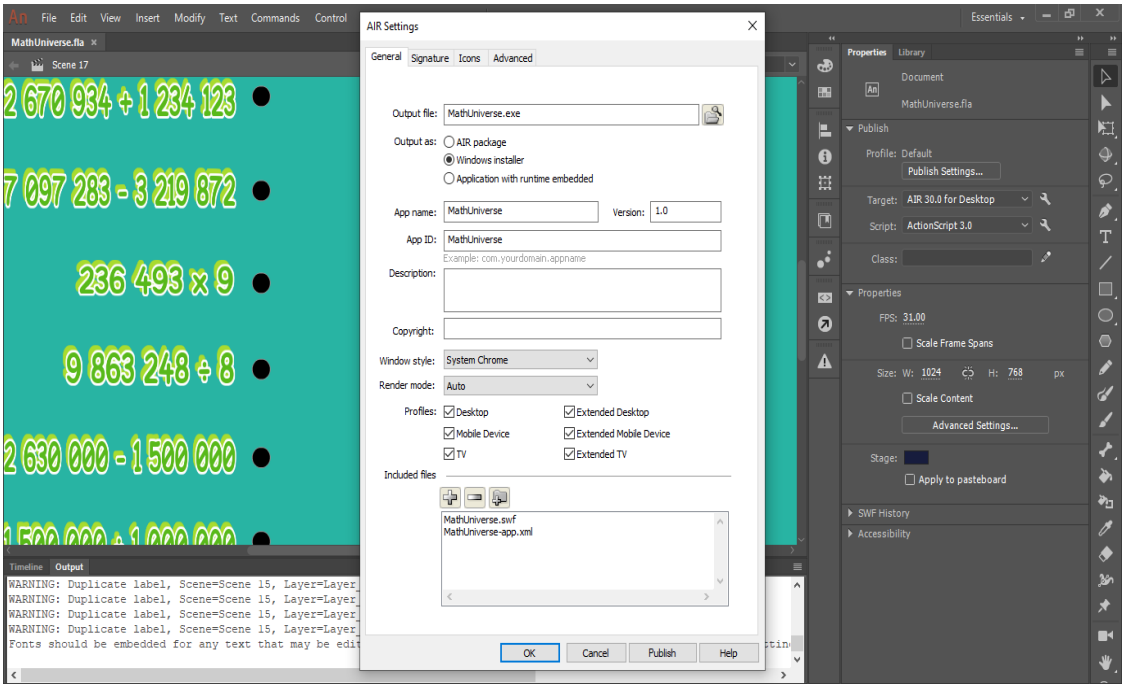


Figure 5-44 Publish the Courseware (2).

Selected “Windows installer” to publish the courseware as .exe file and click on the publish button to output the courseware.

5.4 Testing

Alpha testing was used to test “Math Universe” multimedia courseware. This testing could be conducted by developer only without any users involved in order to verify whether there were any error on the system.

5.4.1 Testing

5.4.1.1 Main Menu

No.	Test Case	Expected Results	Actual Results
1	Mouse hover the Learning button	Animation changed on the button	Success
2	Mouse hover the Practical button	Animation changed on the button	Success
3	Mouse hover the Game button	Animation changed on the button	Success
4	Mouse hover the Quiz button	Animation changed on the button	Success
5	Hit Learning button	Go to menu of Learning Module	Success
6	Hit Practical button	Go to menu of Practical Module	Success
7	Hit Game button	Go to menu of Game Module	Success
8	Hit Quiz button	Go to menu of Quiz Module	Success
9	Hit Sound button	One clicks to mute sound, click again to unmute sound	Success

10	Hit Exit button	Go to exit interface	Success

Table 5-31 Testing for Main Menu.

5.4.1.2 Exit Interface

No.	Test Case	Expected Results	Actual Results
1	Mouse hover the Yes button	The word "Yes" being circled	Success
2	Mouse hover the No button	The word "No" being circled	Success
3	Hit the Yes button	Close the courseware	Success
4	Hit the No button	Exit interface being closed and return to last stop	Success

Table 5-32 Testing for Exit Interface.

5.4.1.3 Menu of Learning Module

No.	Test Case	Expected Results	Actual Results
1	Hit the Whole Numbers and Operations button	Go to sub-topic menu of Whole Numbers and Operations	Success
2	Hit the Fractions button	Go to sub-topic menu of Fractions	Success
3	Hit the Decimals button	Go to sub-topic menu of Decimals	Success
4	Hit the Percentage button	Go to sub-topic menu of Percentage	Success
5	Hit the Money button	Go to sub-topic menu of Money	Success
6	Hit the Time button	Go to sub-topic menu of Time	Success

7	Hit the Topic 7-12 button	Go to next frame which is the second page of the menu	Success
8	Hit the Length, Mass and Volume of Liquid button	Go to sub-topic menu of Length, Mass and Volume of Liquid	Success
9	Hit the Space button	Go to sub-topic menu of Space	Success
10	Hit the Coordinates button	Go to sub-topic menu of Coordinates	Success
11	Hit the Ratio and Proportion button	Go to sub-topic menu of Ratio and Proportion	Success
12	Hit the Data Handling button	Go to sub-topic menu of Data Handling	Success
13	Hit the Probability button	Go to sub-topic menu of Probability	Success
14	Hit the Topic 1-6 button	Go to previous frame which is the first page of the menu	Success
15	Hit the Home button	Back to Main Menu	Success
16	Hit the Exit button	Go to exit interface	Success

Table 5-33 Testing for Menu of Learning Module.

5.4.1.4 Menu of Practical Module

No.	Test Case	Expected Results	Actual Results

1	Hit the Whole Numbers and Operations button	Go to sub-topic menu of Whole Numbers and Operations	Success
2	Hit the Fractions button	Go to sub-topic menu of Fractions	Success
3	Hit the Decimals button	Go to sub-topic menu of Decimals	Success
4	Hit the Percentage button	Go to sub-topic menu of Percentage	Success
5	Hit the Money button	Go to sub-topic menu of Money	Success
6	Hit the Time button	Go to sub-topic menu of Time	Success
7	Hit the Topic 7-12 button	Go to next frame which is the second page of the menu	Success
8	Hit the Length, Mass and Volume of Liquid button	Go to sub-topic menu of Length, Mass and Volume of Liquid	Success
9	Hit the Space button	Go to sub-topic menu of Space	Success
10	Hit the Coordinates button	Go to sub-topic menu of Coordinates	Success
11	Hit the Ratio and Proportion button	Go to sub-topic menu of Ratio and Proportion	Success
12	Hit the Data Handling button	Go to sub-topic menu of Data Handling	Success
13	Hit the Probability button	Go to sub-topic	Success

		menu of Probability	
14	Hit the Topic 1-6 button	Go to previous frame which is the first page of the menu	Success
15	Hit the Home button	Back to Main Menu	Success
16	Hit the Exit button	Go to exit interface	Success

Table 5-34 Testing for Menu of Practical Module.

5.4.1.5 Menu of Game Module

No.	Test Case	Expected Results	Actual Results
1	Hit the Memory Game button	Go to sub-menu of Memory Game	Success
2	Hit the Matching button	Go to sub-menu of Matching Game	Success
3	Hit the Home button	Back to Main Menu	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-35 Testing for Menu of Game Module.

5.4.1.6 Menu of Quiz Module

No.	Test Case	Expected Results	Actual Results
1	Hit the Easy button	Go to instruction of easy level quiz	Success
2	Hit the Medium button	Go to instruction of medium level quiz	Success
3	Hit the Hard button	Go to instruction of hard level quiz	Success
4	Hit the Home button	Back to Main Menu	Success

5	Hit the Exit button	Go to exit interface	Success

Table 5-36 Testing for Menu of Quiz Module.

5.4.1.7 Sub-topic Menu of Whole Numbers and Operations

No.	Test Case	Expected Results	Actual Results
1	Hit the 1.1 Application of Numbers button	Go to 1.1 Application of Numbers interface	Success
2	Hit the 1.2 Prime Numbers button	Go to 1.2 Prime Numbers interface	Success
3	Hit the 1.3 Numbers Up to Seven Digits button	Go to 1.3 Numbers Up to Seven Digits interface	Success
4	Hit the Back button	Back to Menu of Learning Module	Success
5	Hit the Exit button	Go to exit interface	Success

Table 5-37 Testing for Sub-topic Menu of Whole Numbers and Operations.

5.4.1.8 Sub-topic Menu of Fractions

No.	Test Case	Expected Results	Actual Results
1	Hit the 2.1 Multiplication of Fractions button	Go to 2.1 Multiplication of Fractions interface	Success
2	Hit the 2.2 Division of Fractions button	Go to 2.2 Division of Fractions interface	Success
3	Hit the 2.3 Problem Solving button	Go to 2.3 Problem Solving interface	Success
4	Hit the Back button	Back to Menu of Learning Module	Success
5	Hit the Exit button	Go to exit interface	Success

Table 5-38 Testing for Sub-topic Menu of Fractions.

5.4.1.9 Sub-topic Menu of Decimals

No.	Test Case	Expected Results	Actual Results
1	Hit the 3.1 Mix Operations Involving Decimals button	Go to 3.1 Mix Operations Involving Decimals	Success
2	Hit the 3.2 Problem Solving Involving Decimals button	Go to 3.2 Problem Solving Involving Decimals interface	Success
3	Hit the Back button	Back to Menu of Learning Module	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-39 Testing for Sub-topic Menu of Decimals.

5.4.1.10 Sub-topic Menu of Percentage

No.	Test Case	Expected Results	Actual Results
1	Hit the 4.1 Problem Solving Involving Percentage button	Go to 4.1 Problem Solving Involving Percentage interface	Success
2	Hit the Back button	Back to Menu of Learning Module	Success
3	Hit the Exit button	Go to exit interface	Success

Table 5-40 Testing for Sub-topic Menu of Percentage.

5.4.1.11 Sub-topic Menu of Money

No.	Test Case	Expected Results	Actual Results
1	Hit the 5.1 Problem Solving Involving Money button	Go to 5.1 Problem Solving Involving Money interface	Success
4	Hit the Back button	Back to Menu of Learning Module	Success

5	Hit the Exit button	Go to exit interface	Success

Table 5-41 Testing for Sub-topic Menu of Money.

5.4.1.12 Sub-topic Menu of Time

No.	Test Case	Expected Results	Actual Results
1	Hit the 6.1 24-hour System button	Go to 6.1 24-hour System interface	Success
2	Hit the 6.2 Duration button	Go to 6.2 Duration interface	Success
3	Hit the 6.3 Problem Solving Involving Time button	Go to 6.3 Problem Solving Involving Time interface	Success
4	Hit the Back button	Back to Menu of Learning Module	Success
5	Hit the Exit button	Go to exit interface	Success

Table 5-42 Testing for Sub-topic Menu of Time.

5.4.1.13 Sub-topic Menu of Length, Mass and Volume of Liquid

No.	Test Case	Expected Results	Actual Results
1	Hit the 7.1 Problem Solving Involving Length, Mass and Volume of Liquid button	Go to 7.1 Problem Solving Involving Length, Mass and Volume of Liquid interface	Success
3	Hit the Back button	Back to Menu of Learning Module	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-43 Testing for Sub-topic Menu of Length, Mass and Volume of Liquid.

5.4.1.14 Sub-topic Menu of Space

No.	Test Case	Expected Results	Actual Results

1	Hit the 8.1 Angles button	Go to 8.1 Angles interface	Success
2	Hit the 8.2 Two-Dimensional Shape button	Go to 8.2 Two-Dimensional Shape interface	Success
3	Hit the 8.3 Three-Dimensional Shape button	Go to 8.3 Three-Dimensional Shape interface	Success
4	Hit the Back button	Back to Menu of Learning Module	Success
5	Hit the Exit button	Go to exit interface	Success

Table 5-44 Testing for Sub-topic Menu of Space.

5.4.1.15 Sub-topic Menu of Coordinates

No.	Test Case	Expected Results	Actual Results
1	Hit the 9.1 Application Coordinates in the First Quadrant button	Go to 9.1 Application Coordinates in the First Quadrant interface	Success
2	Hit the Back button	Back to Menu of Learning Module	Success
3	Hit the Exit button	Go to exit interface	Success

Table 5-45 Testing for Sub-topic Menu of Coordinates.

5.4.1.16 Sub-topic Menu of Ratio and Proportion

No.	Test Case	Expected Results	Actual Results
1	Hit the 10.1 Ratio and Proportion button	Go to 10.1 Ratio and Proportion interface	Success
2	Hit the Back button	Back to Menu of Learning Module	Success
3	Hit the Exit button	Go to exit interface	Success

Table 5-46 Testing for Sub-topic Menu of Ratio and Proportion.

5.4.1.17 Sub-topic Menu of Data Handling

No.	Test Case	Expected Results	Actual Results
1	Hit the 11.1 Data button	Go to 11.1 Data interface	Success
2	Hit the Back button	Back to Menu of Learning Module	Success
3	Hit the Exit button	Go to exit interface	Success

Table 5-47 Testing for Sub-topic Menu of Data Handling.

5.4.1.18 Sub-topic Menu of Probability

No.	Test Case	Expected Results	Actual Results
1	Hit the 12.1 Probability button	Go to 12.1 Probability interface	Success
2	Hit the Back button	Back to Menu of Learning Module	Success
3	Hit the Exit button	Go to exit interface	Success

Table 5-48 Testing for Sub-topic Menu of Probability.

5.4.1.19 Whole Numbers and Operations

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Back button	Back to sub-topic menu of Whole Numbers and Operations	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-49 Testing for Whole Numbers and Operations.

5.4.1.20 Video Menu of Whole Numbers and Operations

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Numbers Up to Seven Digits button	Play the Numbers Up to Seven Digit video	Success
4	Hit the Using a Calculator button	Play the Using a Calculator video	Success
5	Hit Prime Numbers button	Play the Prime Numbers video	Success
6	Hit the Converting Decimals and Fractions of a Million into Whole Numbers and Vice Versa button	Play the Converting Decimals and Fractions of a Million into Whole Numbers and Vice Versa video	Success
7	Hit the Back button	Back to sub-topic menu of Whole Numbers and Operations	Success
8	Hit the Exit button	Go to exit interface	Success

Table 5-50 Testing for Video Menu of Whole Numbers and Operations.

5.4.1.21 Fractions

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success

3	Hit the Back button	Back to sub-topic menu of Fractions	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-51 Testing for Fractions.

5.4.1.22 Video Menu of Fractions

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Multiply between Proper Fractions button	Play the Multiply between Proper Fractions video	Success
4	Hit the Multiply Proper Fractions by a Mixed Numbers button	Play the Multiply Proper Fractions by a Mixed Numbers video	Success
5	Hit the Multiply Mixed Numbers by Mixed Numbers button	Play the Multiply Mixed Numbers by Mixed Numbers video	Success
6	Hit the Division of Fractions button	Play the Division of Fractions video	Success
7	Hit the Back button	Back to sub-topic menu of Fractions	Success
8	Hit the Exit button	Go to exit interface	Success

Table 5-52 Testing for Video Menu of Fractions.

5.4.1.23 Decimals

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success

3	Hit the Back button	Back to sub-topic menu of Decimals	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-53 Testing for Decimals.

5.4.1.24 Video Menu of Decimals

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Multiply and Divide Decimals button	Play the Multiply and Divide Decimals video	Success
4	Hit the Back button	Back to sub-topic menu of Decimals	Success
5	Hit the Exit button	Go to exit interface	Success

Table 5-54 Testing for Video Menu of Decimals.

5.4.1.25 Percentage

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
2	Hit the Back button	Back to sub-topic menu of Percentage	Success
3	Hit the Exit button	Go to exit interface	Success

Table 5-55 Testing for Percentage.

5.4.1.26 Video Menu of Percentage

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success

2	Hit the Previous button	Back to previous page	Success
3	Hit the Percentage in Savings and Investment button	Play the Percentage in Savings and Investment video	Success
4	Hit the Percentage in Daily Life button	Play the Percentage in Daily Life video	Success
5	Hit the Back button	Back to sub-topic menu of Percentage	Success
6	Hit the Exit button	Go to exit interface	Success

Table 5-56 Testing for Video Menu of Percentage.

5.4.1.27 Money

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Back button	Back to sub-topic menu of Money	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-57 Testing for Money.

5.4.1.28 Video Menu of Money

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Cost Price, Selling Price, Loss and Profit button	Play the Cost Price, Selling Price, Loss and Profit video	Success
4	Hit the Discount, Bill, Rebate and Invoice button	Play the Discount, Bill, Rebate and	Success

		Invoice video	
5	Hit Asset and Liability, Bonus and Service Tax button	Play the Asset and Liability, Bonus and Service Tax video	Success
6	Hit the Back button	Back to sub-topic menu of Money	Success
7	Hit the Exit button	Go to exit interface	Success

Table 5-58 Testing for Video Menu of Money.

5.4.1.29 Time

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Back button	Back to sub-topic menu of Time	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-59 Testing for Time.

5.4.1.30 Video Menu of Time

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Time Systems button	Play the Time Systems video	Success
4	Hit the Time Duration button	Play the Time Duration video	Success
5	Hit Time Zones button	Play the Time Zones video	Success
6	Hit the Back button	Back to sub-topic	Success

		menu of Time	
7	Hit the Exit button	Go to exit interface	Success

Table 5-60 Testing for Video Menu of Time.

5.4.1.31 Length, Mass and Volume of Liquid

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Back button	Back to sub-topic menu of Length, Mass and Volume of Liquid	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-61 Testing for Length, Mass and Volume of Liquid.

5.4.1.32 Video Menu of Length, Mass and Volume of Liquid

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Length, Mass and Volume I button	Play the Length, Mass and Volume I video	Success
4	Hit the Length, Mass and Volume II button	Play the Length, Mass and Volume II video	Success
5	Hit Length, Mass and Volume III button	Play the Length, Mass and Volume III video	Success
6	Hit the Back button	Back to sub-topic menu of Learning	Success

		Module	
7	Hit the Exit button	Go to exit interface	Success

Table 5-62 Testing for Video Menu of Length, Mass and Volume of Liquid.

5.4.1.33 Space

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Back button	Back to sub-topic menu of Space	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-63 Testing for Space.

5.4.1.34 Video Menu of Space

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Polygon button	Play the Polygon video	Success
4	Hit the Perimeter and Area button	Play the Perimeter and Area video	Success
5	Hit Area button	Play the Area video	Success
6	Hit the Solving Problems on the Surface Area and Volume button	Play the Solving Problems on the Surface Area and Volume video	Success
7	Hit the Back button	Back to sub-topic menu of Space	Success
8	Hit the Exit button	Go to exit interface	Success

Table 5-64 Testing for Video Menu of Space.

5.4.1.35 Coordinates

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Back button	Back to sub-topic menu of Coordinates	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-65 Testing for Coordinates.

5.4.1.36 Video Menu of Coordinates

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Coordinates button	Play the Coordinates video	Success
4	Hit the Back button	Back to sub-topic menu of Coordinates	Success
5	Hit the Exit button	Go to exit interface	Success

Table 5-66 Testing for Video Menu of Coordinates.

5.4.1.37 Ratio and Proportion

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Back button	Back to sub-topic menu of Ratio and	Success

		Proportion	
4	Hit the Exit button	Go to exit interface	Success

Table 5-67 Testing for Ratio and Proportion.

5.4.1.38 Video Menu of Ratio and Proportion

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Ratios Representing Two Quantities button	Play the Ratio Representing Two Quantities video	Success
4	Hit the Back button	Back to sub-topic menu of Ratio and Proportion	Success
5	Hit the Exit button	Go to exit interface	Success

Table 5-68 Testing for Video Menu of Ratio and Proportion.

5.4.1.39 Data Handling

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Back button	Back to sub-topic menu of Data Handling	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-69 Testing for Data Handling.

5.4.1.40 Video Menu of Data Handling

No.	Test Case	Expected Results	Actual Results

1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Data Handling button	Play the Data Handling video	Success
4	Hit the Solve Problems Related to Mode, Median, Mean button	Play the Solve Problems Related to Mode, Median, Mean video	Success
5	Hit the Back button	Back to sub-topic menu of Data Handling	Success
6	Hit the Exit button	Go to exit interface	Success

Table 5-70 Testing for Video Menu of Data Handling.

5.4.1.41 Probability

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Back button	Back to sub-topic menu of Probability	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-71 Testing for Probability.

5.4.1.42 Video Menu of Probability

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next page	Success
2	Hit the Previous button	Back to previous page	Success
3	Hit the Probability button	Play the Probability	Success

		video	
4	Hit the Back button	Back to sub-topic menu of Probability	Success
5	Hit the Exit button	Go to exit interface	Success

Table 5-72 Testing for Video Menu of Probability.

5.4.1.43 Practical 1

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next question	Success
2	Hit the Previous button	Back to previous question	Success
3	Hit the Option 1 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
4	Hit the Option 2 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
5	Hit the Option 3 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
6	Hit the Option 4 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
7	Hit the Back button	Back to menu of Practical Module	Success
8	Hit the Exit button	Go to exit interface	Success

Table 5-73 Testing for Practical 1.

5.4.1.44 Practical 2

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next question	Success
2	Hit the Previous button	Back to previous question	Success
3	Hit the Option 1 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
4	Hit the Option 2 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
5	Hit the Option 3 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
6	Hit the Option 4 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
7	Hit the Back button	Back to menu of Practical Module	Success
8	Hit the Exit button	Go to exit interface	Success

Table 5-74 Testing for Practical 2.

5.4.1.45 Practical 3

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next question	Success
2	Hit the Previous button	Back to previous question	Success

3	Hit the Option 1 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
4	Hit the Option 2 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
5	Hit the Option 3 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
6	Hit the Option 4 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
7	Hit the Back button	Back to menu of Practical Module	Success
8	Hit the Exit button	Go to exit interface	Success

Table 5-75 Testing for Practical 3.

5.4.1.46 Practical 4

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next question	Success
2	Hit the Previous button	Back to previous question	Success
3	Hit the Option 1 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
4	Hit the Option 2 button	Dynamic text box will show the result	Success

		of the selection: Correct or Wrong	
5	Hit the Option 3 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
6	Hit the Option 4 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
7	Hit the Back button	Back to menu of Practical Module	Success
8	Hit the Exit button	Go to exit interface	Success

Table 5-76 Testing for Practical 4.

5.4.1.47 Practical 5

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next question	Success
2	Hit the Previous button	Back to previous question	Success
3	Hit the Option 1 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
4	Hit the Option 2 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
5	Hit the Option 3 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success

6	Hit the Option 4 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
7	Hit the Back button	Back to menu of Practical Module	Success
8	Hit the Exit button	Go to exit interface	Success

Table 5-77 Testing for Practical 5.

5.4.1.48 Practical 6

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next question	Success
2	Hit the Previous button	Back to previous question	Success
3	Hit the Option 1 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
4	Hit the Option 2 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
5	Hit the Option 3 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
6	Hit the Option 4 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
7	Hit the Back button	Back to menu of Practical Module	Success

8	Hit the Exit button	Go to exit interface	Success

Table 5-78 Testing for Practical 6.

5.4.1.49 Practical 7

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next question	Success
2	Hit the Previous button	Back to previous question	Success
3	Hit the Option 1 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
4	Hit the Option 2 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
5	Hit the Option 3 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
6	Hit the Option 4 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
7	Hit the Back button	Back to menu of Practical Module	Success
8	Hit the Exit button	Go to exit interface	Success

Table 5-79 Testing for Practical 7.

5.4.1.50 Practical 8

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next question	Success

2	Hit the Previous button	Back to previous question	Success
3	Hit the Option 1 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
4	Hit the Option 2 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
5	Hit the Option 3 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
6	Hit the Option 4 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
7	Hit the Back button	Back to menu of Practical Module	Success
8	Hit the Exit button	Go to exit interface	Success

Table 5-80 Testing for Practical 8.

5.4.1.51 Practical 9

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next question	Success
2	Hit the Previous button	Back to previous question	Success
3	Hit the Option 1 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success

4	Hit the Option 2 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
5	Hit the Option 3 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
6	Hit the Option 4 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
7	Hit the Back button	Back to menu of Practical Module	Success
8	Hit the Exit button	Go to exit interface	Success

Table 5-81 Testing for Practical 9.

5.4.1.52 Practical 10

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next question	Success
2	Hit the Previous button	Back to previous question	Success
3	Hit the Option 1 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
4	Hit the Option 2 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
5	Hit the Option 3 button	Dynamic text box will show the result	Success

		of the selection: Correct or Wrong	
6	Hit the Option 4 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
7	Hit the Back button	Back to menu of Practical Module	Success
8	Hit the Exit button	Go to exit interface	Success

Table 5-82 Testing for Practical 10.

5.4.1.53 Practical 11

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next question	Success
2	Hit the Previous button	Back to previous question	Success
3	Hit the Option 1 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
4	Hit the Option 2 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
5	Hit the Option 3 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
6	Hit the Option 4 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success

7	Hit the Back button	Back to menu of Practical Module	Success
8	Hit the Exit button	Go to exit interface	Success

Table 5-83 Testing for Practical 11.

5.4.1.54 Practical 12

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Go to next question	Success
2	Hit the Previous button	Back to previous question	Success
3	Hit the Option 1 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
4	Hit the Option 2 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
5	Hit the Option 3 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
6	Hit the Option 4 button	Dynamic text box will show the result of the selection: Correct or Wrong	Success
7	Hit the Back button	Back to menu of Practical Module	Success
8	Hit the Exit button	Go to exit interface	Success

Table 5-84 Testing for Practical 12.

5.4.1.55 Instruction of Practical

No.	Test Case	Expected Results	Actual Results
1	Hit the Next button	Start the practical	Success
2	Hit the Back button	Back to menu of Practical Module	Success
3	Hit the Exit button	Go to exit interface	Success

Table 5-85 Testing for Instruction of Practical.

5.4.1.56 Instruction of Quiz

No.	Test Case	Expected Results	Actual Results
1	Hit the Start button	Start the quiz	Success
2	Hit the Back button	Back to menu of Practical Module	Success
3	Hit the Exit button	Go to exit interface	Success

Table 5-86 Testing for Instruction of Quiz.

5.4.1.57 Easy Level of Quiz

No.	Test Case	Expected Results	Actual Results
1	Hit the Option 1 button	Adding 1 to score if it is a correct answer and direct to next question	Success
2	Hit the Option 2 button	Adding 1 to score if it is a correct answer and direct to next question	Success
3	Hit the Option 3 button	Adding 1 to score if it is a correct answer and direct to next question	Success
4	Hit the Option 4 button	Adding 1 to score if it is a correct answer and direct	Success

		to next question	
5	Hit the Close button	Close the quiz immediately and back to Quiz Module	Success

Table 5-87 Testing for Easy Level of Quiz.

5.4.1.58 Result of Easy Level of Quiz

No.	Test Case	Expected Results	Actual Results
1	Total score added and showed in the dynamic text box.	Dynamic text changed regarding to the score obtained from the quiz	Success
2	Hit the Close button	Close the interface and back to Quiz Module	Success

Table 5-88 Testing for Result of Easy Level of Quiz.

5.4.1.59 Medium Level of Quiz

No.	Test Case	Expected Results	Actual Results
1	Hit the Option 1 button	Adding 1 to score if it is a correct answer and direct to next question	Success
2	Hit the Option 2 button	Adding 1 to score if it is a correct answer and direct to next question	Success
3	Hit the Option 3 button	Adding 1 to score if it is a correct	Success

		answer and direct to next question	
4	Hit the Option 4 button	Adding 1 to score if it is a correct answer and direct to next question	Success
5	Hit the Close button	Close the quiz immediately and back to Quiz Module	Success

Table 5-89 Testing for Medium Level of Quiz.

5.4.1.60 Result of Medium Level of Quiz

No.	Test Case	Expected Results	Actual Results
1	Total score added and showed in the dynamic text box.	Dynamic text changed regarding to the score obtained from the quiz	Success
2	Hit the Close button	Close the interface and back to Quiz Module	Success

Table 5-90 Testing for Result of Medium Level of Quiz.

5.4.1.61 Hard Level of Quiz

No.	Test Case	Expected Results	Actual Results
1	Hit the Option 1 button	Adding 1 to score if it is a correct answer and direct to next question	Success
2	Hit the Option 2 button	Adding 1 to score if it is a correct	Success

		answer and direct to next question	
3	Hit the Option 3 button	Adding 1 to score if it is a correct answer and direct to next question	Success
4	Hit the Option 4 button	Adding 1 to score if it is a correct answer and direct to next question	Success
5	Hit the Close button	Close the quiz immediately and back to Quiz Module	Success

Table 5-91 Testing for Hard Level of Quiz.

5.4.1.62 Result of Hard Level of Quiz

No.	Test Case	Expected Results	Actual Results
1	Total score added and showed in the dynamic text box.	Dynamic text changed regarding to the score obtained from the quiz	Success
2	Hit the Close button	Close the interface and back to Quiz Module	Success

Table 5-92 Testing for Result of Hard Level of Quiz.

5.4.1.63 Sub-menu of Memory Game

No.	Test Case	Expected Results	Actual Results
1	Hit the Place Value button	Go to Place Value Memory Game	Success

2	Hit the Space button	Go to Space Memory Game	Success
3	Hit the Time button	Go to Time Memory Game	Success
4	Hit the Fractions, Decimals, Percentage button	Go to Fractions, Decimals, Percentage Memory Game	Success
5	Hit the Back button	Back to menu of Game Module	Success
6	Hit the Exit button	Go to exit interface	Success

Table 5-93 Testing for Sub-menu of Memory Game.

5.4.1.64 Instruction of Memory Game

No.	Test Case	Expected Results	Actual Results
1	Hit the Start button	Start the game	Success
2	Hit the Back button	Back to menu of sub-menu of Game Module	Success
3	Hit the Exit button	Go to exit interface	Success

Table 5-94 Testing for Instruction of Memory Game.

5.4.1.65 Place Value Memory Game

No.	Test Case	Expected Results	Actual Results
1	Click and flip the cards	Both the cards will be removed when match a pair; else, the card will be covered back	Success
2	Hit the Back button	Back to sub-menu of Memory Game	Success
3	Hit the Exit button	Go to exit interface	Success

Table 5-95 Testing for Place Value Memory Game.

5.4.1.66 Space Memory Game

No.	Test Case	Expected Results	Actual Results
1	Click and flip the cards	Both the cards will be removed when match a pair; else, the card will be covered back	Success
2	Hit the Back button	Back to sub-menu of Memory Game	Success
3	Hit the Exit button	Go to exit interface	Success

Table 5-96 Testing for Space Memory Game.

5.4.1.67 Time Memory Game

No.	Test Case	Expected Results	Actual Results
1	Click and flip the cards	Both the cards will be removed when match a pair; else, the card will be covered back	Success
2	Hit the Back button	Back to sub-menu of Memory Game	Success
3	Hit the Exit button	Go to exit interface	Success

Table 5-97 Testing for Time Memory Game.

5.4.1.68 Fractions, Decimals, Percentage Memory Game

No.	Test Case	Expected Results	Actual Results
1	Click and flip the cards	Both the cards will be removed when match a pair; else,	Success

		the card will be covered back	
2	Hit the Back button	Back to sub-menu of Memory Game	Success
3	Hit the Exit button	Go to exit interface	Success

Table 5-98 Testing for Fractions, Decimals, Percentage Memory Game.

5.4.1.69 Instruction of Matching Game

No.	Test Case	Expected Results	Actual Results
1	Hit the Start button	Start the game	Success
2	Hit the Back button	Back to menu of sub-menu of Game Module	Success
3	Hit the Exit button	Go to exit interface	Success

Table 5-99 Testing for Instruction of Matching Game.

5.4.1.70 Whole Numbers and Operations Matching Game

No.	Test Case	Expected Results	Actual Results
1	Join two items to match the value.	Click on the right dots and drag the line on the left dots to match the pair.	Success
2	Hit the Submit button	If match the pair a green tick will appear; if not match the pair a red cross will appear	Success
3	Hit Refresh button	If match a pair wrongly, users are able to click on the refresh button to re-play the game	

3	Hit the Back button	Back to sub-menu of Matching Game	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-100 Testing for Whole Numbers and Operations Matching Game.

5.4.1.71 Polygon Matching Game

No.	Test Case	Expected Results	Actual Results
1	Join two items to match the value.	Click on the right dots and drag the line on the left dots to match the pair.	Success
2	Hit the Submit button	If match the pair a green tick will appear; if not match the pair a red cross will appear	Success
3	Hit Refresh button	If match a pair wrongly, users are able to click on the refresh button to re-play the game	
3	Hit the Back button	Back to sub-menu of Matching Game	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-101 Testing for Polygon Matching Game.

5.4.1.72 Length Matching Game

No.	Test Case	Expected Results	Actual Results
1	Join two items to match the value.	Click on the right dots and drag the line on the left dots to match the pair.	Success

2	Hit the Submit button	If match the pair a green tick will appear; if not match the pair a red cross will appear	Success
3	Hit Refresh button	If match a pair wrongly, users are able to click on the refresh button to re-play the game	
3	Hit the Back button	Back to sub-menu of Matching Game	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-102 Testing for Length Matching Game.

5.4.1.73 Mass Matching Game

No.	Test Case	Expected Results	Actual Results
1	Join two items to match the value.	Click on the right dots and drag the line on the left dots to match the pair.	Success
2	Hit the Submit button	If match the pair a green tick will appear; if not match the pair a red cross will appear	Success
3	Hit Refresh button	If match a pair wrongly, users are able to click on the refresh button to re-play the game	
3	Hit the Back button	Back to sub-menu of Matching Game	Success

4	Hit the Exit button	Go to exit interface	Success

Table 5-103 Testing for Mass Matching Game.

5.4.1.74 Volume of Liquid Matching Game

No.	Test Case	Expected Results	Actual Results
1	Join two items to match the value.	Click on the right dots and drag the line on the left dots to match the pair.	Success
2	Hit the Submit button	If match the pair a green tick will appear; if not match the pair a red cross will appear	Success
3	Hit Refresh button	If match a pair wrongly, users are able to click on the refresh button to re-play the game	
3	Hit the Back button	Back to sub-menu of Matching Game	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-104 Testing for Volume of Liquid Matching Game.

5.4.1.75 Time Matching Game

No.	Test Case	Expected Results	Actual Results
1	Join two items to match the value.	Click on the right dots and drag the line on the left dots to match the pair.	Success
2	Hit the Submit button	If match the pair a green tick will appear; if not	Success

		match the pair a red cross will appear	
3	Hit Refresh button	If match a pair wrongly, users are able to click on the refresh button to re-play the game	
3	Hit the Back button	Back to sub-menu of Matching Game	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-105 Testing for Time Matching Game.

5.4.1.76 Data Handling Matching Game

No.	Test Case	Expected Results	Actual Results
1	Join two items to match the value.	Click on the right dots and drag the line on the left dots to match the pair.	Success
2	Hit the Submit button	If match the pair a green tick will appear; if not match the pair a red cross will appear	Success
3	Hit Refresh button	If match a pair wrongly, users are able to click on the refresh button to re-play the game	
3	Hit the Back button	Back to sub-menu of Matching Game	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-106 Testing for Data Handling Matching Game.

5.4.1.77 Money Matching Game

No.	Test Case	Expected Results	Actual Results
1	Join two items to match the value.	Click on the right dots and drag the line on the left dots to match the pair.	Success
2	Hit the Submit button	If match the pair a green tick will appear; if not match the pair a red cross will appear	Success
3	Hit Refresh button	If match a pair wrongly, users are able to click on the refresh button to re-play the game	
3	Hit the Back button	Back to sub-menu of Matching Game	Success
4	Hit the Exit button	Go to exit interface	Success

Table 5-107 Testing for Money Matching Game.

Chapter 6: Conclusion

6.1 Future Work

The interactive multimedia-based courseware for learning Mathematics is a courseware that designed based on the syllabus of Year 6 Mathematics which has covered all the mathematical knowledge that should be learned in the entire primary school life. However, it is only suitable for Year 6 students to use for learning Mathematics. For the future work, syllabus of Year 4 and Year 5 Mathematics will be added into the system so that students can use it to enhance their Mathematics skill as to help them take into Ujian Pencapaian Sekolah Rendah (UPSR).

Besides that, the user interface design of the courseware will be improved by using more colorful and brighter graphics and adding more animations to attract the students for using it. Furthermore, create more flash game and improve the degree of difficulties of the existing games by adding the time limit and score to make the Game Module more interesting.

6.2 Conclusion

In higher education today, interactive multimedia courseware has been widely used. However, the common method of teaching Mathematics is the traditional method with teacher directed. The traditional teaching method in education system concluded that there are many defeats with it. Since everyone have their own learning pace, it is hard for teacher to accommodate student's learning pace when the lesson has many students. Besides, lack of learning process in classroom is one of the problems in learning as the students are weak applications. Students will also lose of interest and attention in learning since the limitation of usual learning materials is less interactive content that may cause students feel bored about learning.

In this project, an interactive multimedia-based courseware for learning Mathematics has been proposed. The motivation to develop this project is aimed to solve the problems stated above in order to help students to have a better understanding and learning experience in Mathematics. It is believed that learning Mathematics through this courseware, students can adjust and learn at their own pace due to the interactivity that included in it. Furthermore, the proposed system which included practices and

quiz can help students to revise what they have learned in the lesson and help to improve their skills. This proposed courseware which allows interactivity not only can enhance students' learning experience by transforming the boring content into an engaging way, it can also improve the attractiveness and create interest among the learners since they are not taking on a passive role in learning.

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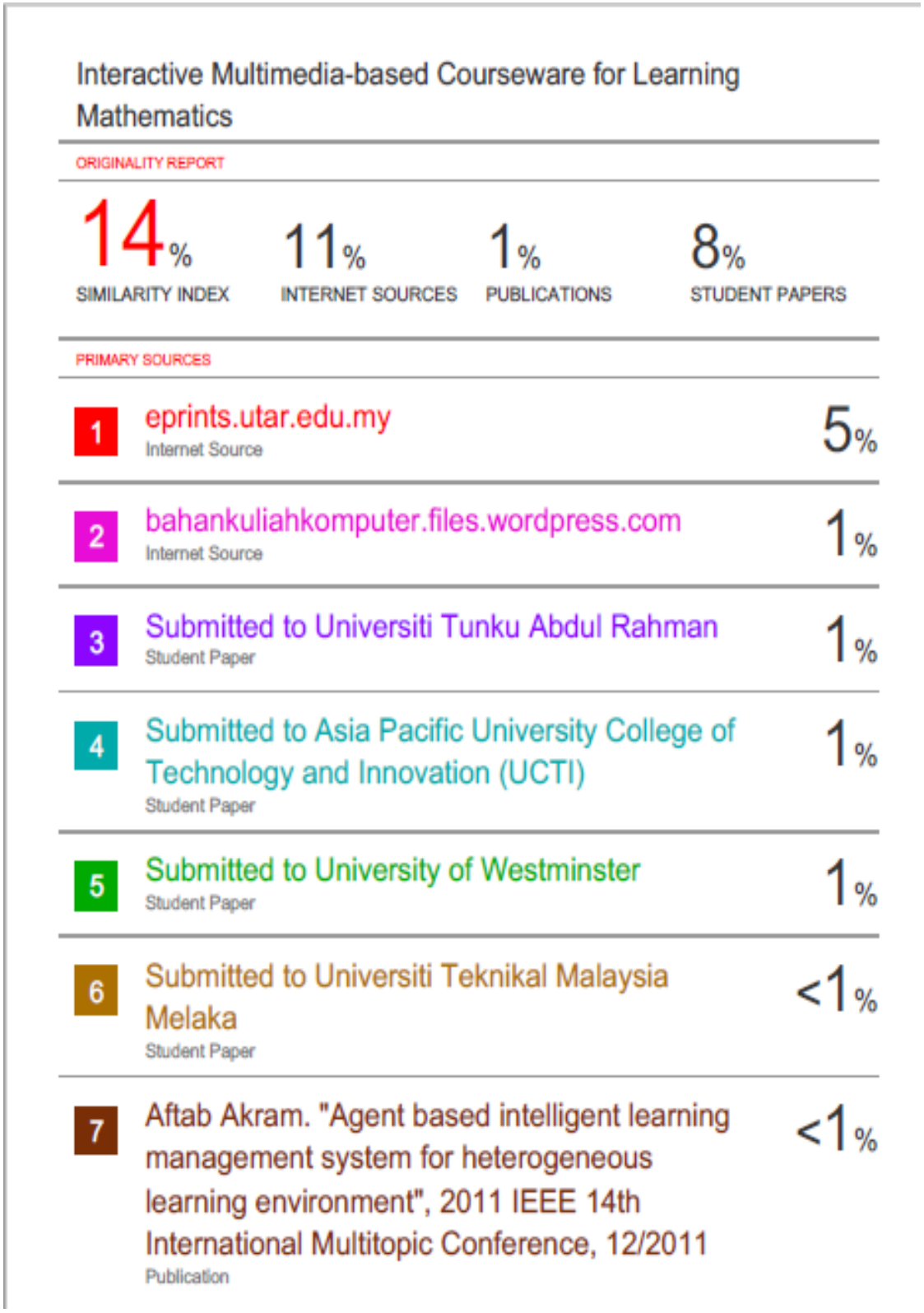
APPENDIX A: TURNITIN ORIGINALITY REPORT



Interactive Multimedia-based Courseware for Learning Mathematics

ORIGINALITY REPORT

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7	Aftab Akram. "Agent based intelligent learning management system for heterogeneous learning environment", 2011 IEEE 14th International Multitopic Conference, 12/2011 Publication	<1%

APPENDIX A TURNITIN ORIGINALITY REPORT

Universiti Tunku Abdul Rahman			
Form Title : Supervisor's Comments on Originality Report Generated by Turnitin for Submission of Final Year Project Report (for Undergraduate Programmes)			
Form Number: FM-IAD-005	Rev No.: 0	Effective Date: 01/10/2013	Page No.: 1of 1

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Full Name(s) of Candidate(s)	TAN FHIH LING
ID Number(s)	1606633
Programme / Course	IA
Title of Final Year Project	MULTIMEDIA-BASED COURSEWARE FOR LEARNING MATHEMATICS.

Similarity	**Supervisor's Comments (Compulsory if parameters of originality exceeds the limits approved by UTAR)**
Overall similarity index: 14% **Similarity by source** Internet Sources: 11 % Publications: 1 % Student Papers: 8 %	
Number of individual sources listed of more than 3% similarity: 1	Cited sources are from student's own work
Parameters of originality required and limits approved by UTAR are as follows: **(i) Overall similarity index is 20% and below, and** **(ii) Matching of individual sources listed must be less than 3% each, and** **(iii) Matching texts in continuous block must not exceed 8 words** ***Note: Parameters (i) – (ii) shall exclude quotes, bibliography and text matches which are less than 8 words.***	

Note Supervisor/Candidate(s) is/are required to provide softcopy of full set of the originality report to
Faculty/Institute

Based on the above results, I hereby declare that I am satisfied with the originality of the Final Year Project Report submitted by my student(s) as named above.

Signature of Supervisor
Name: Khor Siak Wang
Date: 10/9/2020

Signature of Co-Supervisor
Name:
Date:

APPENDIX B: POSTER

APPENDIX C: WEEKLY REPORT

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	**Study week no.: 1**
Student Name & ID: Tan Fhih Ling, 1606633	
Supervisor: Dr. Khor Siak Wang	
Project Title: Multimedia-based Courseware for Learning Mathematics	

1. WORK DONE

- Obtain suggestions from supervisor.
- Discuss improvement that should be included in FYP II from supervisor and moderator.

2. WORK TO BE DONE

- Improve the UI design of current system.

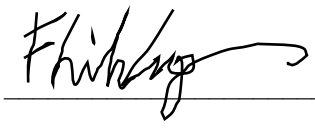
3. PROBLEMS ENCOUNTERED

- The colour used in the current system designed during FYP I is too dark and lack of attractiveness.

4. SELF EVALUATION OF THE PROGRESS

- Fair.

Supervisor's signature



Student's signature

APPENDIX C WEEKLY REPORT

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	**Study week no.: 2**
Student Name & ID: Tan Fhih Ling, 1606633	
Supervisor: Dr. Khor Siak Wang	
Project Title: Multimedia-based Courseware for Learning Mathematics	

1. WORK DONE

- Improve the UI design of current system.

2. WORK TO BE DONE

- Create sub-menu interface for each of the modules.
- Research on Mathematics knowledge that can be used in the system.
- Complete the learning module.

3. PROBLEMS ENCOUNTERED

- The video sound keeps playing even if the video has been closed.

4. SELF EVALUATION OF THE PROGRESS

- Fair.

Supervisor's signature

Student's signature

APPENDIX C WEEKLY REPORT

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	**Study week no.: 3**
Student Name & ID: Tan Fhih Ling, 1606633	
Supervisor: Dr. Khor Siak Wang	
Project Title: Multimedia-based Courseware for Learning Mathematics	

1. WORK DONE

- Video sound will not keep playing after close the video.
- Complete all sub-menu interface of the modules.

2. WORK TO BE DONE

- Complete the learning module.
- Design the question to be used in practical module.

3. PROBLEMS ENCOUNTERED

- The button in learning module could not function as well.

4. SELF EVALUATION OF THE PROGRESS

- Fair.

Supervisor's signature

Student's signature

APPENDIX C WEEKLY REPORT

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	**Study week no.: 4**
Student Name & ID: Tan Fhih Ling, 1606633	
Supervisor: Dr. Khor Siak Wang	
Project Title: Multimedia-based Courseware for Learning Mathematics	

1. WORK DONE

- Solve the problem of button function in learning module.

2. WORK TO BE DONE

- Complete the learning module.
- Design the question to be used in practical module and quiz module.

3. PROBLEMS ENCOUNTERED

- How the answer option can interact with in practical module and quiz module.

4. SELF EVALUATION OF THE PROGRESS

- Fair.

Supervisor's signature

Student's signature

APPENDIX C WEEKLY REPORT

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T2, Y3	**Study week no.: 5**
Student Name & ID: Tan Fhih Ling, 1606633	
Supervisor: Dr. Khor Siak Wang	
Project Title: Multimedia-based Courseware for Learning Mathematics	

1. WORK DONE

- Complete the learning module.

2. WORK TO BE DONE

- Improve the user interface design of learning module.
- Create Practical Module and Quiz Module scenes.

3. PROBLEMS ENCOUNTERED

- The way in designing practical module and quiz module are too similar.

4. SELF EVALUATION OF THE PROGRESS

- Fair.

Supervisor's signature

Student's signature

APPENDIX C WEEKLY REPORT

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	**Study week no.: 6**
Student Name & ID: Tan Fhih Ling, 1606633	
Supervisor: Dr. Khor Siak Wang	
Project Title: Multimedia-based Courseware for Learning Mathematics	

1. WORK DONE

- Discuss and ask for suggestion from supervisor regarding the problem of similarity between practical and quiz module.

2. WORK TO BE DONE

- To make sure the four option buttons for each question work well.

3. PROBLEMS ENCOUNTERED

- The UI design in practical and quiz module can be dazzled.
- Score has not added when users select the correct answer in quiz module.

4. SELF EVALUATION OF THE PROGRESS

- Fair.

Supervisor's signature

Student's signature

APPENDIX C WEEKLY REPORT

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	**Study week no.: 7**
Student Name & ID: Tan Fhih Ling, 1606633	
Supervisor: Dr. Khor Siak Wang	
Project Title: Multimedia-based Courseware for Learning Mathematics	

1. WORK DONE

- Use a simple design in practical and quiz module so that the question can be shown clearly, and users will not be affected by the complicated UI design when they complete the practical and quiz.
- All the option buttons work well.

2. WORK TO BE DONE

- Research on what game suitable to be used in this system.

3. PROBLEMS ENCOUNTERED

- Error occurs that there are duplicated function found in Practical Module and Quiz Module.

4. SELF EVALUATION OF THE PROGRESS

- Fair.

Supervisor's signature

Student's signature

APPENDIX C WEEKLY REPORT

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T2, Y3	**Study week no.: 8**
Student Name & ID: Tan Fhih Ling, 1606633	
Supervisor: Dr. Khor Siak Wang	
Project Title: Multimedia-based Courseware for Learning Mathematics	

1. WORK DONE

- Fix the error of duplicated function.

2. WORK TO BE DONE

- Create the game: Matching Game and Memory Game.
- Edit the clipart to be used in the game.

3. PROBLEMS ENCOUNTERED

- Error occurs when merging the game project with the system project.

4. SELF EVALUATION OF THE PROGRESS

- Fair.

Supervisor's signature

Student's signature

APPENDIX C WEEKLY REPORT

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	**Study week no.: 9**
Student Name & ID: Tan Fhih Ling, 1606633	
Supervisor: Dr. Khor Siak Wang	
Project Title: Multimedia-based Courseware for Learning Mathematics	

1. WORK DONE

- Fix the error by loading the .SWF file of the game into the system project.
- Memory game works well.

2. WORK TO BE DONE

- Complete the design of memory game.
- Create matching game.

3. PROBLEMS ENCOUNTERED

- Script error that users can not drag the line from the left dots to the right dots when joining two items in matching game.

4. SELF EVALUATION OF THE PROGRESS

- Fair.

Supervisor's signature

Student's signature

APPENDIX C WEEKLY REPORT

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	**Study week no.: 10**
Student Name & ID: Tan Fhih Ling, 1606633	
Supervisor: Dr. Khor Siak Wang	
Project Title: Multimedia-based Courseware for Learning Mathematics	

1. WORK DONE

- Fix the script error.
- Complete the design of memory game.

2. WORK TO BE DONE

- Complete the matching game.

3. PROBLEMS ENCOUNTERED

- The .SWF file of memory game does not exit well when proceed to the next scene.

4. SELF EVALUATION OF THE PROGRESS

- Fair.

Supervisor's signature

Student's signature

APPENDIX C WEEKLY REPORT

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	**Study week no.: 11**
Student Name & ID: Tan Fhih Ling, 1606633	
Supervisor: Dr. Khor Siak Wang	
Project Title: Multimedia-based Courseware for Learning Mathematics	

1. WORK DONE

- Fixed the script error. The .SWF file of memory game exit completely when proceed to next scene.
- Complete the design of matching game.

2. WORK TO BE DONE

- Modify and improve the UI design of the game.

3. PROBLEMS ENCOUNTERED

- Error occurs when run the entire system.

4. SELF EVALUATION OF THE PROGRESS

- Fair.

Supervisor's signature

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	**Study week no.: 12**
Student Name & ID: Tan Fhih Ling, 1606633	
Supervisor: Dr. Khor Siak Wang	
Project Title: Multimedia-based Courseware for Learning Mathematics	

1. WORK DONE

- Fix the error.
- Complete all the modules.

2. WORK TO BE DONE

- Improve the UI design of the system.

3. PROBLEMS ENCOUNTERED

- Should add more types of game in Game Module.
- Number of questions provided in Practical Module is not enough.

4. SELF EVALUATION OF THE PROGRESS

- Fair.

Supervisor's signature

Student's signature

APPENDIX D: CHECKLIST FOR FYP2 THESIS SUBMISSION

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF INFORMATION & COMMUNICATION TECHNOLOGY (KAMPAR CAMPUS)

CHECKLIST FOR FYP2 THESIS SUBMISSION

Student Id	1606633
Student Name	Tan Fhih Ling
Supervisor Name	Dr. Khor Siak Wang

TICK (√)	DOCUMENT ITEMS Your report must include all the items below. Put a tick on the left column after you have checked your report with respect to the corresponding item.
√	Front Cover
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√	Title Page
√	Signed form of the Declaration of Originality
√	Acknowledgement
√	Abstract
√	Table of Contents
√	List of Figures (if applicable)
√	List of Tables (if applicable)
√	List of Symbols (if applicable)
√	List of Abbreviations (if applicable)
√	Chapters / Content
√	Bibliography (or References)
√	All references in bibliography are cited in the thesis, especially in the chapter of literature review
√	Appendices (if applicable)
√	Poster
√	Signed Turnitin Report (Plagiarism Check Result - Form Number: FM-IAD-005)

*Include this form (checklist) in the thesis (Bind together as the last page)

I, the author, have checked and confirmed all the items listed in the table are included in my report. _____ (Signature of Student) Date: 9 September 2020	Supervisor verification. Report with incorrect format can get 5 mark (1 grade) reduction. _____ (Signature of Supervisor) Date: 10/9/2020