TECHNOLOGY ASSISTED LEARNING

COURSEWARE FOR BIOLOGICAL SCIENCE

BY

LIM HWA YAN

A REPORT

SUBMITTED TO

UNIVERSITI TUNKU ABDUL RAHMAN

In Partial Fulfillment Of The Requirements

For The Degree Of

BACHELOR OF INFORMATION SYSTEMS (HONS)

Faculty of Information and Communication Technology

(Kampar Campus)

JAN 2019

UNIVERSITI TUNKU ABDUL RAHMAN

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SIMPANG RENGGAM JOHOR   Supervisor's name

Date: _____8 April 2019_____   **Date**: _____8 April 2019_____

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DECLARATION OF ORIGINALITY

I declare that this report entitled "**METHODOLOGY, CONCEPT AND DESIGN OF TECHNOLOGY ASSISTED LEARNING COURSEWARE FOR BIOLOGICAL SCIENCE**" 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 : _____LIM HWA YAN_____

Date : _____8 APRIL 2019_____

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Finally, I must say thanks to my parents, my family and my friends for their love, who helped me a lot, give support and continuous encouragement throughout the project.

ABSTRACT

This project provides interactive educational courseware for Form 4 students in learning the biology subject. This project aims to develop a fun and interesting educational courseware for secondary school students. The main purpose of developing this project is to solve the problem that the students nowadays faced boring and complex content in the study of biology. In general, this project organizes information into categories and then integrate text, graphics, images, sound, animation, video and other media materials in both time and space, to integrating them and giving them interactive features. So that, to produce a variety of colorful multimedia application software products. The user interface is design to be more interactive than traditional, helping students learn and understand the course content. Therefore, by using this courseware, students have higher academic performance. This project consists of 5 Modules, which are Introduction Module, Experiment Module, Simulation Lab Module, Quiz Module and Mini Game Module. Furthermore, ADDIE model has been chosen as the project methodology for developing the courseware.

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LIST OF ABBREVIATIONS

PC	Personal Computer
UI	User Interface
ADDIE	Analysis, Design, Development, Implementation and Evaluation
RGB	Red, Green, Blue
3D	Three Dimensional
2D	Two Dimensional
GUI	Graphical user interface
B	Button
E	Exit
T	Text
AU	Audio
V	Video
A	Animation
MP3	MPEG Layer III Audio Encoding
WAV	Waveform Audio File Format
VAR	Value-Added-Reseller
JS File	JavaScript File

Chapter 1 INTRODUCTION

1.1 Introduction

This project is to study and review educational courseware in the current market about the pros and cons. In this project, we will study and review 5 similar courseware that are in the current market and we try to implement it into platform and make it more efficiency.

Nowadays, there are a lot of educational courseware has been created for students to improve their academic performance, courseware is constantly innovating to enhance the learning of students. Although there are numerous choices of educational software out there, but most of its just for PC (Personal Computer) only. This cause inconveniences to those who does not have a PC at home.

Furthermore, there are numerous problem such as inconveniences in learning biology science concept due to lack of accessibility to the software. To those secondary student who fail to grasp biology subject, they will face hardship to their next course. Furthermore, the teaching style of some teacher are too rigid and boring. This causes the students cannot learn well and to become less interested in this subject.

Therefore, the main purpose to develop this project is to ease the student in their learning, it will be developed by using multimedia authoring tools that integrates multimedia elements. Moreover, the courseware design is based on the largest interest of Form 4 and 5 student. The user interface is design to be more interactive than traditional User Interface (UI). Furthermore, ADDIE model has been chosen as the project methodology for developing the courseware.

1.2 Background

Biology is the science that studies the occurrence, development, structure and function of organisms, including plants, animals, and microbes. Biology also a part of natural science. The aim is to clarify and control life activities, transform nature, and serve practices such as medicine, agriculture and industry. It is the science that studies the function, behaviour, species, development, structure and origin evolution of various levels of biology and the relationship between living things and the surrounding environment. Nowadays, the influence of biology has breakthrough the above mentioned traditional fields and expanded to the food, chemical, environmental protection, energy and metallurgical industries. Human beings are also a kind of living thing and are also the object of biological research. Hence, the provision of technology assisted learning courseware has a good effect on learning biology teaching.

Multimedia technology is an information technology that integrates graphic and audio images. It has a good effect on biology teaching, can make biology teaching intuitive, improve students interest in learning, help students understand and grasp difficult points, and improve classroom knowledge. Moreover, content and classroom efficiency can foster student creativity. However, multimedia courseware also has some limitations. Teachers should use multimedia courseware in a timely manner to optimize their teaching.

1.3 Problem Statement

Below are the problem statements identified from the existing educational courseware in the current market.

1.3.1 The unappealing content in existing educational courseware.

There are some existing educational courseware, it was found out that are lack of innovation and boring（Ong, 2013）. This is due to a general misconception about courseware development. The development of courseware is not just about converting textbooks to electronic format. It is to create a different learning environment for students to enhance their interesting in learning. Normally, the contents of the courseware are similar to those found in normal textbooks. Consequently, the students seem uninterested

in these contents. That is why have to solve this problem, an interesting and innovative educational courseware will be developed for students.

1.3.2 The existing complex scientific theory.

To guide students to use scientific theoretical knowledge and to explore the underlying scientific concepts is also a major challenge in courseware design. Some of the students are not willing to explore the basic biology science concepts because they feel bored, difficult to understand and lack of interest. Every students learning style is based on different levels, some learning pace is slow and some cannot understand and catch up teaching methods from their teachers, they might be lost study confidence and interest in learning. For an example, the cellular of plant contains of many parts. Ordinary ways to present the plant cell is showing the whole component names and functions as a picture and label it to show. This problem can be overcome by using interactive element which is an animation and using technology as a learning tool (Ben McNeely 2018). By this, provide the help of multimedia elements such as sound instead of relying only on textbook.

1.3.3 The problem of a complex interface design in existing educational courseware

There are a lot of existing educational courseware do not have a user-friendly interface design for the students and the content lacks of motivational elements that to serve as usability strategies (Lyashenko, 2010). Most existing courseware failed to engage student in the learning process because some may looked as difficult to understand. This has caused the user have difficulties in using educational interface tool to guide their learning (Maj et al, 2007) and does not know where to click or where to go. Moreover, this has caused the students failed to be involved in the learning process because the GUI design have not been designed properly to guide them. Furthermore, ordinary courseware are too many buttons on a particular screen, but did not further explain each function. Besides that, the educational courseware available in the market are lack of sub functions. The developer may feel that it is not so important but actually they are useful for students. For an example, the users want direct to go next page by 1 click. However, the users have to go back to the main menu and choose the function that they want to perform. This is time-consuming and not exactly user-friendly. Besides that, some of the courseware do not provide help function to help user to solve their problem, cause users cannot solve the problem immediately.

1.4 Project Objectives

This interactive multimedia courseware aims to provide an effective learning platform for Form 4 students in learning the biology subject. This courseware is developed to help those students who want to start to learn and more understand biology subject. After going through the lessons provided by the courseware, the student will be at least gain a better understanding of the content in this biology subject and have easy access to knowledge. The main objective are further divided into three sub-objectives as follow:

1.4.1 To design an interesting courseware of the biology content to attract user attention.

Understanding how to effectively transfer the knowledge to user is critical in courseware development. So, the courseware have to first through all the content and request provide an interactive multimedia courseware to user that are easy to understand. By this way, users can more understand from the biology content on the part which they confuse to understand. From this learning process, can know well about how to design a courseware that is best suited for the target user because from this point, need think to know the weakness of the notes and student. This is done so that can design some aided method to help student to understand well on the content that is hard to understand using the conventional learning method.

1.4.2 To integrate multimedia elements into courseware to enhance students learning experience.

This courseware will be designed in an interactive manner and will add in some explanation, interesting video and some interactive animation that use for those title that is hard to understand, so that student can interact with it. Multimedia teaching is accommodated in the course teaching. With the development of technology, multimedia teaching as a supplement to improve academic efficiency. For an example, when showing the animation video about the adaption of leaf cell for photosynthesis or the human digestive system process, student can do observation to get more understand about each structure, function and process if they are not able to understand the assimilation of

nutrients or cross section of leaf for photosynthesis. Besides that, a few extra audio and introduction features will provided and student can choose among them**.**

1.4.3 To develop an user-friendly learning courseware for biology science students instead of using traditional learning ways.

Traditional learning biology content such as reference textbook, students usually feel less motivation and lost interested on learning biology because reference textbook are very boring to read. Another traditional learning such as getting a tutoring is not time-efficiency because students need to pay extra monthly fees to tutor and It does not necessarily help them to gain interest in learning. So, to design an user-friendly courseware to enhance students learning experience and which can saving their time of learning biology content instead of using traditional learning. Furthermore, can provide a free and different learning environment for those who like to learn biology.

1.5 Project Scope

The author is going to develop an interactive multimedia courseware. The author will combine the multimedia elements and the biology science learning together to provide another choice to students to learn and more understand about biology course. The courseware will show the basics lesson of biology, providing the way for secondary students to learn biology course. This courseware will be offline mode which means user no need able to access to internet to use the courseware. So users can use the courseware anytime and anywhere. Each part in this courseware has given different knowledge and assessment for the users. The courseware requires some modules to enable students to learn basic biology course. The following with figure 1.1 to show the project scope of the project. The modules included: Introduction module, stimulation lab module, experiment module, quiz module and mini game module.
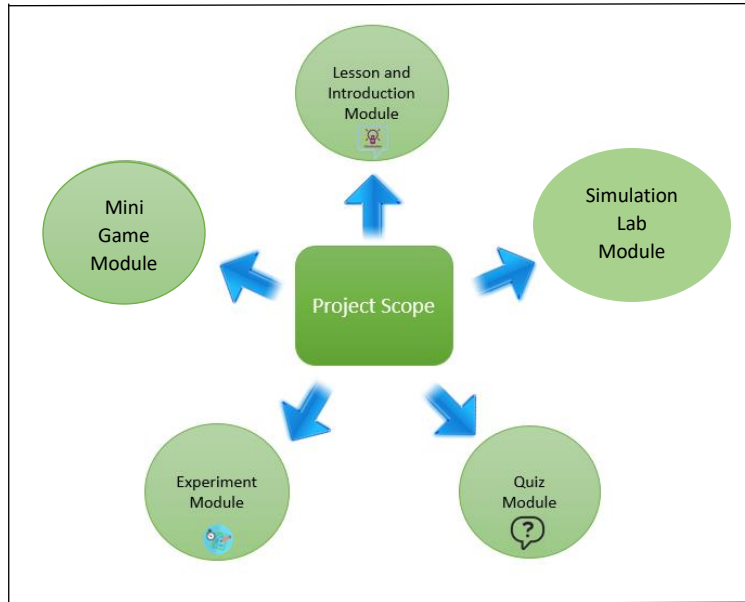
Figure 1. 1 Diagram Of Project Scope

1.5.1 Biology Lesson and Introduction Module

This module is to provide a set of lesson and basic introduction in order to guide beginner biology course students to understand biology science. This is very useful to secondary school biology science students, because some students usually do not know how to start up the lesson if they want to learn and understand biology. So, by this module, student can easily understand basic biology course and introduction by set of lesson tutorial. This module will show basic lesson and introduction such as, name, component, function, description, sub-chapter of nutrition and so on.

1.5.2 Simulation Lab Module

This module is to help students more understand biology course content, allowing users to enter the learning state before the course begins. Provide interactive features to enhance the attractiveness, increase the fun but also enhancing students learning initiative. In addition, provide audio features, courseware can make a sound teaching to help users understand the course content. By audio features, students can learn English in audio teaching but also better understand biology content by additional pictures. It can help students understand biology content with audio features and allowing students to start and end lesson with comfortable in the rhythm.

1.5.3 Quiz Module

This module is to provide some simple questions for users to test their understanding of the biology science after reviewing this interactive multimedia courseware. Understanding is the main objective for this biology interactive multimedia courseware, so user can test their biology knowledge on this quiz module. The quiz module will provides timing and scores for correct answers.

1.5.4 Experiment Module

This module will provide an experiment which is one of the most important part in scientific laboratory biology education. For an example, provide experiment testing for the presence of starch, reducing sugars, non-reducing sugars, protein and lipids in food samples for students to understand and do observation. Students can learned a lot of knowledge in playing during the experiment. Students can learn through observation, thinking, questioning, hands on, cooperation and expression to promote students observation, thinking, cognitive, hands-on and full improvement in expressiveness.

1.5.5 Mini Game Module

The author will to create a mini game that allows to entertain students during their studies. This mini game allows students to learn knowledge in a fun way and at the same time there is a higher chance that students will use this project as their revision material. The interactive maze game with question will be created.

1.6 Innovation of the Project

From the perspective of technology, none of existing courseware in market contains virtual reality element with hierarchical effects. By importing virtual effects elements into courseware, it will help to guide the student in their learning and help them to easily understand more about the contents. Moreover, they feel more interesting if the teaching is in virtual reality style. In addition, provide higher standard quality and a demonstration of vibrant. Provide pleasant sound effects into multimedia teaching courseware, give students a sense of novelty and inspire students interest. The most important is to improve user interface to be more friendly and convenient and should have higher graphic quality,

definition and instructions. It will help to ease the student in their learning and help them to easily understand more about the contents.

1.7 Target Audience

The main target audience of this project is focus on the form 4 students in secondary school and other learner who want to learn it. To combine the multimedia elements and the biology science learning together, providing the way for secondary students to learn biology course. This can help them to easily understand more about biology. Moreover, also provide some test section such as quiz test for them to try intentionally to have better understanding about the subject.

Chapter 2 LITERATURE REVIEW

2.1 Review on Similar Application

The author have done some research regarding existing biological educational courseware available. This five biological courseware are basically similar to what the author want to produce and can get some idea to produce a better biological courseware.

2.1.1 Nutrition – Balanced Diet

Figure 2. 1 **Balanced Diet experiment. (Michelle, 2014).**

This balanced diet interactive multimedia courseware (as shown in Figure 2.1), which was one another similar technology assisted learning for biology science. In this lesson plan, by providing food pyramids and nutritionally balanced introductions to investigate how source of nutrients required by the human body and understand that what food is easy to cause the imbalance of nutrient intake (Sandi, 2018). This courseware can help students understand how to match a variety of nutritious foods and so on. Use the multimedia courseware to introduce the Food Pyramid by layer and to understand the nutrition of the pyramid diet. The daily diet of humans contains seven major nutrients such as carbohydrates, protein, fat, minerals, fiber, vitamins and water (Heron, 2006). This courseware also introduce the food nutrition sources and intake reminders for each food pyramid stage one by one. (Michelle, 2014)

Strengths

The skills of operation is very simple, it can get more easy to understand and convenience to use for secondary school students, it is because all features will not be too complicated. Besides that, the use of color is very attractive to the users and is so interactive, such as the source food and image color and so on (Label 1). Furthermore, user interface design are interactive and colorful, not too confusing. Moreover, provide food guide pyramid with each level explanation to help users more clearly to understand the appropriate balanced diet. Lastly, mini games was provided that is course related and interesting.

Limitations

Firstly, this courseware has some limitation, such as the font color display is too dark and confuse, not attractive (label 2). Moreover, some of the features there did not provide tooltips function that could make students confuse with the use of some features. Furthermore, this interactive multimedia courseware have the biggest limitation is no audio teaching function provided. Besides that, animation and functionality are limited.

2.1.2 Nutrition – Nutrient content in food and leaves.
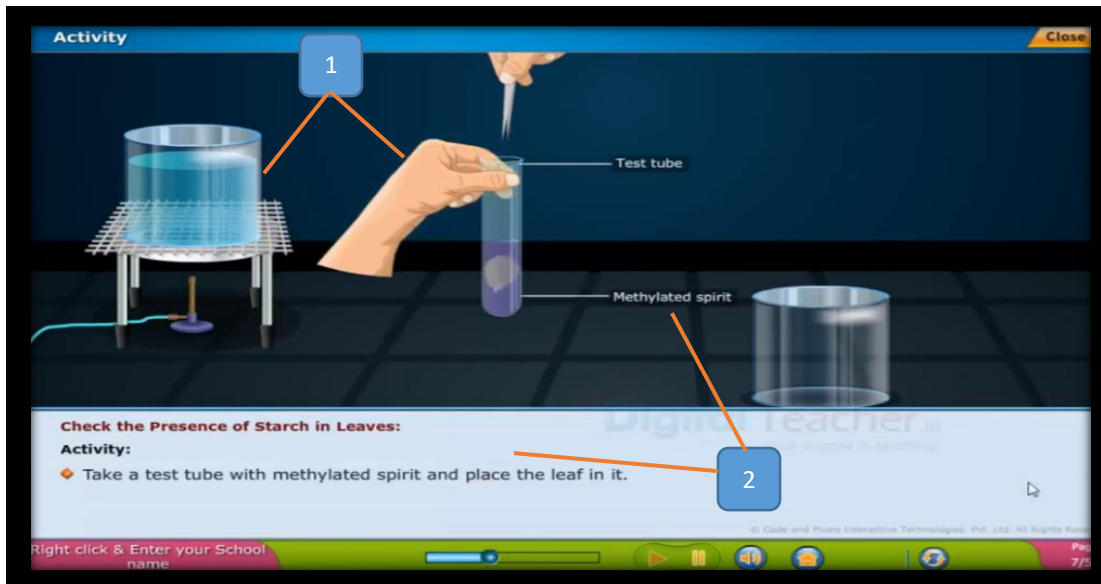
Figure 2. 2 Presence of starch in leave experiment. (Subha Eswaran, 2011).

This courseware (as shown in Figure 2.2) provide interactive testing for presence starch in leaf teaching method, it can helps students more understand in this lesson. In the leaves, excess glucose is rapidly converted to starch and the starch of the leaves is tested to show that photosynthesis has occurred instead of testing glucose. (Richard J, 2008). Design principles are based on student learning. (Bransford et al., 2000) Furthermore, this courseware to explain the sequence of major events that occur within a glucose that leads to starch (Subha Eswaran, 2011). In addition, this multimedia assisted instruction also allows students to understand how to reducing sugar is heated with Benedict solution, the reducing sugar reduces the blue copper sulphate in Benedict solution to form a brick-red precipitate of copper oxide. (Melissa Kelly, 2018)

Strengths

In this interactive multimedia courseware (as shown in Figure 2.2), 3D & 2D dynamic object was provided for use of observation (label 1). Besides that, the overall performance of testing for presence of starch in leaves was regularity and clearly. Furthermore, in expression experiment clearly provided every tool names, procedures and explanation, it make users convenient to use and understand (label 2). Moreover, this courseware also provide real image to show the color and process of the presence of starch in leaves, it help user get clearer understand to the topic. Lastly, interactive animation content are interesting with color and comfortable to use.

Limitations

The first limitation from this courseware is lack of background music, which makes some quiet. Moreover, it cannot be stopped in the audio teaching function. For example, when the user clicks on the next page or fast forward, the previous audio function will still playing, resulting in two sounds at the same time and causing confusion. Besides that, did not provide a basic introduction and explanation on this courseware, which may cause some students do not understand the topic and operation skill before start to use this courseware. Lastly, lack of basic teaching reminder, it causes the user to spend time understanding how to use and interact with this courseware.

2.1.3 Nutrition - Vitamins
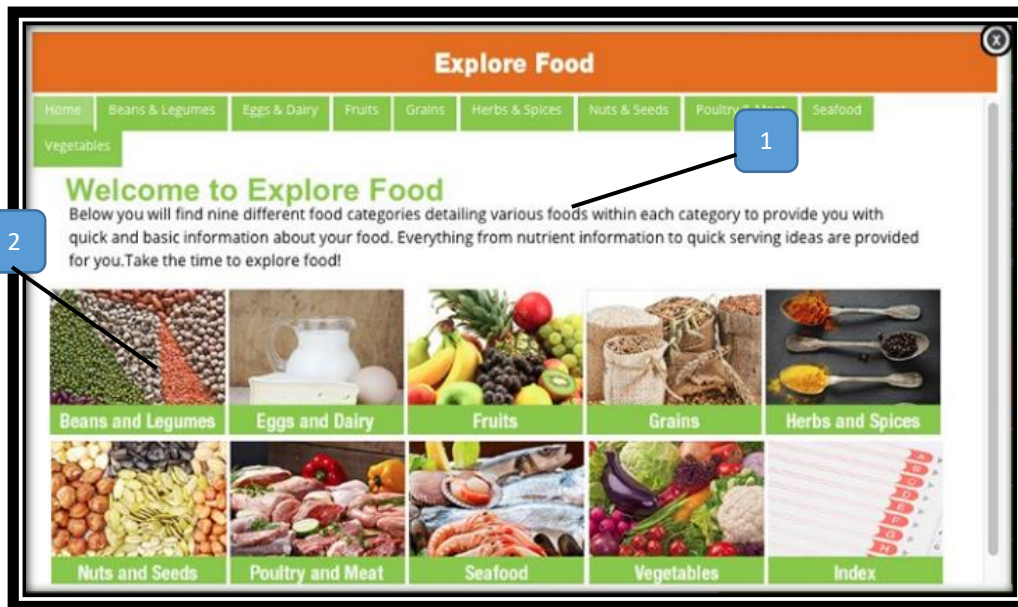
Figure 2. 3 Vitamins Lesson. (Vial's, 2011)

The content of this interactive multimedia courseware (as shown in Figure 2.3) is to use explore the importance, function and food source of vitamins and understand the symptoms of vitamin deficiency. To observe the presence of vitamin in the dietary sources, the nutrients depends on the vitamin requirements of the food. Furthermore, use this interactive teaching experiment to observe symptoms of deficiency caused by lack of different vitamin intake. (Vial's, 2011), understand the signs and symptoms of vitamin deficiency anemia and so on (mayo, 2016). Furthermore, through this interactive learning to understand the each vitamins function, advantage, names and get understand the main differences between the fat-soluble vitamins and water-soluble vitamins. (Moore, 2012)

Strengths

Firstly, this courseware had audio teaching function provided. When users clicked on every dietary sources food image, audio teaching function will start to simple introduce which vitamins are included in each source food and explain each name and its vitamin function. Furthermore, some interactive was provided, it very attractive to the user. Besides that, each source food provides a clearer description, function and introduction, which help users more understand in their learning (label 1). Lastly, interactive content are interesting, overall design with neat and comfortable to use.

Limitations

There are some limitation, since all images are composed of real images, there lack of design inspiration (label 2). The overall design is like using the presentation slide style, design is simple not attractive. Although this courseware is design to provide the knowledge of full aspect of the vitamins component, but it is without the unique inspiration design that can make user satisfied. Furthermore, lack of background music, which makes some quiet. Furthermore, lack of tooltips function and introduction manual. Moreover, limited interactive animation provided, it may cause the student feel bored in using the courseware.

2.1.4 Nutrition - Photosynthesis

Figure 2. 4 Photosynthesis experiment. (Diana Lopez, 2012)

This courseware (as shown in Figure 2.4) mainly enables users to understand the photosynthesis process through interactive learning. Through this fun assisted learning, users can learn more about leaf structure and understand the basic units that make up the structure and function of the photosynthesis. This courseware mainly describes the

discovery of photosynthesis, the pigment in chlorophyll, the process of photosynthesis and the significance of photosynthesis. (Davidson, 2004). The exploration of pigments in chlorophyll, through the extraction of chloroplast pigments in the experiment and separation that allows the user to personally see the appearance of yellow, blue-green and yellow-green from top to bottom.(Darcy S, 2011). Photosynthesis is the synthesis of light energy. It is a biochemical process in which plants, algae and certain bacteria react with light and carbon under visible light and use photosynthetic pigments to convert carbon dioxide and water into organic matter and release the biochemical process of oxygen. (Diana, 2012)

.**Strengths**

The first strength of this interactive multimedia courseware is there provides fast forward function, horizontal pull is fast forward, backward, vertical pull down is the size of the adjustment, strong decoding, special convenience to observe the photosynthesis process as they move across the leaf structure (label 1). Besides that, user interface is clean and comfortable, interactive animation is very interesting and design with neat and comfortable. Furthermore, provide a clear explanation, function, names and provide accessibility function to help users better understand (label 2). Lastly, background music was provided and features with audio explanation is very attractive.

Limitations

There are some limitation, firstly the content display screen design too small and no the full screen mode cause the user need to watch carefully (label 3). Furthermore, when fast forward speed, the picture will freeze in the specified position. Lastly, limited interaction is the biggest limitation in this interactive multimedia education learning.

2.1.5 Nutrition – Food Digestion
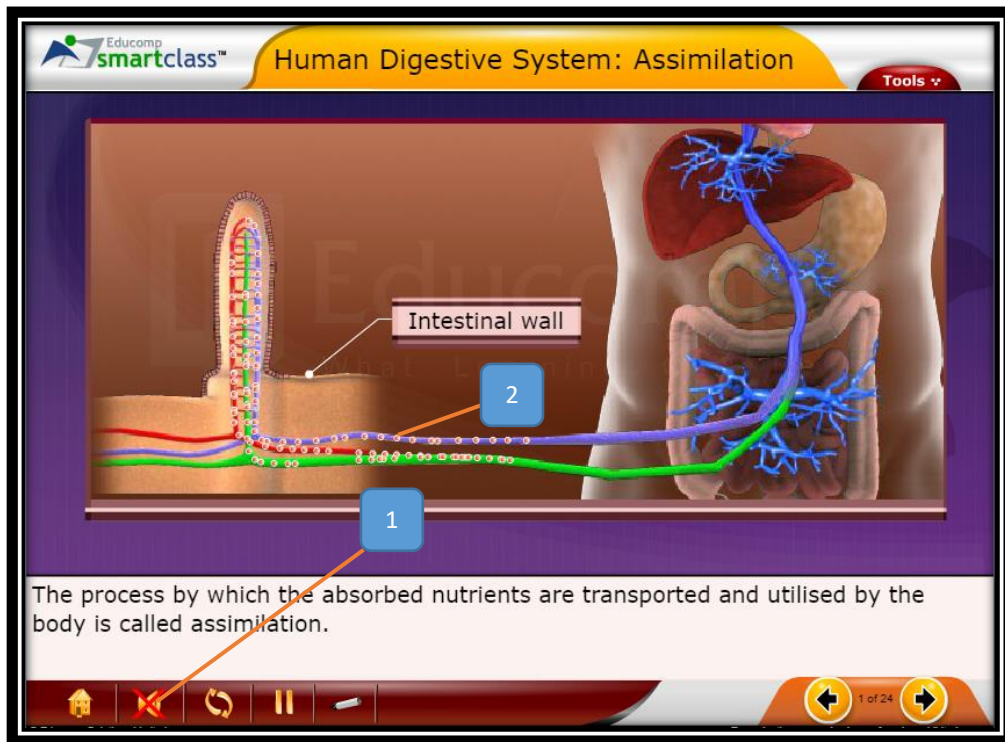
Figure 2. 5 Human Digestive System experiment. (Wilson, 2013).

This interactive multimedia courseware (as shown in Figure 2.5) is mainly to help users to learn from the human digestive system from intestine. The process by which absorbed nutrients are transported and utilized by the body is called assimilation. The blood in the villi is rich in simple sugars. the blood capillaries unite to form larger blood vessels, which in turn unite to form a large vein, the hepatic portal vein. this vein transports the sugar to the liver(Louis, 2011). Besides that, learn about human digestive system and understanding of villi and assimilation process through fun interactive teaching (Wilson, 2013). In addition, cognitive villi and vein function such as vein transport the sugar to the liver, understanding the glucose stored in the liver cell as glycogen (Hugh miller, 2018). Pancreas produces the hormone insulin, which converts glucose to glycogen. This glycogen is converted back into glucose by the liver and transported by the blood to the cells when the body is needed of energy and so on.

<u>Strengths</u>

The first strength in this courseware is the animation very interesting, it very attractive to user. Moreover, user interface is clean and comfortable, interactive animation is very interesting and design with neat and comfortable. In addition, during the process of vein transport sugar, it makes a sound that makes the user feel magical and interesting (label 1). Moreover, interpretation and guidance of glucose flow processes are also provided during explanation (label 2).

<u>Limitations</u>

There are some limitation such as lack of tooltips function, firstly some button maybe a little confusing because lack of button function introduction and some button do not allow manual display that causes the user do not understand the use of their features.

2.2 Comparisons of Similar Multimedia Applications (Comparisons Table)
2.2.1 Courseware Specification Comparison Table

Table 2. 1 Courseware Specifications Comparison Table

Multimedia application element	Balanced Diet	Nutrient content in food and leaves	Vitamins	Photosynthesis	Food Digestion
Interface Design (consistency)	YES	YES	YES	YES	NO
Navigation	NO	YES	NO	YES	YES
Colour	YES	YES	YES	YES	YES
User Friendliness (usability)	YES	YES	YES	YES	YES
Content (Richness resource)	YES	YES	YES	NO	YES
Interactivity	YES	YES	YES	YES	YES

2.2.2 Multimedia Element Comparison Table

Table 2. 2 Multimedia Element Comparison Table

Multimedia application element	Balanced Diet	Nutrient content in food and leaves	Vitamins	Photosynthesis	Food Digestion
Audio	2	4	3	5	4
Animation	2	5	2	4	5
2D & 3D	2	4	2	4	5
Text	2	5	4	3	3
Graphic	3	5	4	3	3
Video	1	4	3	3	3

*5 Very Satisfied   *4 Satisfied   *3 Neutral   * 2 Unsatisfied   *1 Very Unsatisfied

2.3 User Centered Approach

User centered is an approach of engaging and efficient user experience. (Jesse James, 2010). The user centered approach idea is very simple, the user must be considered in every step of developing the product. User centered approach can be described as a multi stage problem solving process and need to verify its assumptions by testing actual users in a real environment. (Jeffrey Rubin, 2016) The first is demand analysis, provide user analysis based on user requirements and design requirements. Moreover, propose user research reports and usability design recommendations based on analysis of target users usage characteristics, emotions, habits, psychology, and needs. The second is prototyping, which define effective features and interface specifications for courseware. Furthermore, create interactive design prototypes and provides design standard specifications for user interface and interaction design implementation.

The third is visual management, which makes the interface design more in line with user requirement and uses the user habits and standard layout to guide the implementation of functions correctly and effectively. The fourth is usability testing, which is used to observe what problems have occurred during the test, what features and operations the user likes or dislikes and so on. The last is follow up the investigation, accept feedback on courseware usage results. Based on the feedback and actual investigation and writing product feedback results according to the intended purpose, make changes and meet the satisfaction of the user requirements. It also includes accepting designs that are worthy of recognition and suggestions for modifications.

2.4 User Requirements Data Collection and Analysis
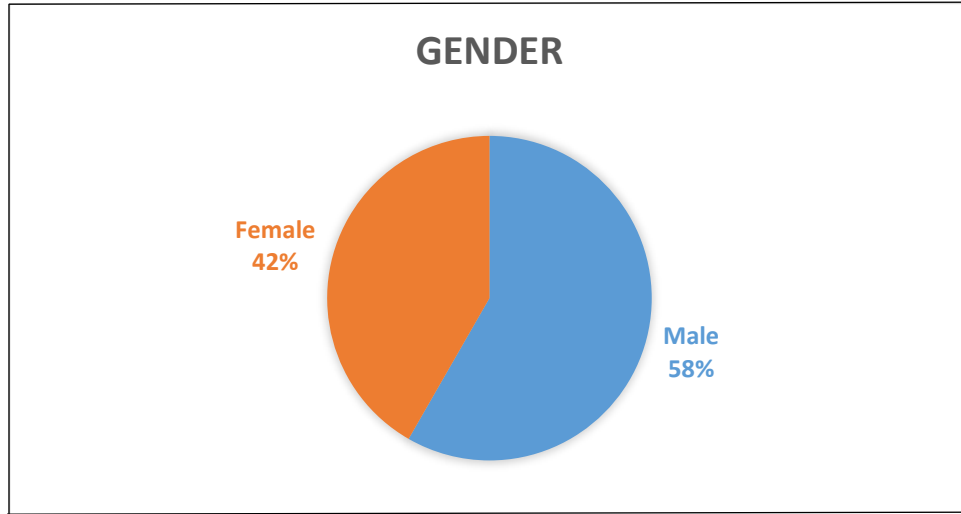
Figure 2. 6 Gender of Respondents

As refer to Figure 2.6, it can be identified that majority of the respondents are male, up to (58.3%), the female only (41.7%).
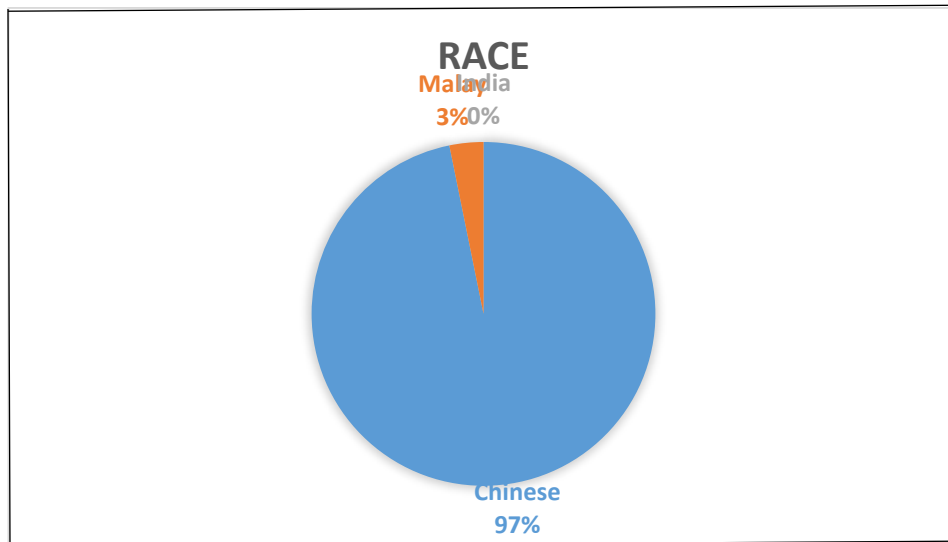
Figure 2. 7 Race of Respondents

As refer to Figure 2.7, it can be identified that majority of respondents are chinese (97.2%) and there are only few person are malay people (2.8%).

What are the problems faced when learning biology science? The following is the responses from respondents.

Have to invest money in learning new things.
A lot of term need to remember and its function.

Always forget where the organs located at.
Scientific terms.
Too many specific vocabulary.
Too difficult to remember.
Lack of practical experiment.
Difficult to recognize and remember the keyword for the biology.
Specific Term.
Too hard to understand.
Syllabus vary according to student education level.
Memorising.
Difficult words.
Difficult to understand the content.
Lack of animation.
Too complex.
Too difficult to understand.
Surgical Practice.
Looking for the most suitable information to meet the current depth of study.
Unable to memorize and understand theories.

Figure 2. 8 Respondents faced the problem when learning biology science

As refer to Figure 2.8, it can be identified that there are the many different problem faced by respondents when learning biology science.
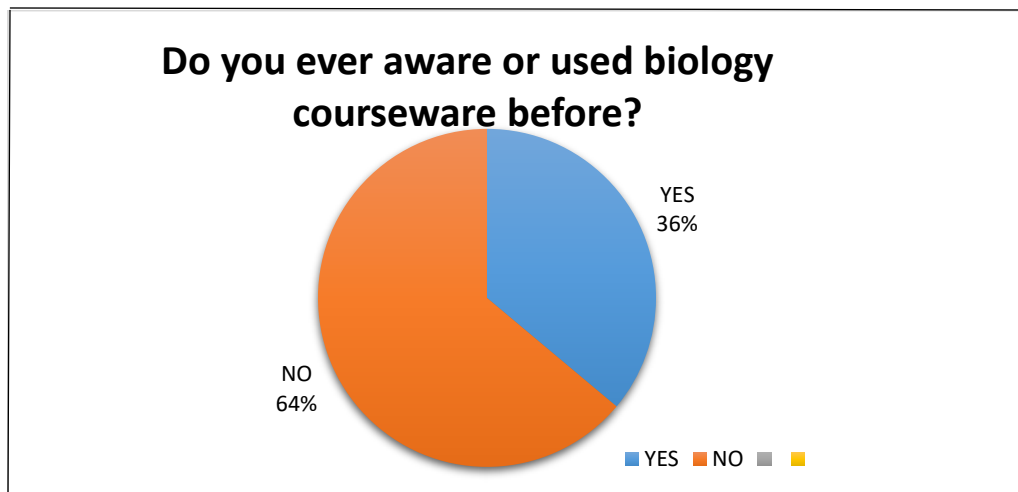
Figure 2. 9 The responses from users who aware or used biology courseware before.

As refer to Figure 2.9, it can be identified that up to (63.9%) of the respondents aware and used the biology courseware before, only a few of the rspondent (36.1%) did not aware.

If the biological courseware is introduced in the classroom, Do you think it is suitable to assist students learning?

Strongly Disagree 8%
Disagree 4%
Neutral 48%
Agree 22%
Strongly Agree 18%

Legend: ■ Strongly Disagree ■ Disagree ■ Neutral ■ Agree ■ Strongly Agree
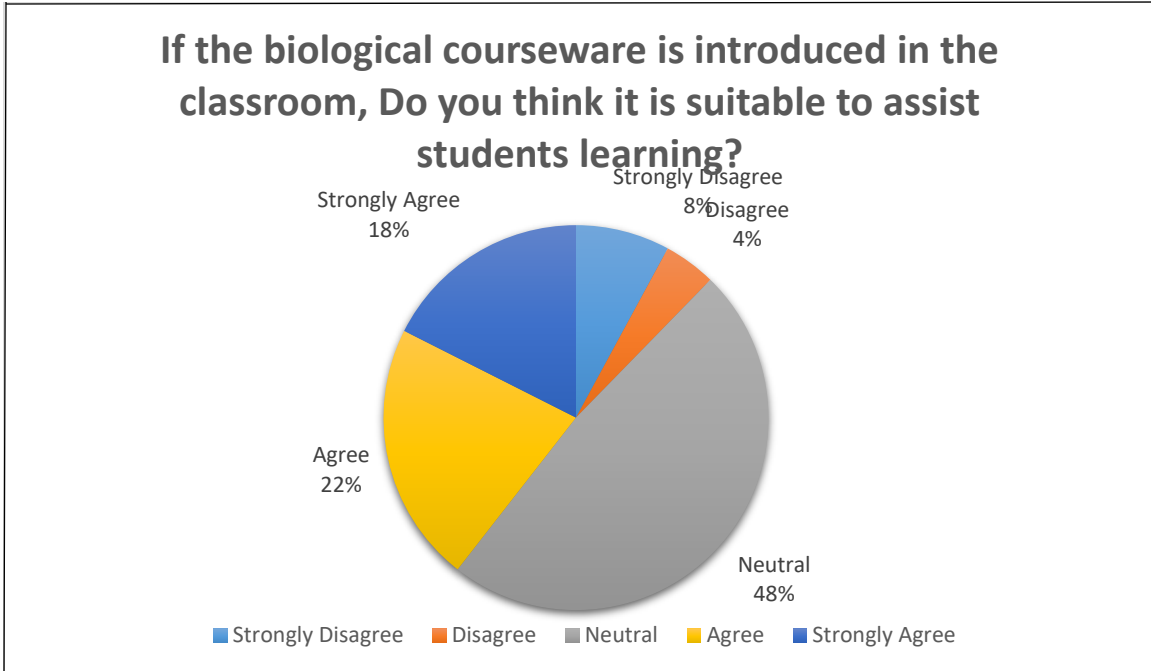
Figure 2. 10 The opinion of respondents on whether courseware that is suitable to assist students learning in the classroom.

As refer to Figure 2.10, it can be identified that up to 50% of respondents stay neutral on this, 22.7% agree on this and only 18.2% of respondents strongly agree that it is suitable to assist students learning.

The reason of the opinion given by respondents on whether the courseware assists the students learning.

Depend on the student interest, different student have different interest.
Interactive motivate student to use.
Reduce the student misunderstand of what teacher said.
Allows students having more understanding.
Biological courseware can be more attractive to student in learning the subject.
Not really understand what is biological courseware.
Student can understand more and easy to catch up.
People learn the basics at the beginning from surgerical practice before having a true Practical. Lack of resources while pros demonstrated the processes to learners.
Can learn the new thing.
Easy for student to learn and boost up their interest.

Figure 2. 11 The reason of opinion on whether courseware assist students learning.

As refer to Figure 2.11, it can be identified that the respondents provided the reasons for the selection according to Figure 2.10.
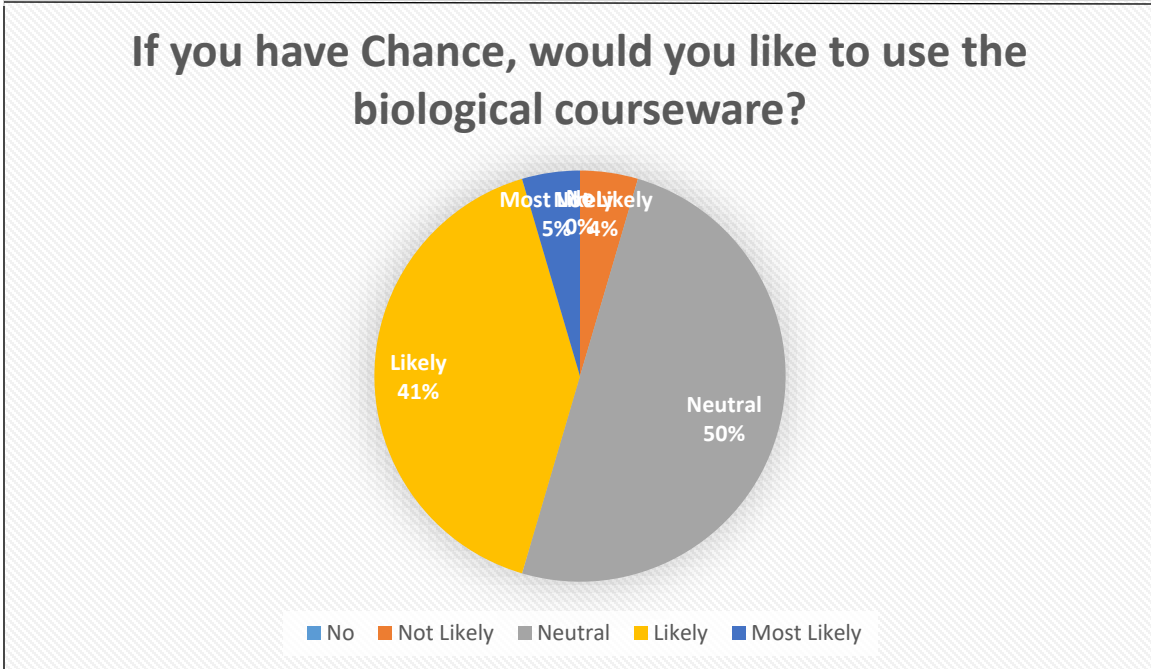
Figure 2. 12 The opinion of respondents on whether try to use the biological courseware.

As refer to Figure 2.12, it can be identified that up to 50% of respondents stay neutral on this, 40.9% of respondents likely to try and the remaining 9.1% are most likely and not likely to try.

The reason of opinion given by respondents on whether try to use the biological courseware.

More likely to study by myself.
More fun.
Improve learning efficiency.
I will more interest and understand about the subject in the class.
Enhance the interaction of the lecturer and the students.
I am Interested.
Try and learning some new things.
Easy.
May try.
I am willing to try, to improve my good performance.

Figure 2. 13 The reason of opinion on whether try to use biological courseware

As refer to Figure 2.13, it can be identified that the respondents provided the reasons for the selection according to Figure 2.12.
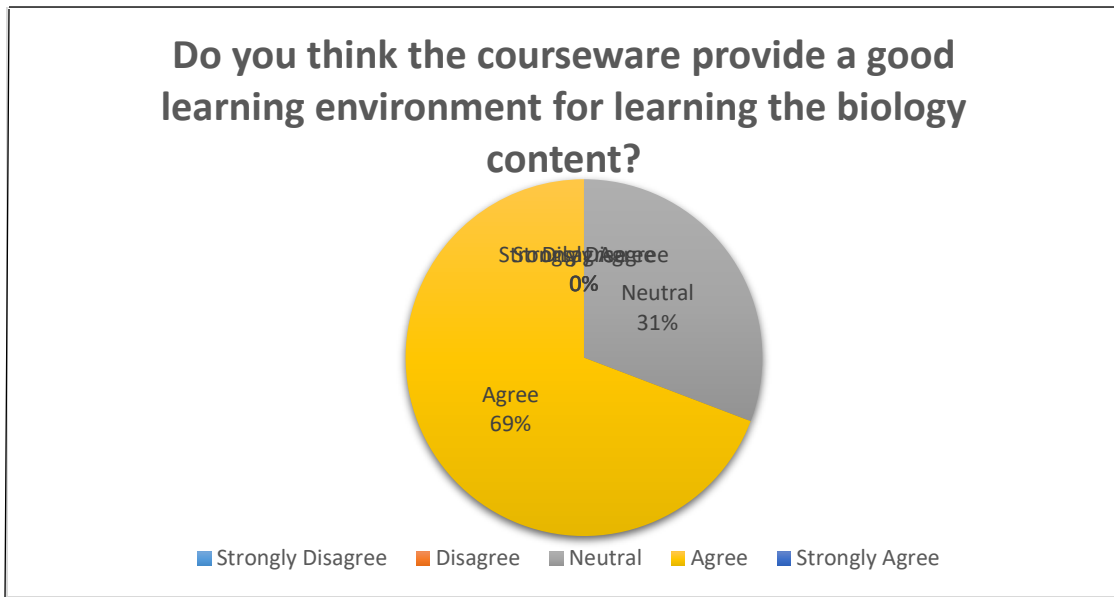
Figure 2. 14 The opinion of respondents on whether courseware provide a good learning environment.

As refer to Figure 2.14, it can be identified that up to 69.2% of respondents agree that courseware provide a good learning environment, the remaining of 30.8% stay in neutral.
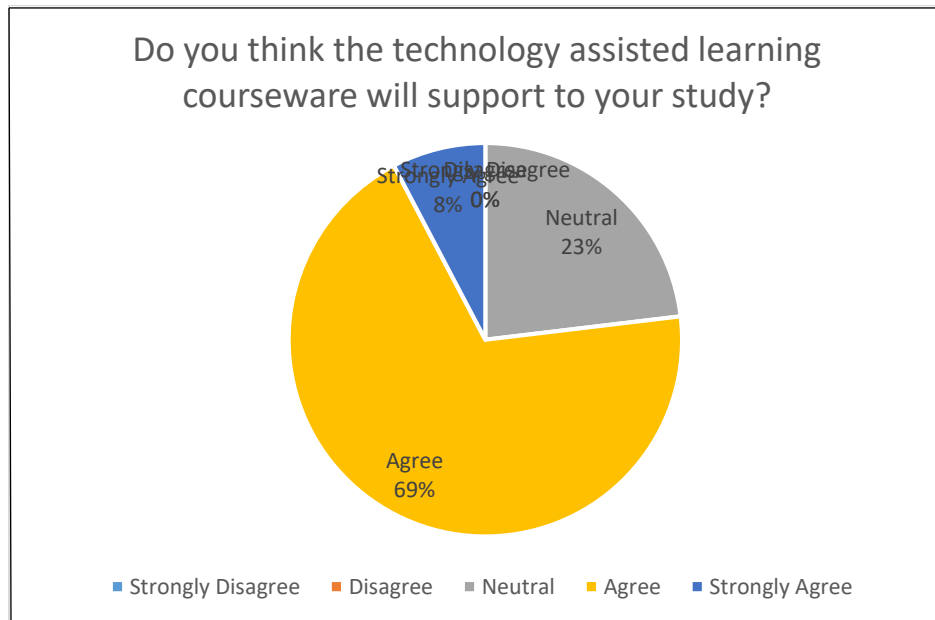
Figure 2. 15 The opinion of respondents on whether courseware will support to study.

As refer to Figure 2.15, it can be identified that up to 69.2% of respondents agree that learning courseware will support to the study, 23.1% stay in neutral and only 7.7% of respondents strongly agree on this.

Do you think the courseware can help you to understand biological content better than the existing traditional learning method?

8% 0%

31%

61%

■ Strongly Disagree ■ Disagree ■ Neutral ■ Agree ■ Strongly Agree
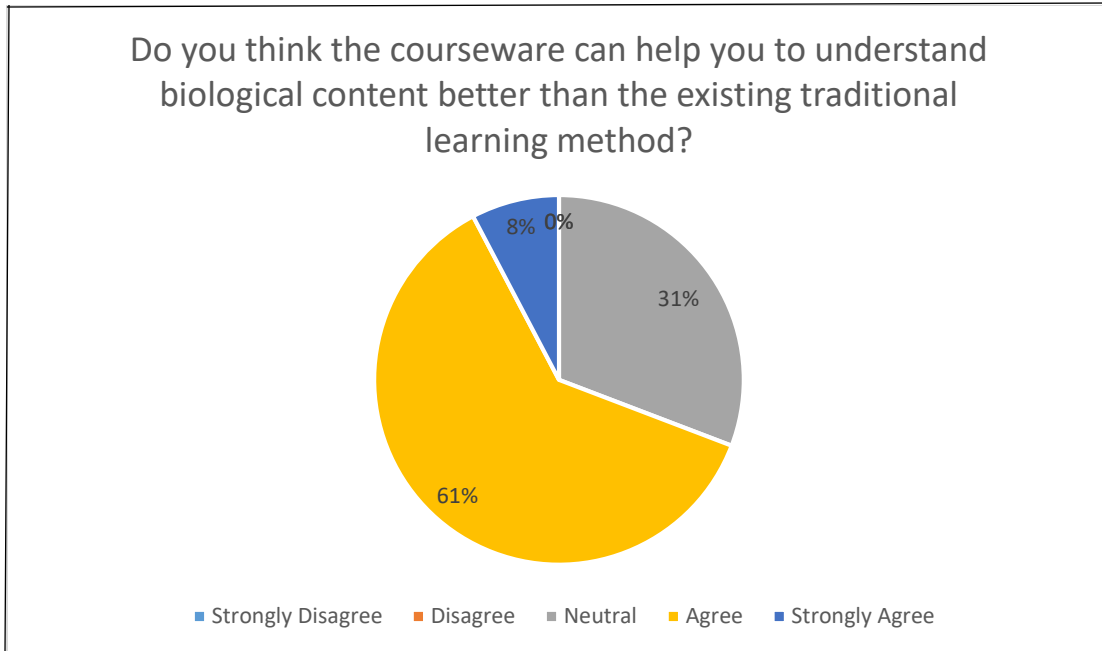
Figure 2. 16 The opinion of respondents on whether study using courseware better than traditional learning method.

As refer to Figure 2.16, it can be identified that up to 61.5% of respondents agree courseware that can help more understand biological than traditional learning method, 30.8% stay in neutral and only 7.7% of respondents strongly agree on this.

Respondents evaluate the multimedia performance of the existing courseware used before.
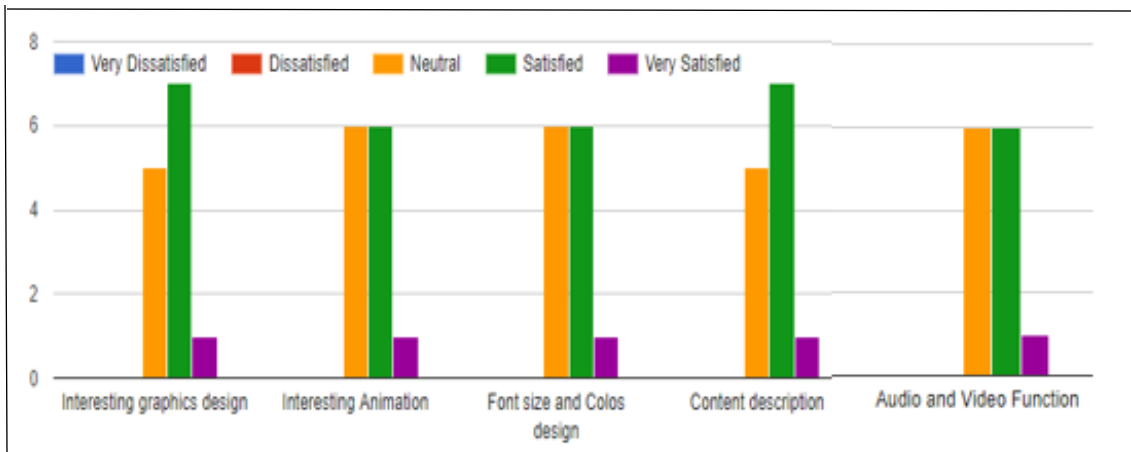
Figure 2. 17 Multimedia Performance

As refer to Figure 2.17, it can be identified that respondents evaluated a multimedia performance of the courseware that they had used before. Including, interesting graphic design, interesting animation, font size and colors design, content description, audio and video function.

Respondents provide any thoughts on how to improve the quality of biological courseware. The following is the responses from respondents.

Make more fun.
Provide clearer content for users.
Make a video to explain the process that difficult to understand.
Make some animation to attract users.
More practical.
May add on biology dictionary on side of the page, which may help user in unknown words, especially biological terms.
better to provide more audio and video function, for easy to understand
Must have subtitles. As biology is a complex thing so we might hard to catch up with only audio and animation.

Figure 2. 18 The suggestion of respondents to improve quality of biological courseware

As refer to Figure 2.18, it can be identified that the respondents provided a lot of suggestions to improve the quality of biological courseware.

Chapter 3 SYSTEM DESIGN
3.1 Overview

The chapter discusses about the system design and each motivation for this educational courseware. The project is an interactive multimedia educational courseware aim to provide an effective learning platform for Form 4 students in learning the biology subject.

3.2 System Requirements
3.2.1 Software Requirements

Table 3. 1 Software Requirement with Multimedia Elements.

Multimedia Elements		Software
Audio		• Adobe Audition CC, Google Translate
Animation	2D	• Toon Boom Harmony 2018, Adobe Flash
	3D	• Autodesk's official CG community, Adobe Flash
Text		• Microsoft Word 2013, Adobe Flash
Graphic		• Adobe Photoshop CC, GIMP, Adobe Indesign
Video		• Filmora, iMovie, Movie Maker, Adobe Flash
Authoring Tool		• Adobe Director 12, Adobe Flash CS6

3.2.2 Hardware Requirements

Table 3. 2 Hardware Requirement for Multimedia Application.

No	Hardware	Minimum Requirement	Optimal Requirement
1	Platform	Windows 7	Windows 8, Windows10
2	Processor	1GHz Intel® Core™ i5	2.59GHz Intel® Core™ i7
3	Number of Cores	Dual-Core	Quad-Core
4	Memory	4GB RAM	8GB RAM

3.3ADDIE Model

The ADDIE model is basically a method of systematically developing teaching. (Ed Forest, 2018). Mainly include the formulation of learning objectives, the use of learning strategies and to judge the learners have reached learning effectiveness. The ADDIE model are used by the developers and trainers to ensure the trainee gains the knowledge and skills needed for the job and course development become efficient. The ADDIE model is divided into five stages: Analysis, Design, Develop, Implement and Evaluate. Contain following phase:

Figure 3. 1 The process of ADDIE Model

3.3.1 Analysis

During analysis, the developer must determine the perceived needs and prove the actual needs, learner need, existing knowledge, objectives and any other relevant characteristic (David L, 2014). Developer should analyze learner expectations and needs for courseware before developing courseware for learners, use the analysis to reach a consensus between the curriculum designer and the learner.

In this phase, the author project is about biology science lesson, to help students more understand about biology contents. So the learner will be those secondary school form 4 students. The author cannot analyze every characteristic of each learner, but there are several factors that are crucial to making good projects and decisions. In this phase, the author have to identify the existing problem, provide a solution and innovation, to define objectives and user requirements. For an example, determine the problem in an existing courseware and collect information about learner needs and expectation of the courseware through survey and interview. Hence, can determine what should do that to achieve learner needs and expectation at next project development. Moreover, to determine user

requirements by providing survey questionnaire to users, understanding user needs and design analysis, improving existing courseware and making improve based on user suggestions to meet the satisfaction of the user requirements

3.3.2 Design

After identify the existing problems and solution, the author can start to design the courseware. Design phase is the process of identifying, specifying, research and planning. In this phase, the content usability, visual design, the storyboarding of the learning objects, objectives, planning, prototyping, delivery options and topic content are also specified (Takis, 2018). The design phase should be systematic and specific. The design mean is a purposeful creative behavior, developing and evaluating a set of planning strategies to achieve project goals. Graphical user interface (GUI) and content are determined at this stage. This means that developers should study how to design courseware that is helpful to learners and how to develop user friendly educational courseware.

In this phase, the author should start to design the initial interface of the courseware. Moreover, to analyze the interface strength and limitations of the existing courseware on the market. Then, try to design something more attractive and useful than the current courseware and add it in proposed courseware. The author will try to consider what kind of technology and tools used to develop educational courseware. Moreover, author can build storyboards and design system flow diagram and then build the results of wireframes, prototypes, and designs to convey the design of the entire courseware. All research, design and solutions are based on real users that will target people as "target users" based on their performance, reflection and feedback. In order to make the courseware better, the author must understand the operating mechanism of the courseware, understand what the user thinks. Hence, the storyboard is the key to all of this.

3.3.3 Development

The development phase begins with production and test the method used in the project (Ed Forest, 2018). The main point of the development phase is to develop methods and processes for creating teaching materials. During the development phase, developers create and integrate the content built during the design phase. The development of content and learning materials based on the Design Phase.

In this phase, the author will start to develop the educational courseware that the author proposed after finish the analysis phase and design phase. After finish developing the courseware, the author continue move to next implementation phase. Furthermore, the author will develop the prototype, which will display the main functions and interfaces of the courseware to the user through rapid development and production, and timely solicit user comments to unambiguously identify user needs.

3.3.4 Implementation

The main key point in the implementation phase is to develop the project implementation procedures and continuous modification to make sure maximum efficiency and positive results are obtained (Ed Forest, 2018). Before the official implementation of the project, pilot testing is require. The developer must identify the implementer such as students and let learners know about the project. After identifying, the effectiveness of the training materials is evaluated. During this phase, the developer will verify and ensure that all technical tools are in normal working condition.

In this phase, the author will invite some students who is learning biology science subject, work on integration and allowing implementer to test the courseware that the author proposed. Projects are modified and enhanced based on feedback.

3.3.5 Evaluation

Among all the key elements of the courseware design process, the establishment of evaluation is the most representative value in the entire process and it is also the most knowledgeable step. The evaluation phase consists of two parts which are formative assessment and summative assessment (Ed Forest, 2018). Formal assessments are conducted at each stage of the ADDIE process and summative assessments are usually performed after the implementation of several projects.

After going through Implementation phase, the author will ask for their comments to see whether the courseware is helping them in learning and save time in learning the same content compare with the existing courseware. If the implementer provides some comments or suggestion that could be improved, the author will to make it become more complete application.

3.4 System Flow Diagram
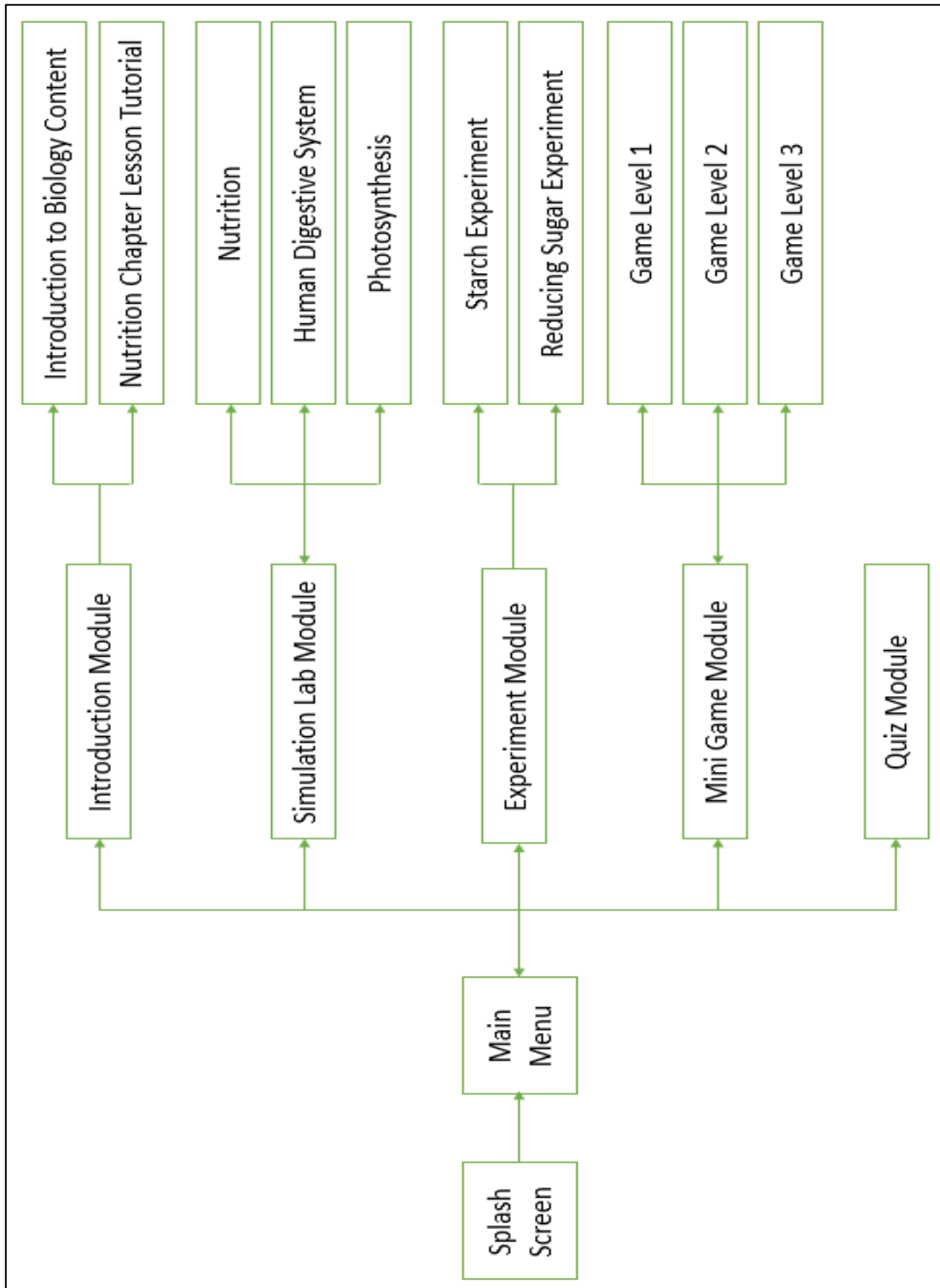
Figure 3. 2 System Flow Diagram

3.5 Storyboarding Design
3.5.1Main Menu

```
┌─────────────────────────────────────────────────────────┐
│                           T1                            │
├─────────────────────────────────────────────────────────┤
│  ┌──────────────┐                                       │
│  │     B1       │                                       │
│  └──────────────┘                                       │
│   ┌──────────────┐                                      │
│   │     B2       │                                      │
│   └──────────────┘                                      │
│  ┌──────────────┐               G1                      │
│  │     B3       │                                       │
│  └──────────────┘                                       │
│    ┌──────────────┐                                     │
│    │     B5       │                                     │
│    └──────────────┘                                     │
│      ┌──────────────┐                                   │
│      │     B4       │                                   │
│      └──────────────┘                                   │
└─────────────────────────────────────────────────────────┘
```
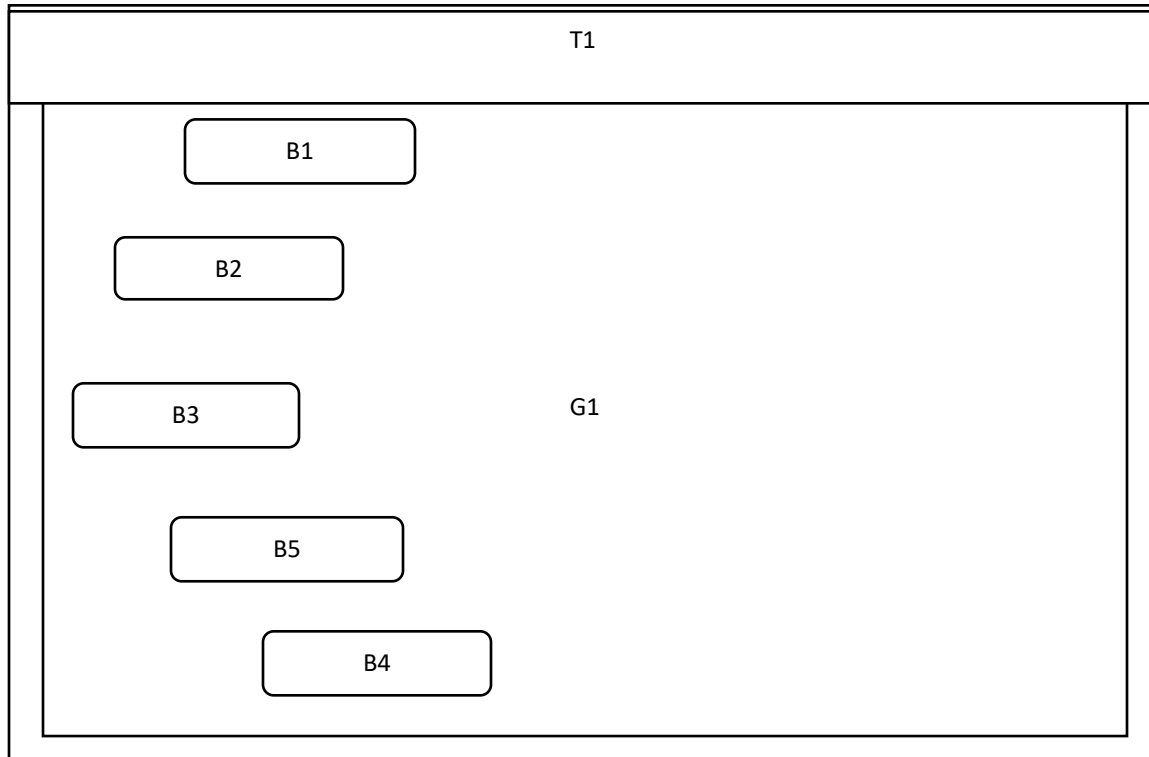
Figure 3. 3 Main Menu Storyboard Design

B = Button, T = Title, G = Graphic

Table 3. 3 Main Menu Description Table

Element	Description
B1	"Introduction" button, A link that will bring audience to the introduction module, users can get understanding of the basic biology knowledge by set of lesson tutorial.
B2	"Simulation Lab" button, A link will bring audience to the simulation lab module, users can get more understanding the of the nutrition chapter by interactive function.
B3	"Experiment" button, A link will bring audience to the experiment module, this module will provide experiment function testing for presence in food samples, that allow users to understand and do observation.

B4	"Quiz" button, A link will bring audience to the multiple quiz module, will provide some simple questions for users to test their understanding of the biology science after reviewing this interactive multimedia courseware.
B5	"Mini game" button, A link will bring audience to the mini game module, allows users to learn knowledge in a fun way. For an example, provide maze mini game with 3 different level.
T1	Title for this courseware. For an example, welcome to interactive biology courseware.
G1	Display background image course related biology science.
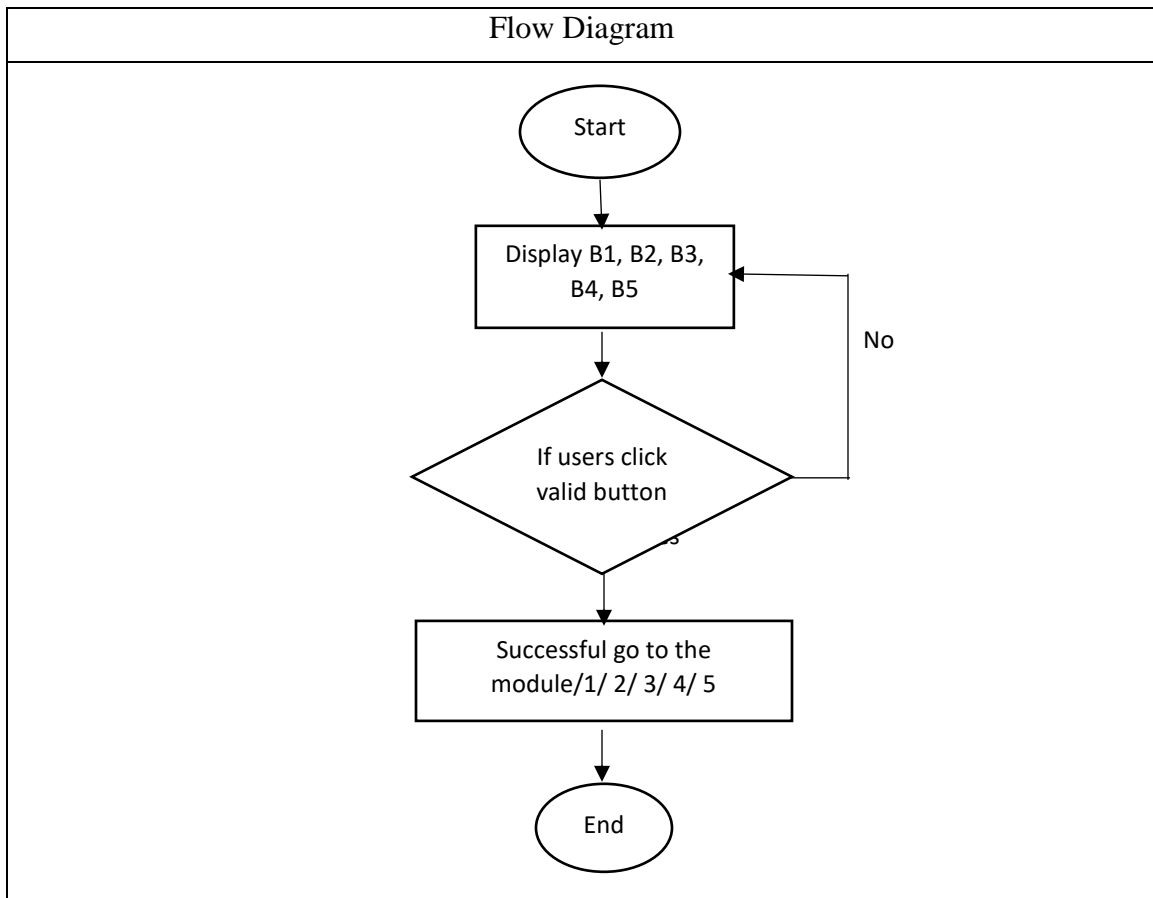
Figure 3. 4 Main Menu Flow Diagram

3.5.2 Quiz Module
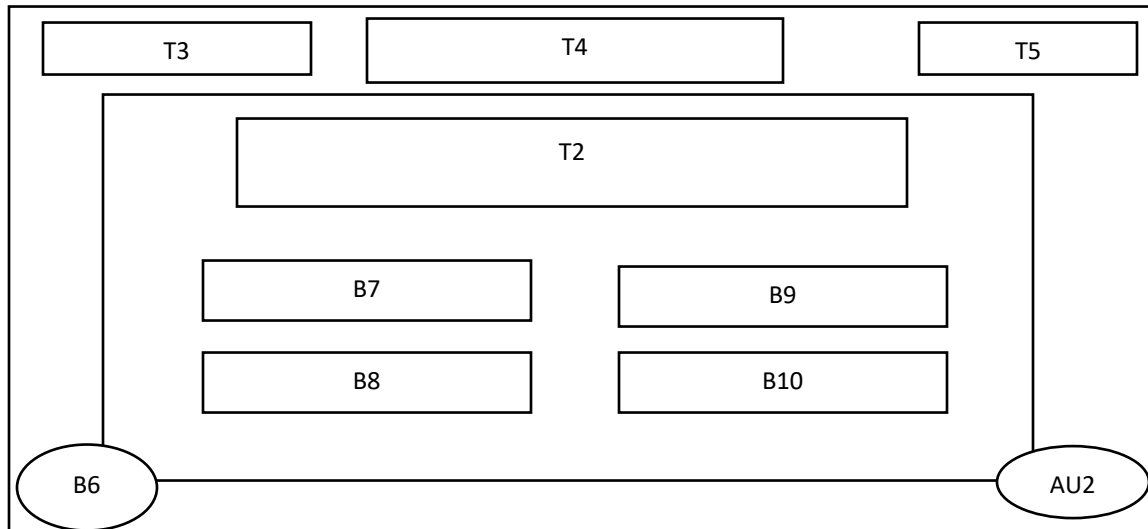
Figure 3. 5 The Quiz Module Storyboard Design

B = Button, E = Exit, T = Text, AU = Audio,

Table 3. 4 Quiz Module Description Table

Element	Description
B6	"Back" button, A link that will bring audience back to the main menu.
B7	"Answer 1" button, multiple quiz answer provided for users to select.
B8	"Answer 2" button, multiple quiz answer provided for users to select.
B9	"Answer 3" button, multiple quiz answer provided for users to select.
B10	"Answer 4" button, multiple quiz answer provided for users to select.
T2	Simple question provided that are course related with biology science, to test users understanding after reviewed this courseware.
T3	Provide time counting function during the test.
T4	"Quiz Platform" module title display.
T5	Answer progress remind. For an example: 4 of 10 Questions
AU2	Audio volume button, allow users to adjust the volume of the background music.
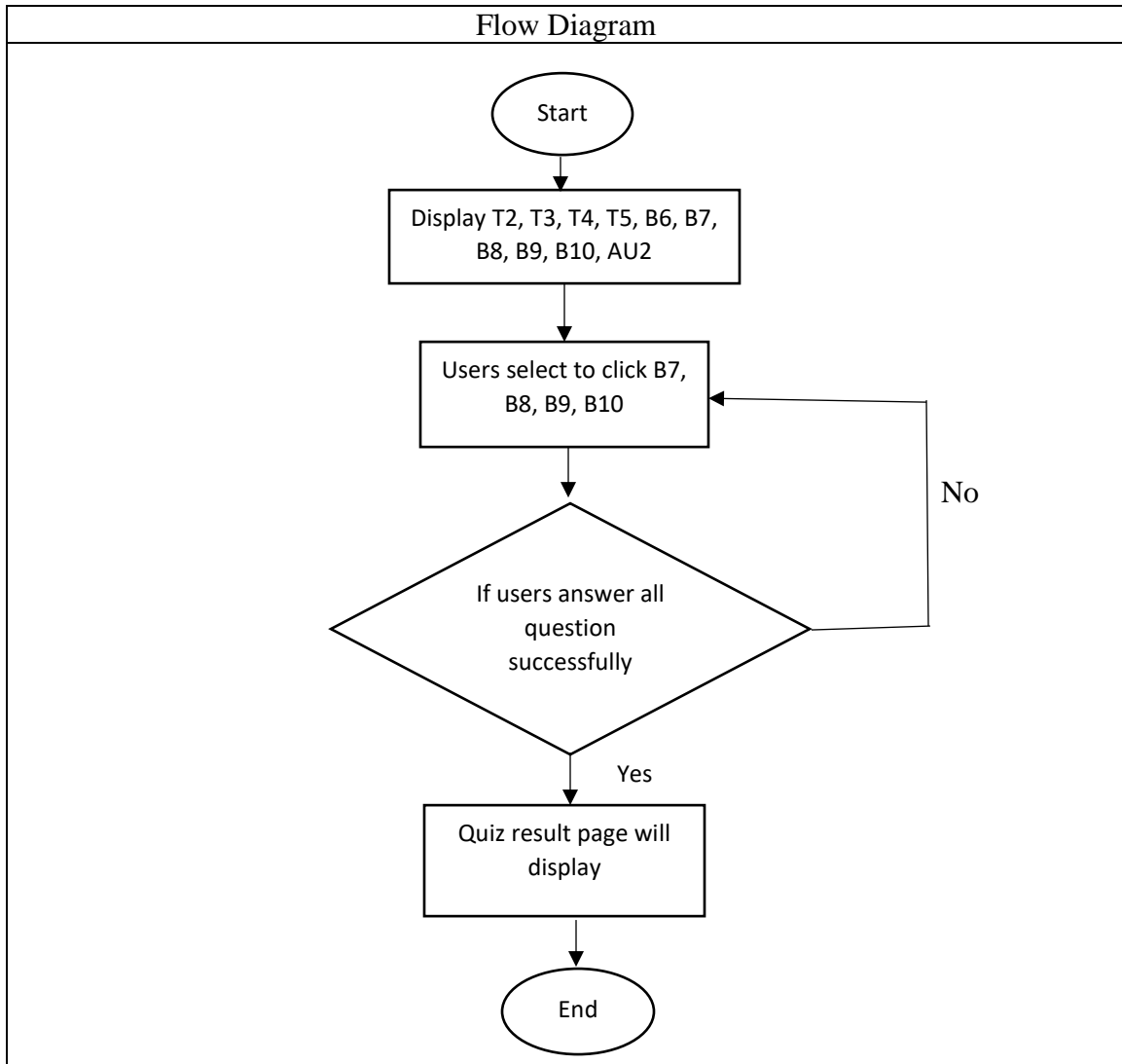
Flow Diagram

Figure 3. 6 Quiz Module Flow Diagram

3.5.3 Experiment Module

Figure 3. 7 Experiment Module Storyboard Design

B = Button, T = Text, AU = Audio, V = Video, G = Graphic

Table 3. 5 Experiment Module Description Table

Element	Description
B11	"Boiling 5 min" button, a interactive button, link that will bring audience go to the result of boiling the liquid 5 minutes.
B12	"25'c" temperature button. A temperature button for user to select to do the experiment and do observation the process presence of starch reducing sugar. Interactive effect display
B13	"50'c" temperature button. A temperature button for user to select to do the experiment and do observation the process presence of starch reducing sugar. Interactive effect display
B14	"75'c" temperature button. A temperature button for user to select to do the experiment and do observation the process presence of starch reducing sugar. Interactive effect display
B15	"100'c" temperature button. A temperature button for user to select to do the experiment and do observation the process presence of starch reducing sugar. Interactive effect display
T7	Display the title of the experiment, for an example, iodine solution test for starch in food.

T8	Experiment page display, allow audience use to do experiment and do observation. For an example, included any experiment tool and reagent solution given.
T6	Explain the testing for the presence of starch, reducing sugar, non-reducing sugars, proteins and lipid in food samples process and provide description.
B16	"Back" button, A link will bring the audience go to the experiment module main menu.
AU3	Audio volume button, allow users to adjust the volume of the background music.
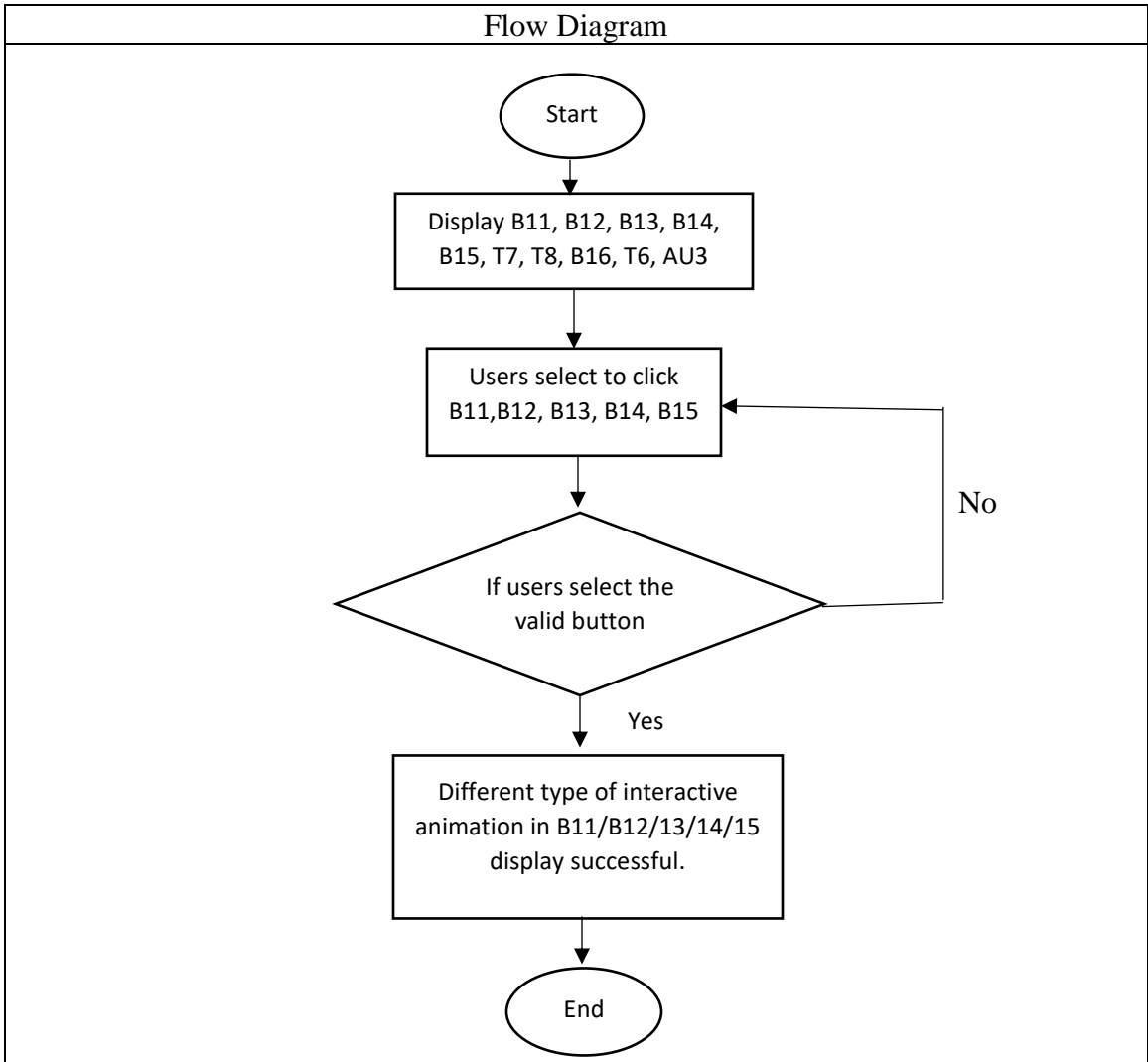
Flow Diagram

Figure 3. 8 Experiment Module Flow Diagram
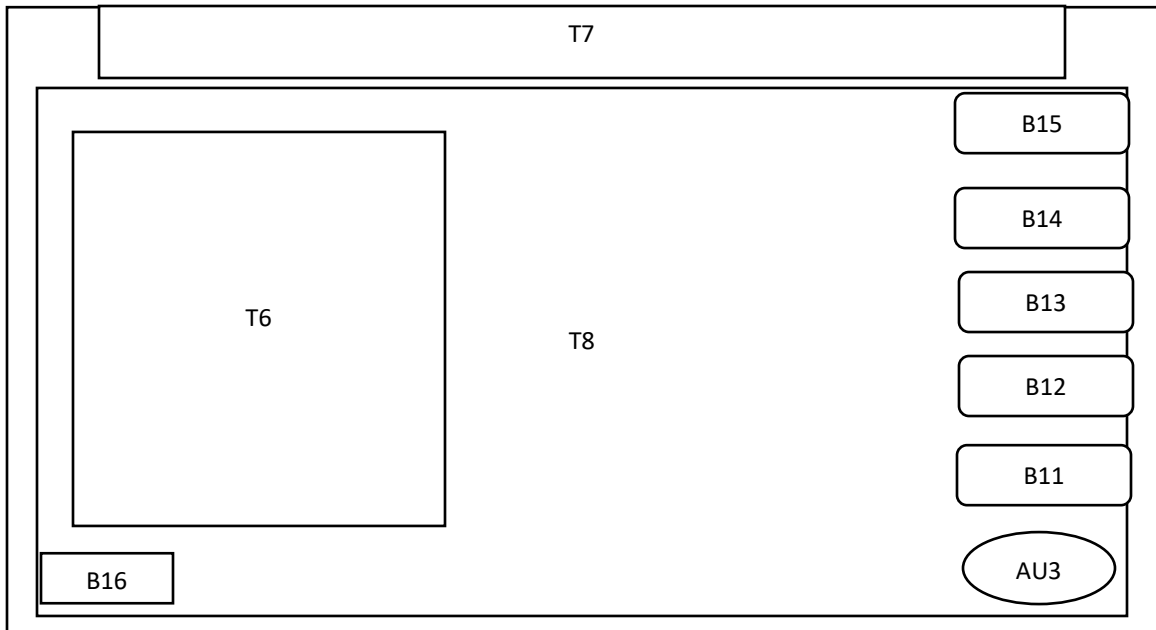
3.5.4 Introduction Module
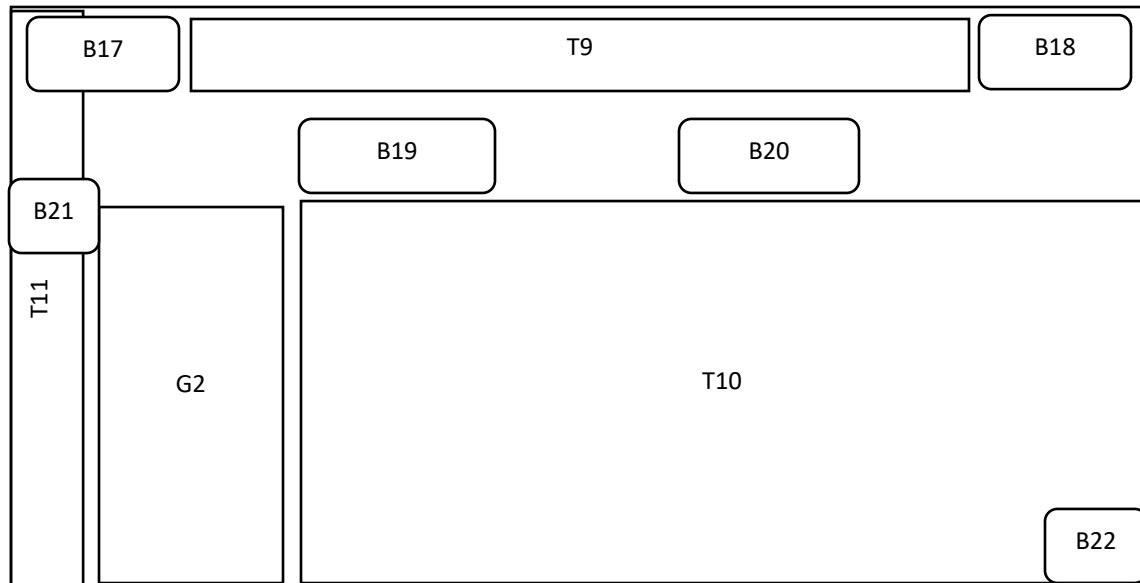
Figure 3. 9 Introduction Module Storyboard Design

B = Button, T = Text, AU = Audio, V = Video, G = Graphic

Table 3. 6 Introduction Module Description Table

Element	Description
B17	"Back" button, A link that will bring audience back to the main menu of introduction module.
B18	"Home" button. A link that will bring audience back to the main menu.
B19	"Lesson" button. Navigation link to introduction to nutrition chapter content, some pictures and type also provided.
B20	"Lesson" button. Navigation link to nutrition content, some definition and function also provided.
B21	"Video" button, that allow audience to watch video to learn the sub0chapter content.
B22	"Back" button, A link that will bring audience back to the main menu of sub-chapter.
T9	Title for this module. For an example "6.1 Type of the Nutrition- Autotrophs".
T10	Content description and explanation.
T11	Title for this module. For an example "Type of Nutrition".

G2	Display graphics course related to the chapter.

Flow Diagram

```
                    ┌─────────┐
                   (  Start   )
                    └────┬────┘
                         ↓
              ┌──────────────────────┐
              │ Display B17, B18, B19,│
              │ B20,B21,B22, T9, T10, │
              │      T11,G2           │
              └──────────┬───────────┘
                         ↓
              ┌──────────────────────┐
              │  Users select to click│◄──────┐
              │      B19, B20         │       │
              └──────────┬───────────┘       │
                         ↓                    │
                    ╱─────────╲               │
                   ╱ If users   ╲         No  │
                  ◄ click the valid ►─────────┘
                   ╲  button    ╱
                    ╲─────────╱
                         ↓ Yes
              ┌──────────────────────┐
              │Content of the introduction│
              │ module in B19/20 display  │
              │      successfully.        │
              └──────────┬───────────┘
                         ↓
                    ┌─────────┐
                   (   End    )
                    └─────────┘
```

Figure 3. 10 Introduction Module Flow Diagram
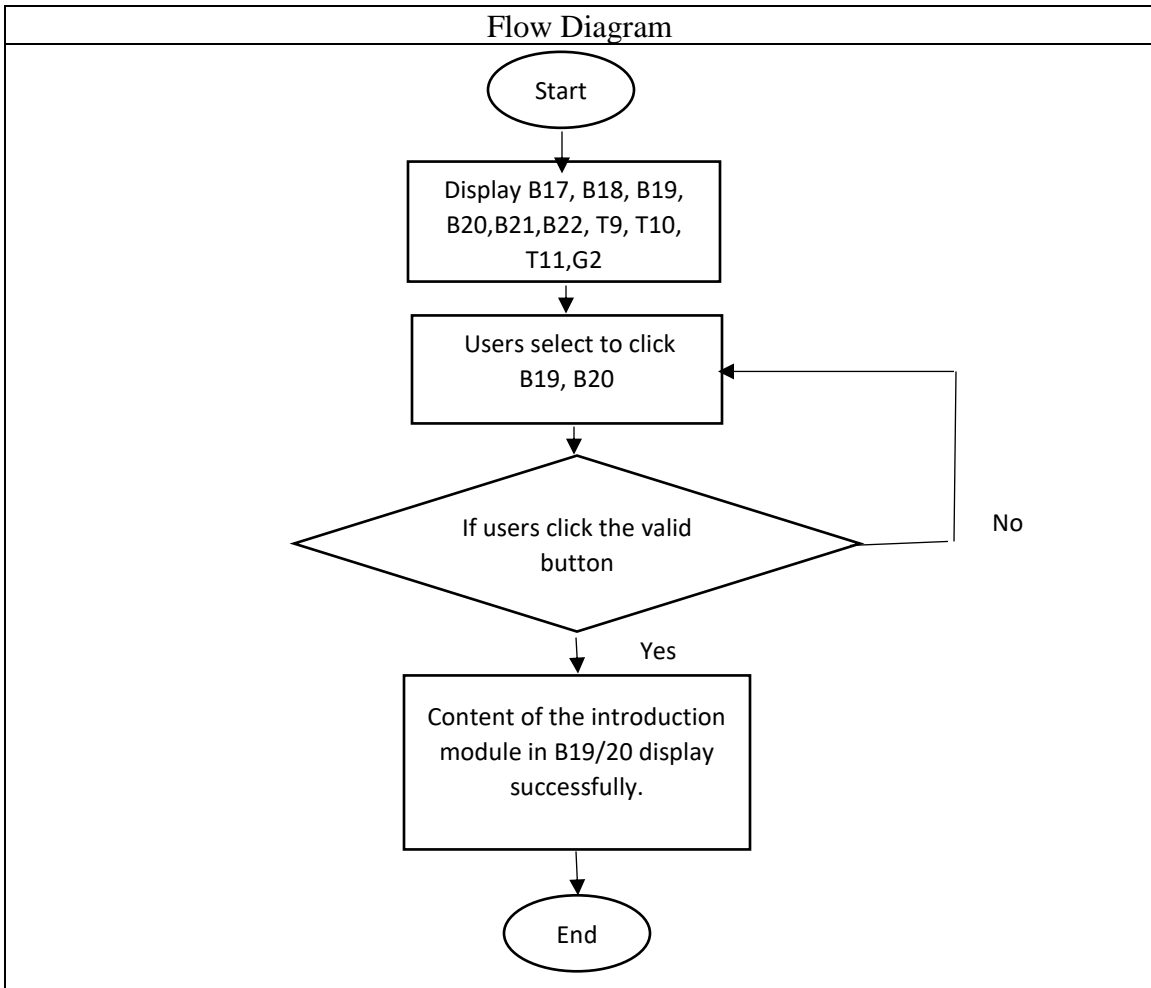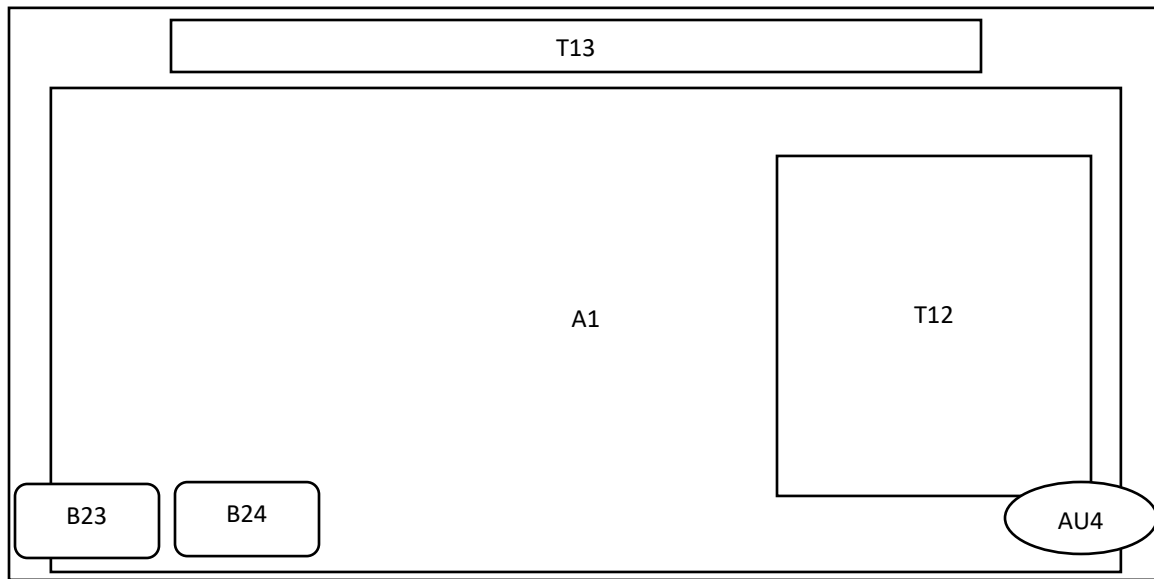
3.5.5 Simulation Lab Module

Figure 3. 11 Simulation Lab Module Storyboard Design

B = Button, T = Text, AU = Audio, V = Video, A = Animation

Table 3. 7 Simulation Lab Module Description Table

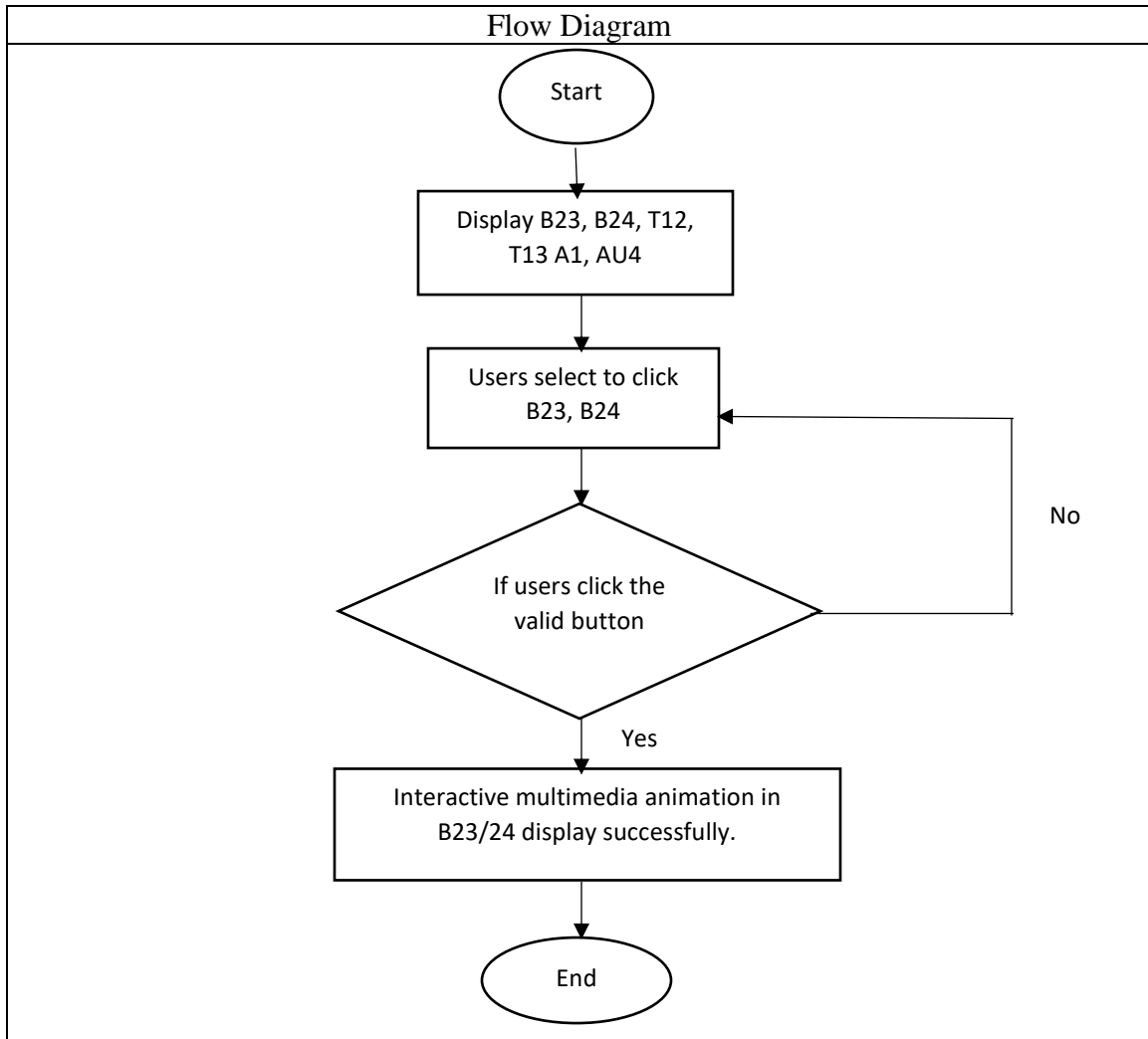| Element	Description
B23	"Back" button, A link that will bring audience back to the previous part.
B24	"Next" button. Navigation link to human digestive animation page, interactive and audio explanation functions also provided. User may do interaction with this module.
T12	Display content, description of the human digestive system. Moreover, explain process and structure of human digestive system and it function.
T13	Title for this module. For an example "Simulation Lab – Human Digestive System".
A1	Interactive multimedia content, include pictures with animation.
AU4	Audio volume button, allow users to click to display the audio explanation function.

Flow Diagram

Figure 3. 12 Simulation Lab Module Flow Diagram

3.5.6 Mini Game Module
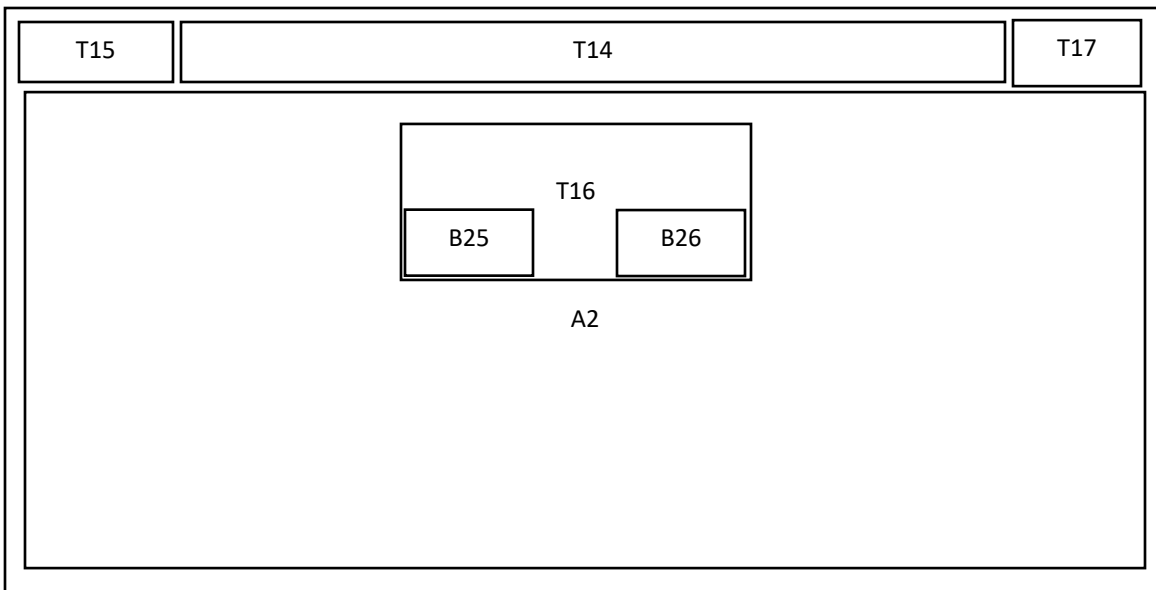
Figure 3. 13 Mini Game Module Storyboard Design

B = Button, E = Exit, T = Text, AU = Audio, V = Video, A = Animation

Table 3. 8 Mini Game Module Description Table

Element	Description
B25	"Answer 1" button, answer display allow audience to choose the correct answer.
B26	"Answer 2" button, answer display allow audience to choose the correct answer.
T14	Title for this module. For an example "Mini Game".
T15	Display the level of the game, For an example "Level 1'.
T16	Question pop out at every station point of maze game.
T17	Display timing count function.
A2	Provide interactive multimedia mini game with some simple quiz that are course related biology. For an example: station game or maze game.

Flow Diagram

Start

Display B25, B26 T14, T15, T16, T17, A2

Users select start the game

Select again

If users complete the game

No

Time out/Game over notification display

Yes

Complete/Successful notification display

End
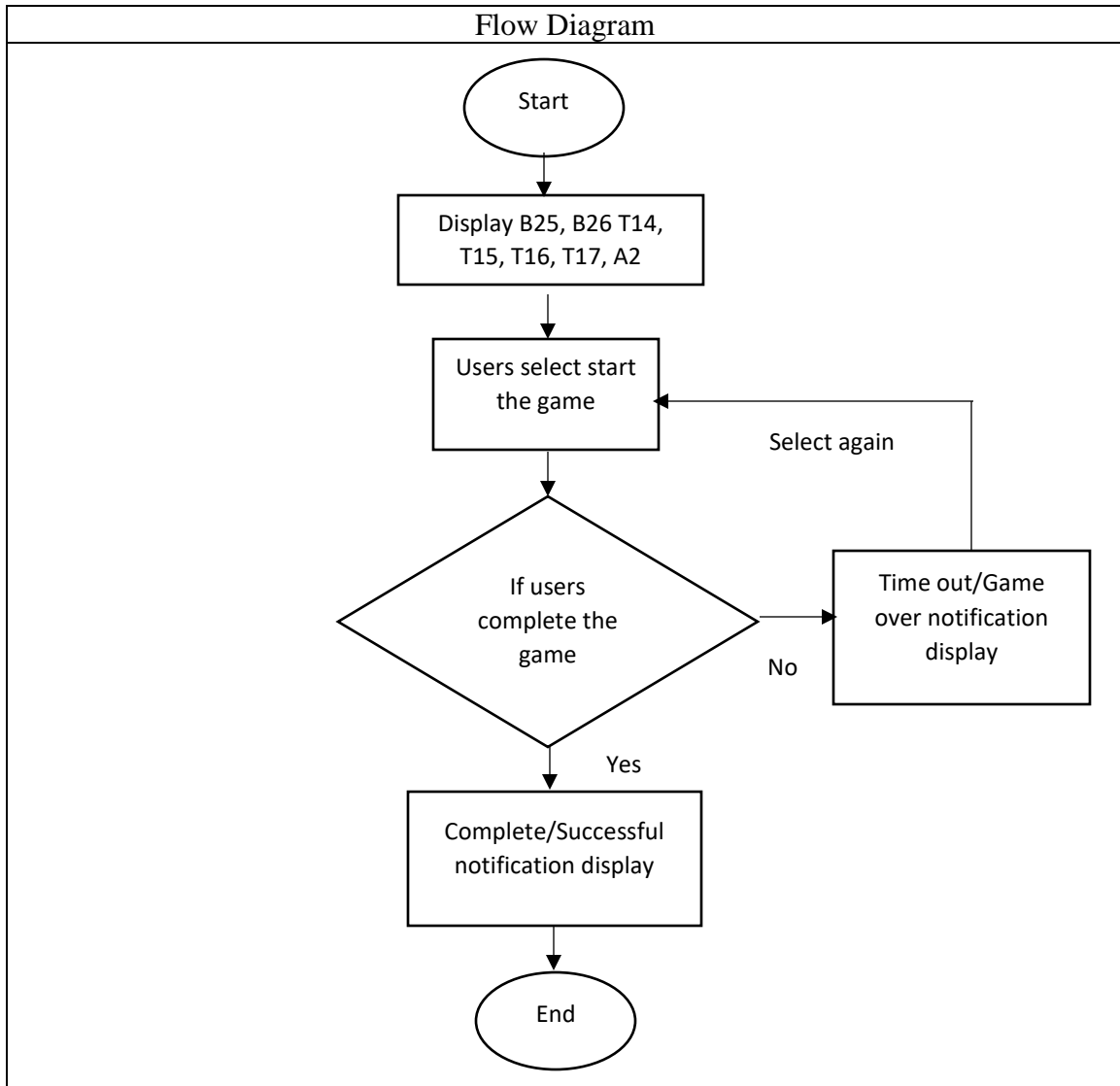
Figure 3. 14 Mini Game Module Flow Diagram

3.6 Project Planning
3.6.1 Project 1

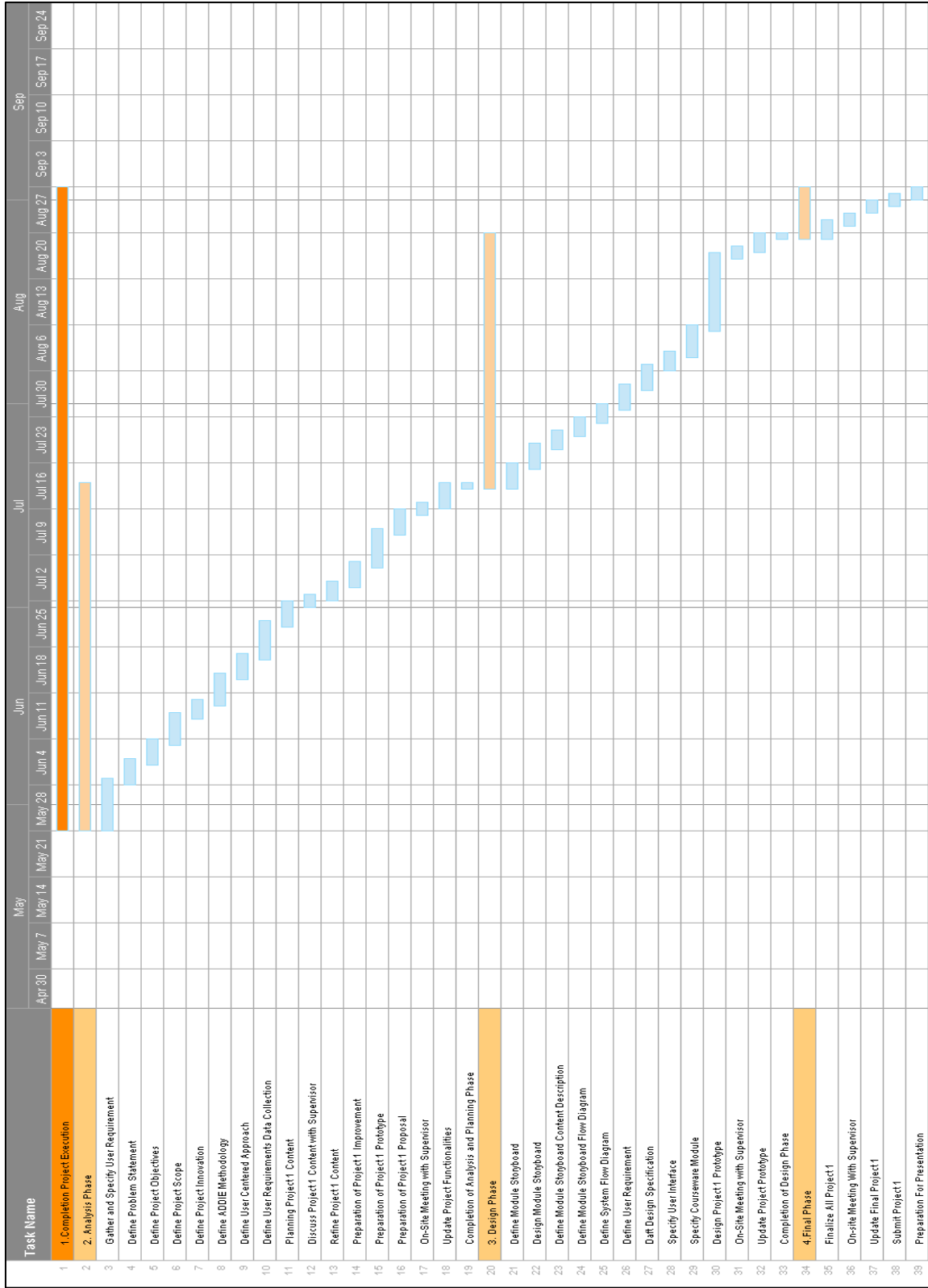| Task Name	Duration	Start	Finish
1. Completion Project Execution	97 days	28/05/2018	02/09/2018
2. Analysis Phase	52 days	28/05/2018	19/07/2018
Gather and Specify User Requirement	7 days	28/05/2018	04/06/2018
Define Problem Statement	3 days	04/06/2018	07/06/2018
Define Project Objectives	3 days	07/06/2018	10/06/2018
Define Project Scope	4 days	10/06/2018	14/06/2018
Define Project Innovation	2 days	14/06/2018	16/06/2018
Define ADDIE Methodology	4 days	16/06/2018	20/06/2018
Define User Centered Approach	3 days	20/06/2018	23/06/2018
Define User Requirements Data Collection	5 days	23/06/2018	28/06/2018
Planning Project 1 Content	3 days	28/06/2018	01/07/2018
Discuss Project 1 Content with Supervisor	1 day	01/07/2018	02/07/2018
Refine Project 1 Content	2 days	02/07/2018	04/07/2018
Preparation of Project 1 Improvement	3 days	04/07/2018	07/07/2018
Preparation of Project 1 Prototype	5 days	07/07/2018	12/07/2018
Preparation of Project 1 Proposal	3 days	12/07/2018	15/07/2018
On-Site Meeting With Supervisor	1 day	15/07/2018	16/07/2018
Update Project Functionalities	3 days	16/07/2018	19/07/2018
Completion Of Analysis and Planning Phase	0 day	19/07/2018	19/07/2018
3. Design Phase	38 days	19/07/2018	26/08/2018
Define Module Storyboard	3 days	19/07/2018	22/07/2018
Design Module Storyboard	3 days	22/07/2018	25/07/2018
Define Module Storyboard Content Descripti	2 days	25/07/2018	27/07/2018
Define Module Storyboard Flow Diagram	2 days	27/07/2018	29/07/2018
Define System Flow Diagram	2 days	29/07/2018	31/07/2018
Define User Requirements	3 days	31/07/2018	03/08/2018
Daft Design Specification	3 days	03/08/2018	06/08/2018
Specify User Interface	2 days	06/08/2018	08/08/2018
Specify Courseware Module	4 days	08/08/2018	12/08/2018
Design Project 1 Prototype	11 days	12/08/2018	23/08/2018
On-Site Meeting With Supervisor	1 day	23/08/2018	24/08/2018
Update Project Prototype	2 days	24/08/2018	26/08/2018
Completion Of Design Phase	0 day	26/08/2018	26/08/2018
4. Final Phase	7 days	26/08/2018	02/09/2018
Fianalize All Project 1	2 days	26/08/2018	28/08/2018
On-Site Meeting With Supervisor	1 day	28/08/2018	29/08/2018
Update Final Project 1	1 day	30/08/2018	31/08/2018
Submit Project 1	1 day	31/08/2018	01/09/2018
Preparation For Presentation	2 days	01/09/2018	02/09/2018

Figure 3. 15 Project l Planning

Figure 3. 16 Project l Gantt Chart

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3.6.2 Project 2

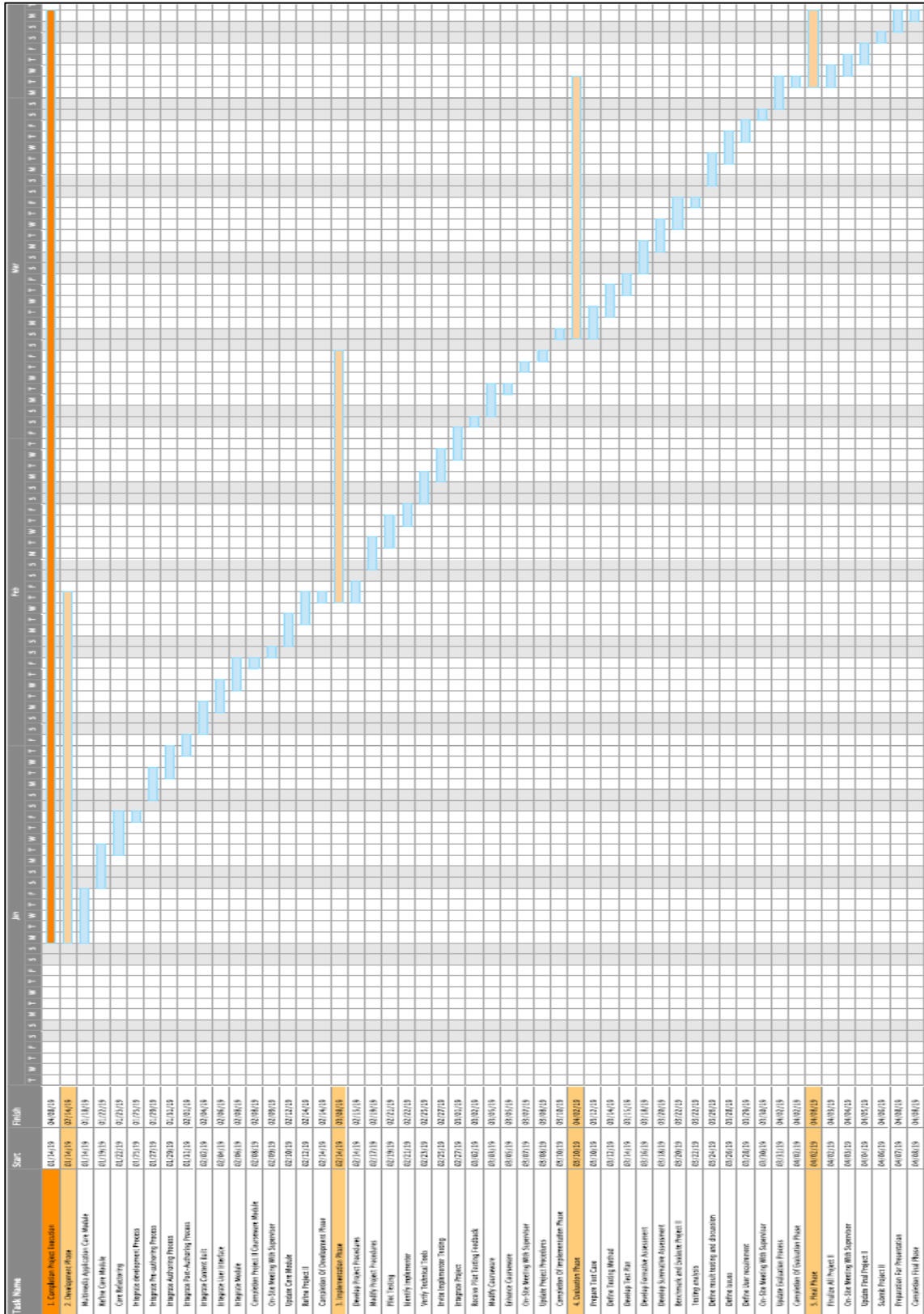| Task Name	Duration	Start	Finish
1. Completion Project Execution	84 days	14/1/2019	8/4/2019
2. Development Phase	31 days	14/1/2019	14/2/2019
Multimedia Application Core Module	5 days	14/1/2019	19/1/2019
Refine Core Module	3 days	19/1/2019	22/1/2019
Core Refactoring	3 days	22/1/2019	25/1/2019
Integrate development Process	2 days	25/1/2019	27/1/2019
Integrate Pre-authoring Process	2 days	27/1/2019	29/1/2019
Integrate Authoring Process	2 day	29/1/2019	31/1/2019
Integrate Post-Authoring Process	2 days	31/1/2019	2/2/2019
Integrate Content Built	2 days	2/2/2019	4/2/2019
Integrate User Interface	2 days	4/2/2019	6/2/2019
Integrate Module	2 days	6/2/2019	8/2/2019
Completion Project II Courseware Module	1 days	8/2/2019	9/2/2019
On-Site Meeting With Supervisor	1 days	9/2/2019	10/2/2019
Update Core Module	2 days	10/2/2019	12/2/2019
Refine Project II	2 days	12/2/2019	14/2/2019
Completion Of Development Phase	0 day	14/2/2019	14/2/2019
3. Implementation Phase	24 days	14/2/2019	10/3/2019
Develop Project Procedures	3 days	14/2/2019	17/2/2019
Modify Project Procedures	2 days	17/2/2019	19/2/2019
Pilot Testing	2 days	19/2/2019	21/2/2019
Identify Implementer	2 days	21/2/2019	23/2/2019
Verify Technical Tools	2 days	23/2/2019	25/2/2019
Invite Implementer Testing	2 days	25/2/2019	27/2/2019
Integrate Project	3 days	27/2/2019	2/3/2019
Receive Pilot Testing Feedback	1 days	2/3/2019	3/3/2019
Modify Courseware	2 days	3/3/2019	5/3/2019
Enhance Courseware	2 days	5/3/2019	7/3/2019
On-Site Meeting With Supervisor	1 days	7/3/2019	8/3/2019
Update Project Procedures	2 days	8/3/2019	10/3/2019
Completion Of Implementation Phase	0 day	10/3/2019	10/3/2019
4. Evaluation Phase	23 days	10/3/2019	2/4/2019
Prepare Test Case	2 days	10/3/2019	12/3/2019
Define Testing Method	2 days	12/3/2019	14/3/2019
Develop Test Plan	2 days	14/3/2019	16/3/2019
Develop Formative Assessment	2 days	16/3/2019	18/3/2019
Develop Summative Assessment	2 days	18/3/2019	20/3/2019
Benchmark and Evalaute Project II	2 days	20/3/2019	22/3/2019
Testing analysis	2 days	22/3/2019	24/3/2019
Define result testing and discussion	2 days	24/3/2019	26/3/2019
Define Issues	2 days	26/3/2019	28/3/2019
Define User requirement	2 days	28/3/2019	30/3/2019
On-Site Meeting With Supervisor	1 days	30/3/2019	31/3/2019
Update Evaluation Process	2 days	31/3/2019	2/4/2019
Completion Of Evaluation Phase	0 day	2/4/2019	2/4/2019
5. Final Phase	6 days	2/4/2019	8/4/2019
Finalize All Project II	1 days	2/4/2019	3/4/2019
On-Site Meeting With Supervisor	1 day	3/4/2019	4/4/2019
Update Final Project II	2 days	4/4/2019	6/4/2019
Submit Project II	1 days	6/4/2019	7/4/2019
Preparation For Presentation	1 days	7/4/2019	8/4/2019
Completion Final Phase	0 days	8/4/2019	8/4/2019

Figure 3. 17 Project ll Planning

Figure 3. 18 Project ll Gantt Chart

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Chapter 4 DEVELOPMENT

4.1Overview

In the design and development of multimedia courseware, teaching design is the key link and the concrete embodiment of teaching thought. According to the teaching objectives, content and characteristics of the learning objects, to analyze the problems and needs in teaching, determine the effective steps of solving the problems in the courseware and reasonably select and organize the teaching media and teaching methods. According to the teaching media to design an appropriate teaching environment, determine the overall style design of the courseware, including interface content design, interface structure design, color application and courseware structure. The tool that describes the results of the multimedia courseware design phase is the script. Script design is the core of the whole courseware development that divided into two types, one is a text script and the other is a produced script.

The text script is based on the teaching requirements to describe the content of the courseware. The general text script contains the following contents which were course name, teaching objectives, priorities, teaching processes, media use, courseware types and timing of use.

The produced script is written on the basis of text scripts. It is a shot-like script similar to filming. It changes the text script into a form suitable for computer media performance, such as interactive interface, media expression, content presentation order, effect and navigation. The produced script for each sub-item contains the following contents such as interface layout, interface description, screen content, screen display category, screen display time, interactive control, dubbing, and soundtrack. Produced scripts is the direct basis for developing multimedia courseware and it is necessary to develop effective multimedia courseware based on the produced script. Lastly, the following will show the development process included pre-authoring process, authoring process and post-authoring process

4.2 Development Process
4.2.1 Pre-authoring Process
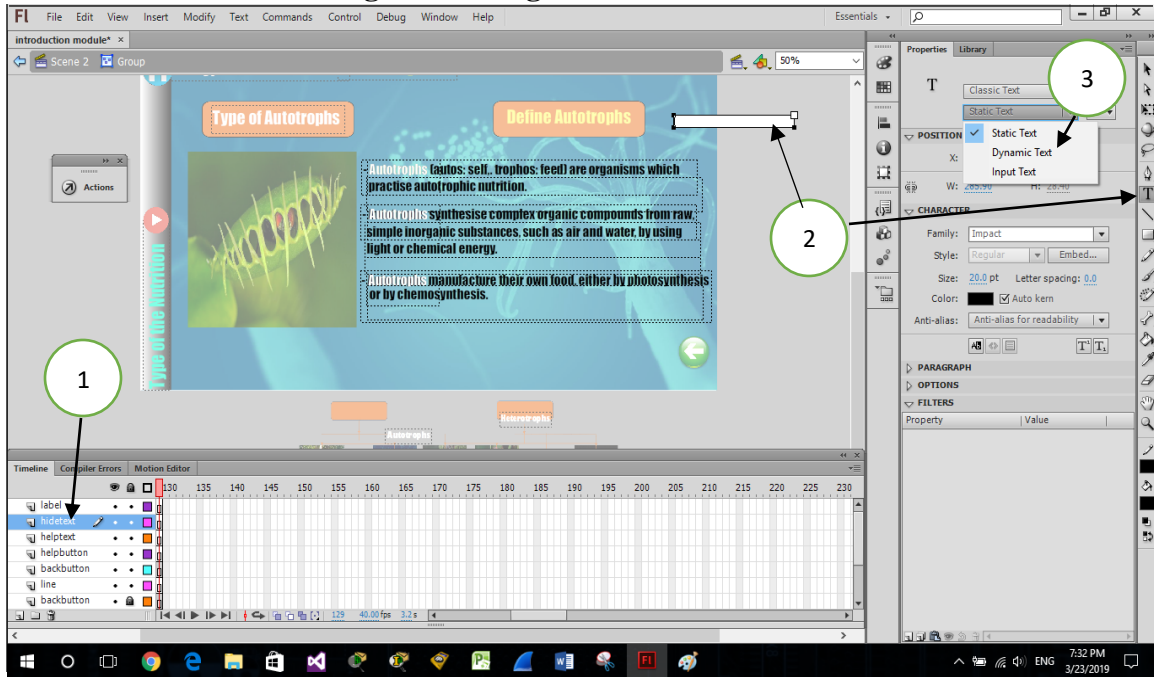
4.2.1.1   Process of creating and editing text.
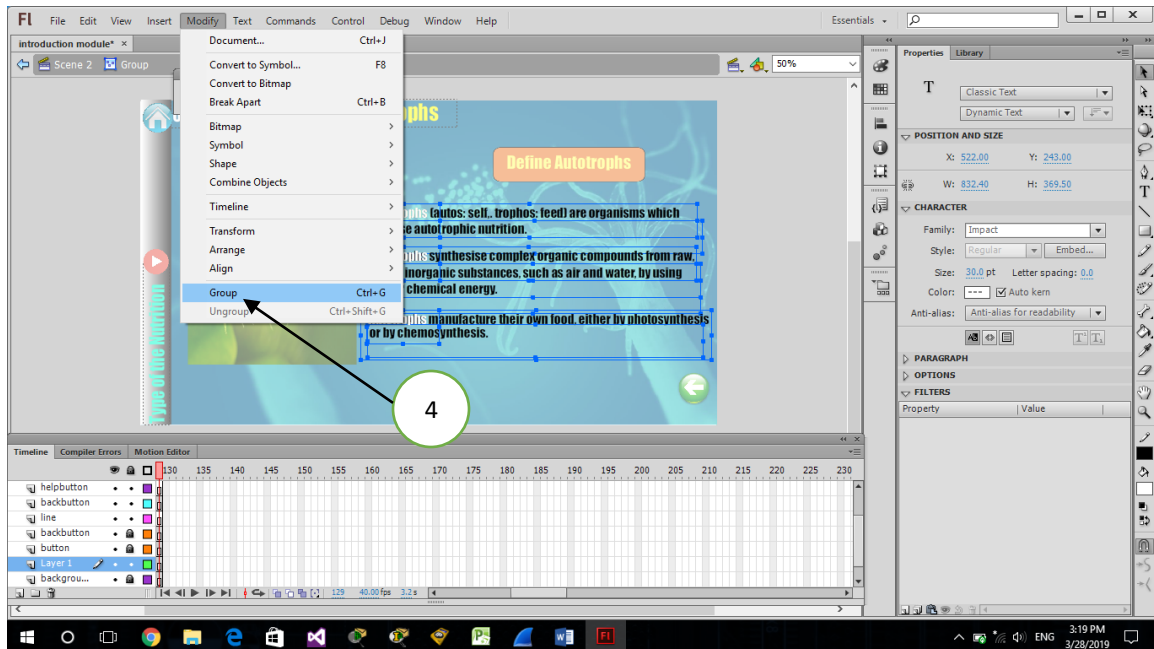

Figure 4.1 Use Adobe flash software create text

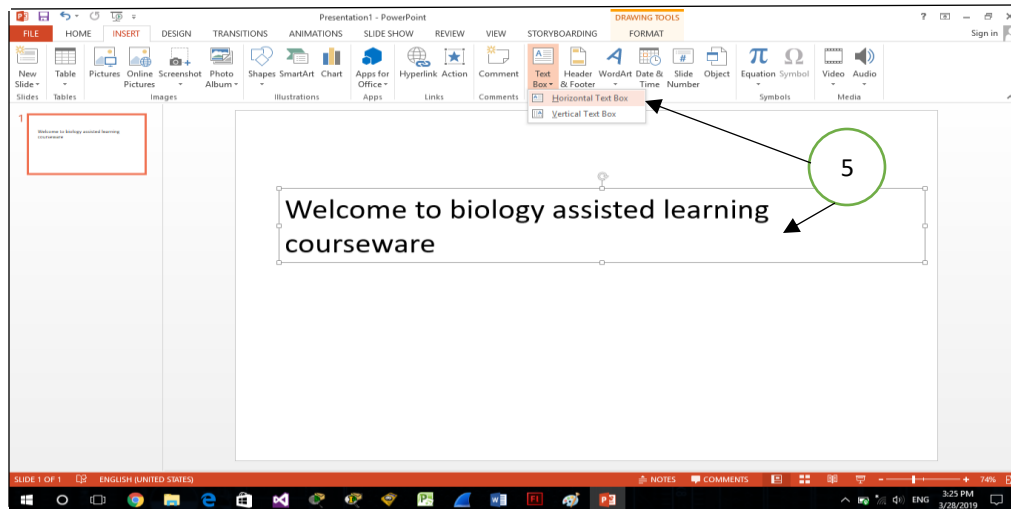*Figure 4.2 Select modify the text into group format.*

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Figure 4.3 Use power point to edit the text.

Based on the development of this courseware, all are done by used adobe flash software, any text created or edited are using the existing text editor features in adobe flash. It is very convenient to use adobe flash to create text and dynamic fonts. First, to open the Flash software, then create a new Flash document, modify the document size to 1366 wide, 768 high to reach the full screen mode of computer and then make the required components separately.

Step 1, before to create a text, the most important step is to add a new layer and set the layer name as text in the timeline (label 1) and then need a text box to edit the text. Open the text editor on the right and drag out the text box to enter the font as shown in the figure (label 2). The text can also be selected from few categories such as static text, dynamic text and input text (label 3). Step 2, use the keyboard to enter the text such as content and description. The fonts color and size can be changed and adjusted at any time to achieve neatly. Step 3, select modify the text into a group format for easy movement (label 4).

In the final step, save the file of the created text and go to file choose debug in flash to check the font success. If are not satisfied, can change it at any time. In addition, creating and editing text is also done by using PowerPoint, which is very easy to create. For an example, go to insert and drag out the text box and start to enter the text to finish the editing (label5), finally save the text as picture and use the adobe director to combine all.

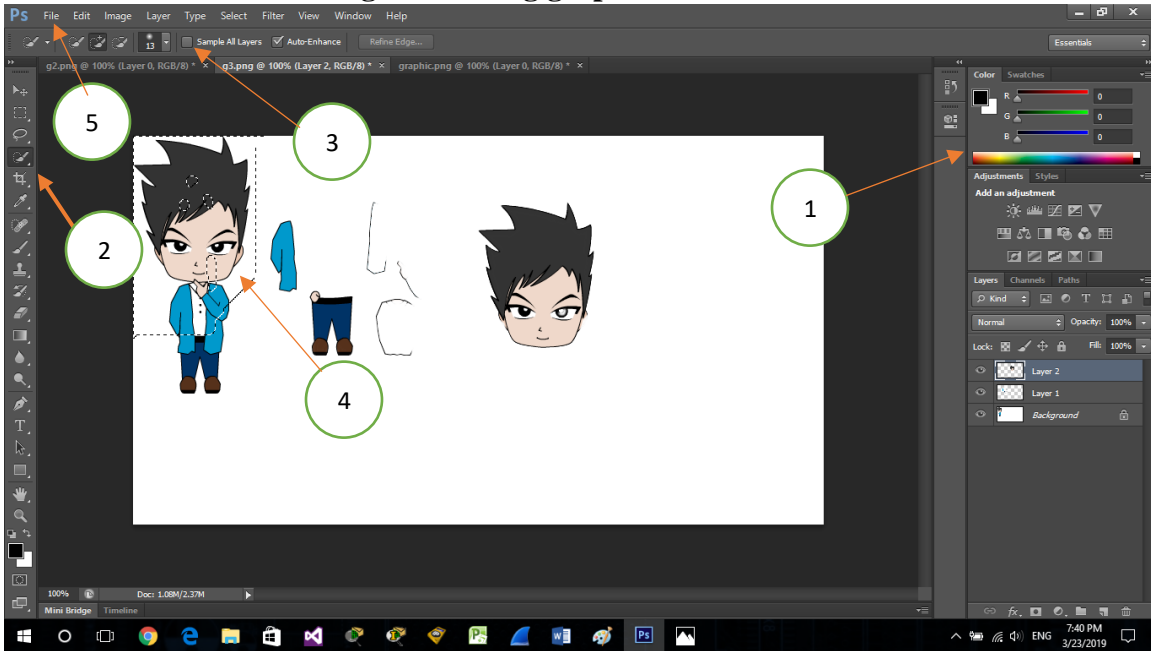**4.2.1.2 Process of creating and editing graphics.**

Figure 4.4 Use Adobe Photoshop CS6 to crop the graphics
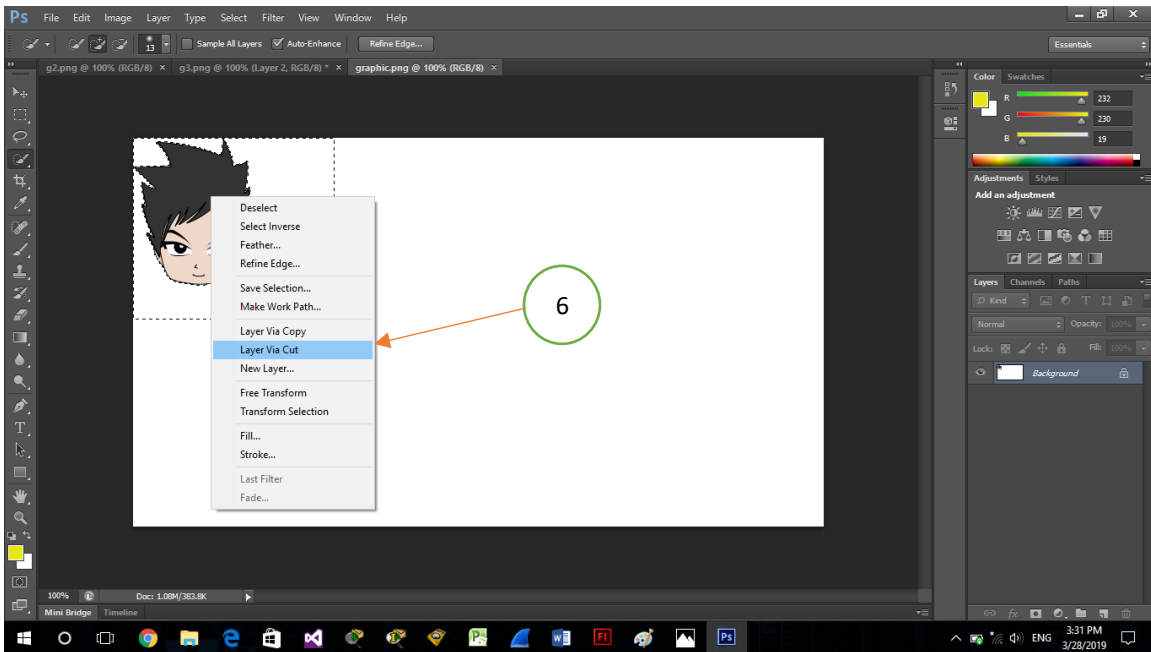

Figure 4.5 To crop the graphics by right on click and select layer via cut.

Used of adobe Photoshop to create and edit graphics to complete this multimedia courseware. For creating graphics, choose a shape tool or a pen tool and to select shape from the menu in the options bar. Then select the color of the shape, click the swatch in the

options bar and choose a color from the color picker (label 1). Set tool options in the options bar. Click the reverse arrow next to the shape button to see additional options for each tool then start to create the graphics.

In addition, for editing graphics, to used adobe Photoshop to crop the graphics. First open Photoshop software, double-click on the 'File' option or edit area, the "Open" dialog box will pop up. In the "Open" dialog box, find the image that want to crop. After selecting the image, click on the "Open" button in the lower right corner. After the image is imported, click the "Cropping" tool in the toolbox on the left, as shown in the figure (label 2). Fill in the required width and height in the position shown, and fill in with px (pixels) as the unit, for example 500px (label 3). After filling out, use the left mouse button to select the desired part (label 4). To determine the selection and location, right-click on the crop selection area and select the layer via cut to complete the crop (label 6). Click on the "File" menu in the top left corner and select "Save As" from the drop-down menu (label 5). The "Save As" dialog box will pop up. Select the location of the storage in the dialog box, then write the name of the file, then click the "Save" button. Finally, that is the process of used the adobe Photoshop to creating and editing the graphics. Hence, the graphics can be used for creating the module by using the adobe flash.

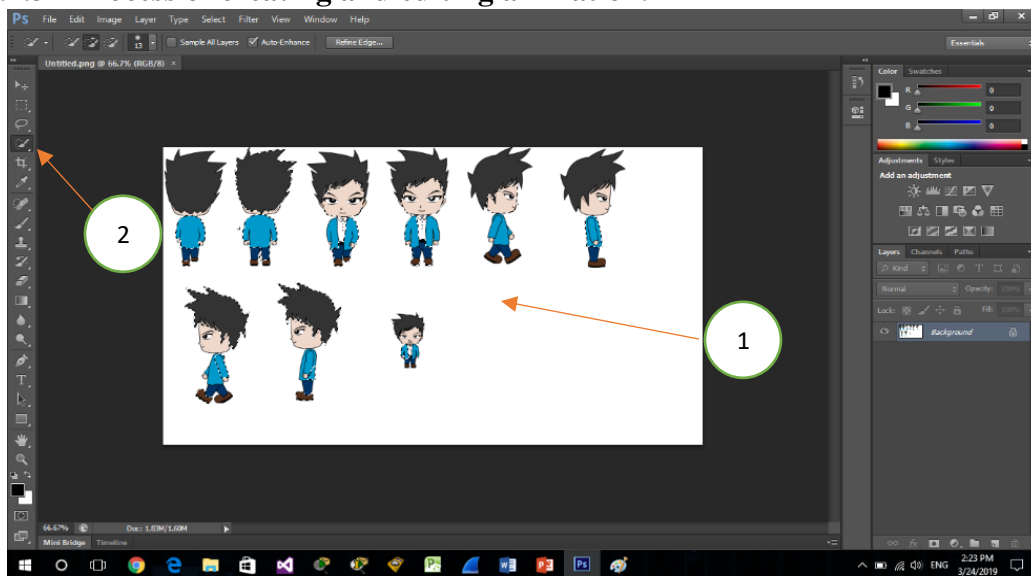### 4.2.1.3 Process of creating and editing animation.

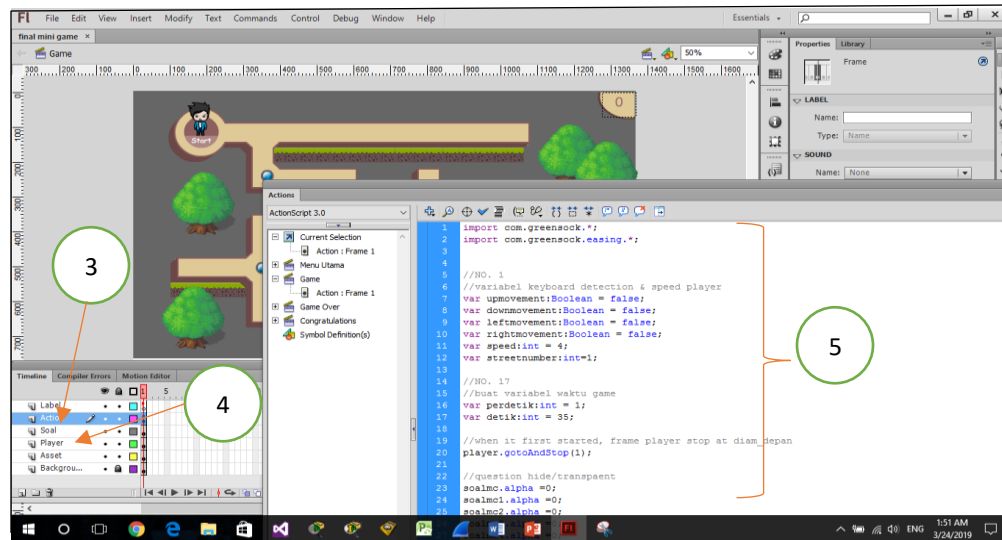*Figure 4.6 Use Adobe Photoshop to editing animation prototype graphics.*

Figure 4.7 Use Adobe Flash to creating and editing animation.

Based on the development of this courseware are all done by using adobe flash, so creating and editing animations also are done by using adobe flash. First used adobe Photoshop to create animated illustrations and prototype. The creating process is to use Photoshop to create and draw animated prototype graphics. Such as the graphics of character walking process, character front and back face, character side face, character hand and foot movement and so on, as shown in figure 4.6 (label 1).

After creating and painting the prototype graphics in Photoshop, the next step is to crop the graphics. Such as to crop the part of the hand, the part of the head, the part of the body and the part of the foot and so on as shown in figure 4.6 and in order for to create a pre-authoring for the animation. Cropping is also done to click the "Cropping" tool in the toolbox on the left, as shown in the figure (label 2). Once all the graphics creating and cutting are ready, start to create the animation.

To create an animation with adobe flash, need to add a new layer and set the layer name as action in timeline, this compulsory for creating the animation (label 3). Moreover, continue add another new layer and set the layer name as animation or player (label 4). Next, import the finished animated prototype graphics into the adobe flash to start the creating the animation. Then, in order to create an animated character moving scene, a series of action scripts command is needed to achieve the success of the character movement. For an example, "var upmovement:Boolean = false;", "var topdistance =

player.width/100;", "var speed:int = 4;", "var streetnumber:int=1;" and so on (label 5). These action scripts command are very basic and important in order to create interactive animations.
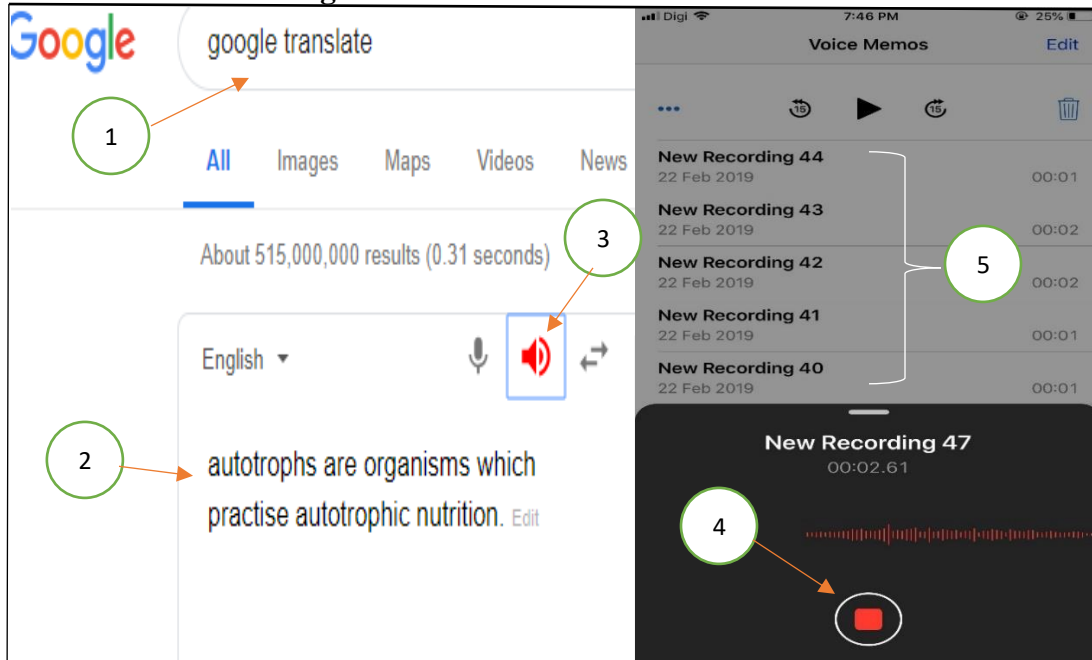
4.2.1.4   Process of editing audio.

Figure 4.8 Use Google translate create audio and mobile phone record audio.

Because of Adobe Audition software update problem had to be abandoned. Hence, to use another assisted software to complete the process of editing audio, that is to use the sound of online Google translation to complete the process of editing audio. Can save audio directly without having to install any software. In order to achieve user-friendly convenience for multimedia courseware, the use of female voices was chosen as the audio required to develop this courseware.

First, open the Google page and enter Google translate to go the page (label 1). On the Google translate page, enter the text or content that want to record, such as autotrophs are organism which practice autotrophs nutrition (label 2). Then click the listen button to listen (label 3). After confirming that the listen button is pressed, start listening to the pronunciation of Google Translate. The editing of the audio is completed.

In addition, another tool used in editing audio is the mobile phone. First, in the process of listening to the pronunciation of Google Translate, to open the mobile application voice memos to record audio (label 4). Moreover, in order to achieve the perfect sound volume, the speaker is also used to increase the volume. After the audio is recorded, then click on the save button to save in mobile phone (label 5). After that, to transfer the audio to the computer via Google drive or messenger. Then to use the laptop start to download the audio. After downloaded audio, use the online audio converter to convert the audio format from MP3 to WAV format. The purpose of the conversion format is because Adobe Flash only supports WAV format audio and it is also convenient for making courseware.

4.2.1.5 Process of editing video.
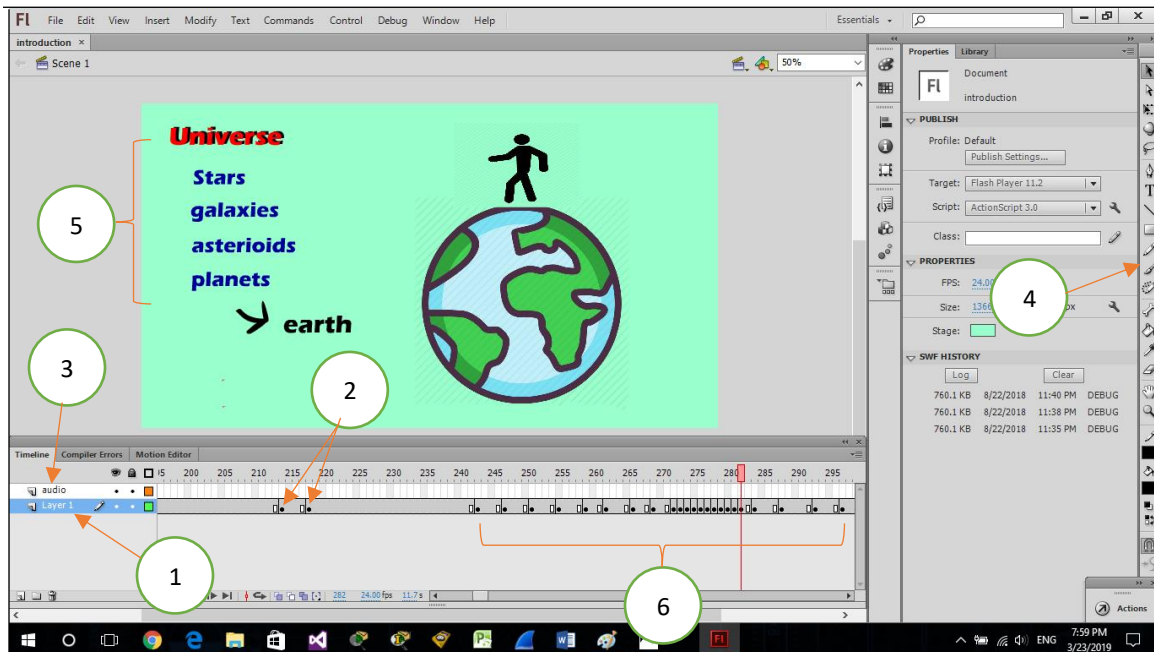
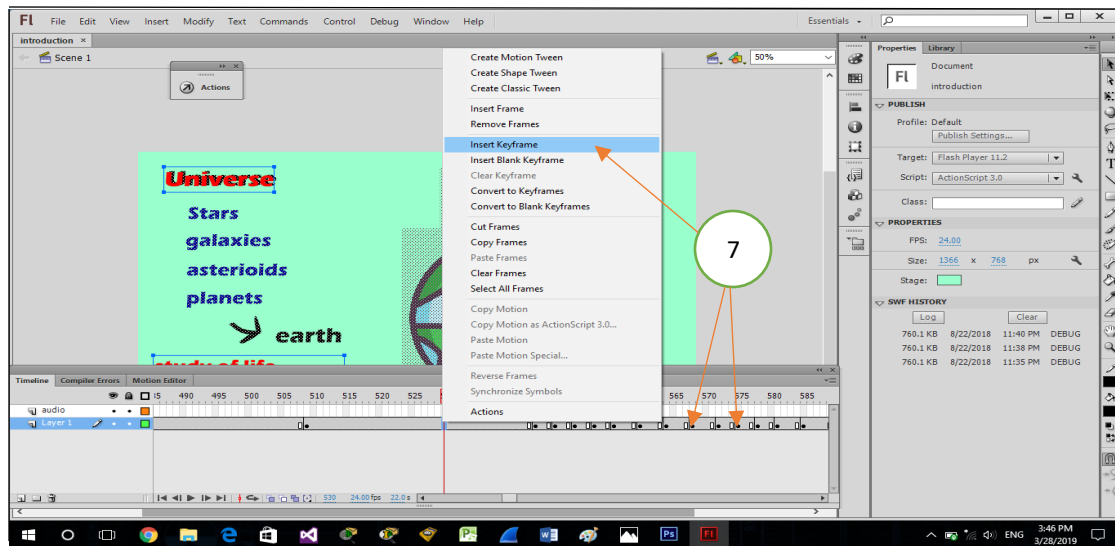*Figure 4.9 Use Adobe Flash to create video animation*

Figure 4.10 Insert Keyframe to create the illusion of movement

The editing video is also created by using Adobe Flash, using Adobe flash to create a simple animated video, such as the introduction to biology explanation video. First, open adobe flash and add new layer and set the layer name as layer1 or video in the timeline (label 1), this must be added before starting to create animated video. Next, import the created graphics into adobe flash to start creation. All images are produced by adobe Photoshop.

Next, open a new page to start create, the creation process will continuously to insert Keyframe to create the illusion of movement or video scene movement (label 2 and label 7). In addition, audio will be imported into the produced video (label 3) and the audio is also edited by using Google translate to record. While creating an animated video, to draw some special effects by use of the painting tools provided in adobe flash (label 4) and enter text or content (label 5) and so on, in order to create a video with more informative, interactive, interesting and understandable. The distance time of each Keyframe is sorted according to the video narrative time and audio explanation time. So each Keyframe has a different length (label 6).

In addition, the movie maker is also used to edit the video. First, go to the operation interface of the software, find the file to be processed, to import it and start to edit the video. This is very convenient to editing the video.

4.2.2 Authoring Process

4.2.2.1   Splash Screen Design
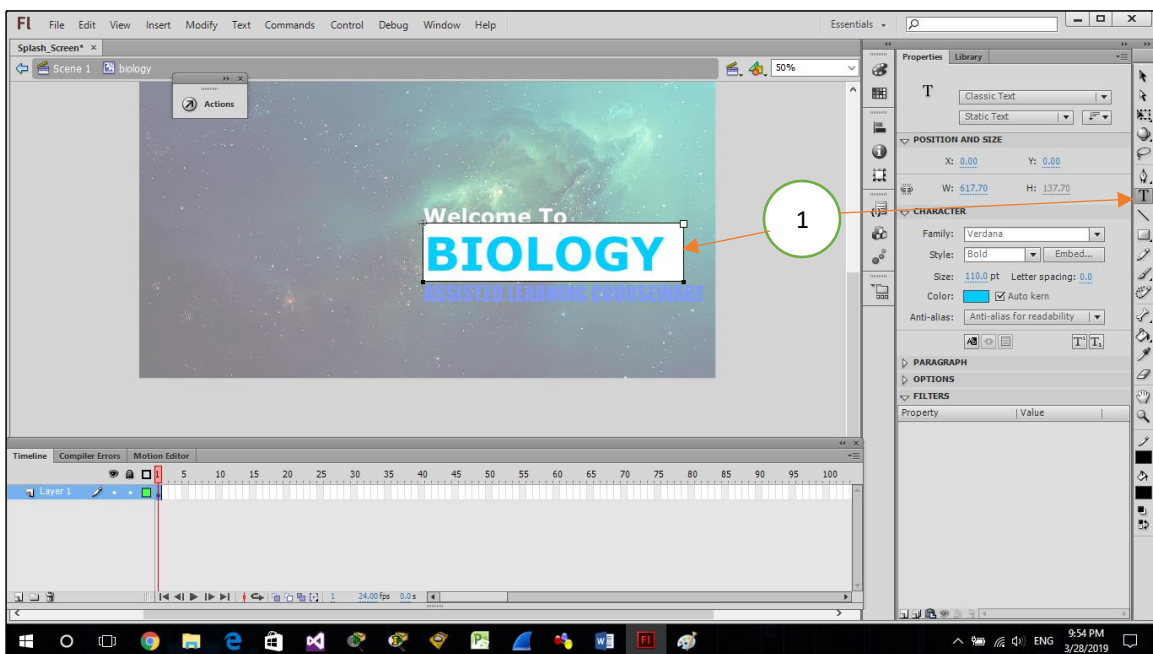

Figure 4.11 Splash Screen Design.

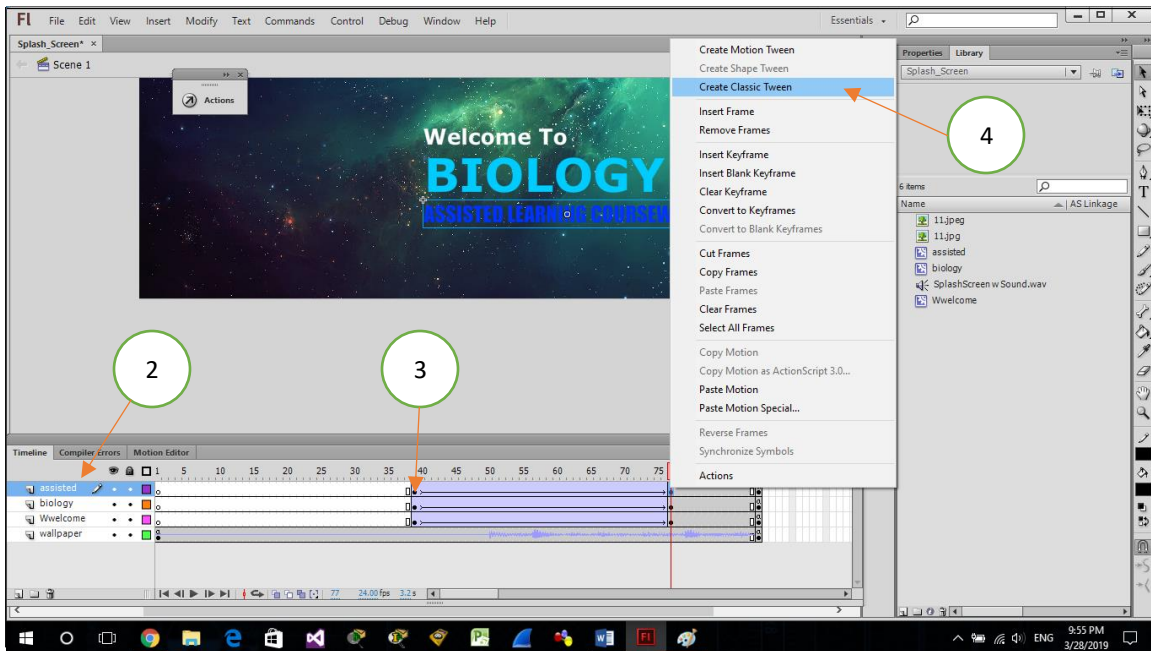*Figure 4.12 Editing text design*

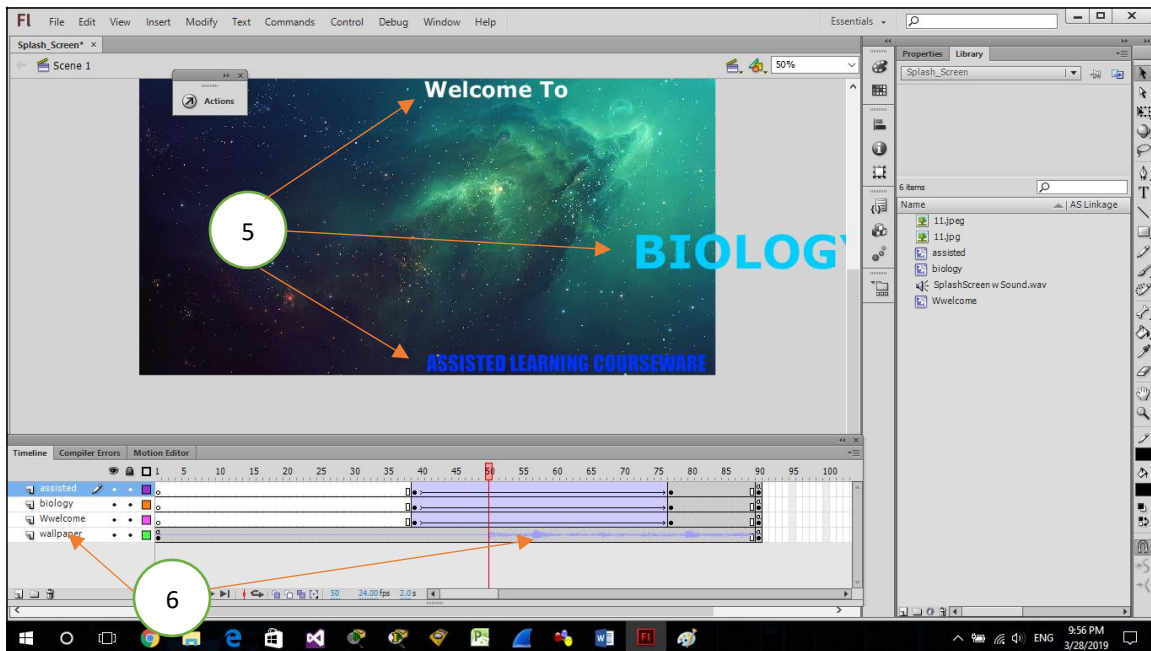*Figure 4.13 Create classic tween effect for text*

Figure 4.14 Text Classic tween result

The same splash screen is also done by using adobe flash. First use text box or tool to create and edit text in Adobe flash (label 1), then add new layer for each word in timeline as show in figure 4.13(label 2). Next, insert Keyframe to create the illusion of movement (label 3). After complete inserted Keyframe, then continue right-on click the Keyframe and

select create classic tween to maintained in animate primary for transition purposes as shown in figure 4.13(label 4). The purpose of selecting create classic tween is to make the effect of font movement as shown in the figure 4.14 (label 5). Then, import the background image and sound to make the splash screen to be more interactive and beautiful (label 6).

The action scripts command has used:

```
fscommand("fullscreen", "true");    ← 1

stop();    ← 2
```

The action scripts command label 1 is used to make the splash screen become full screen mode display. The action script command label 2 is stop(); is the function used to stop looping of the work.

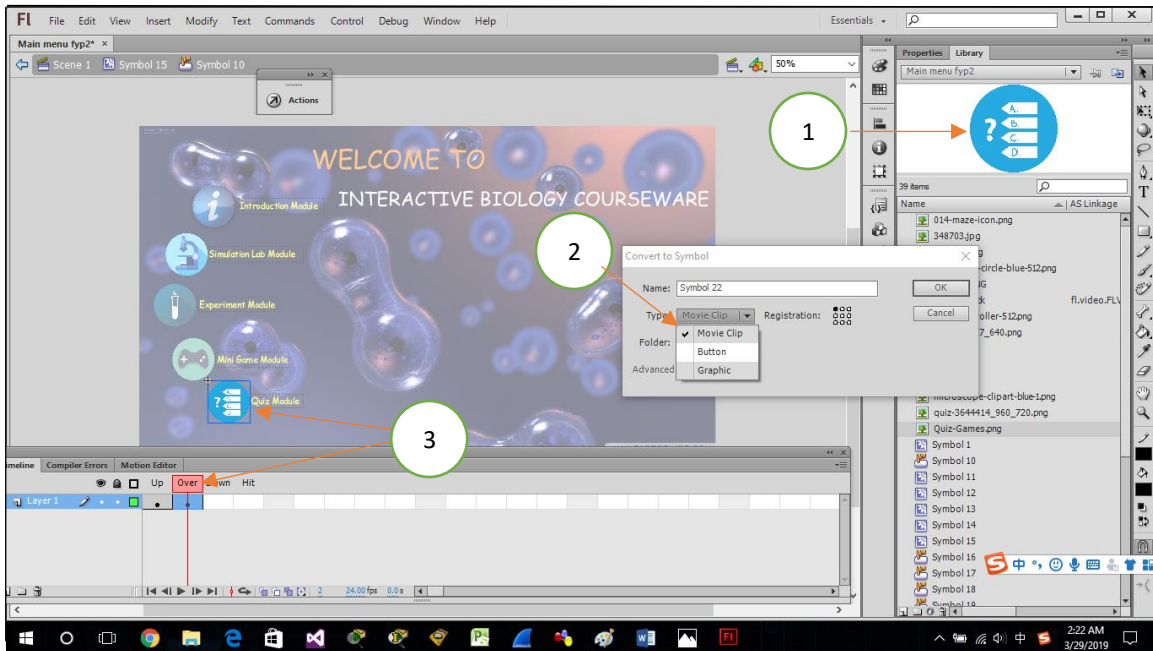### 4.2.2.2 Main Menu Module

Figure 4.15 Main Menu design

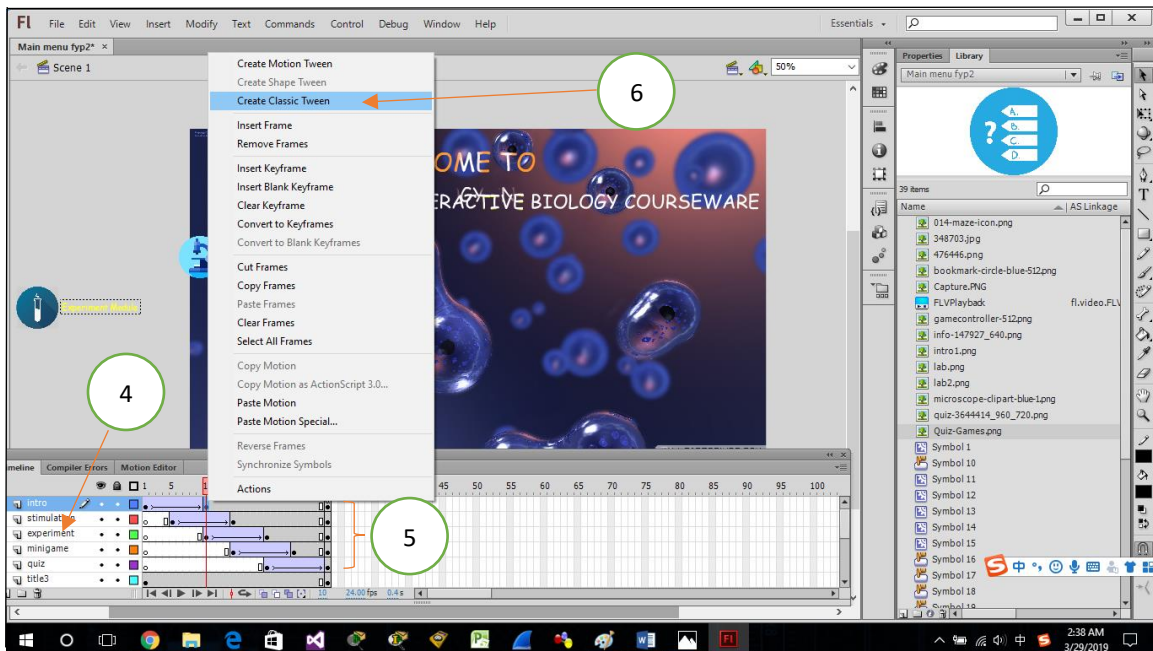*Figure 4.16 Create button with mouse over effect*

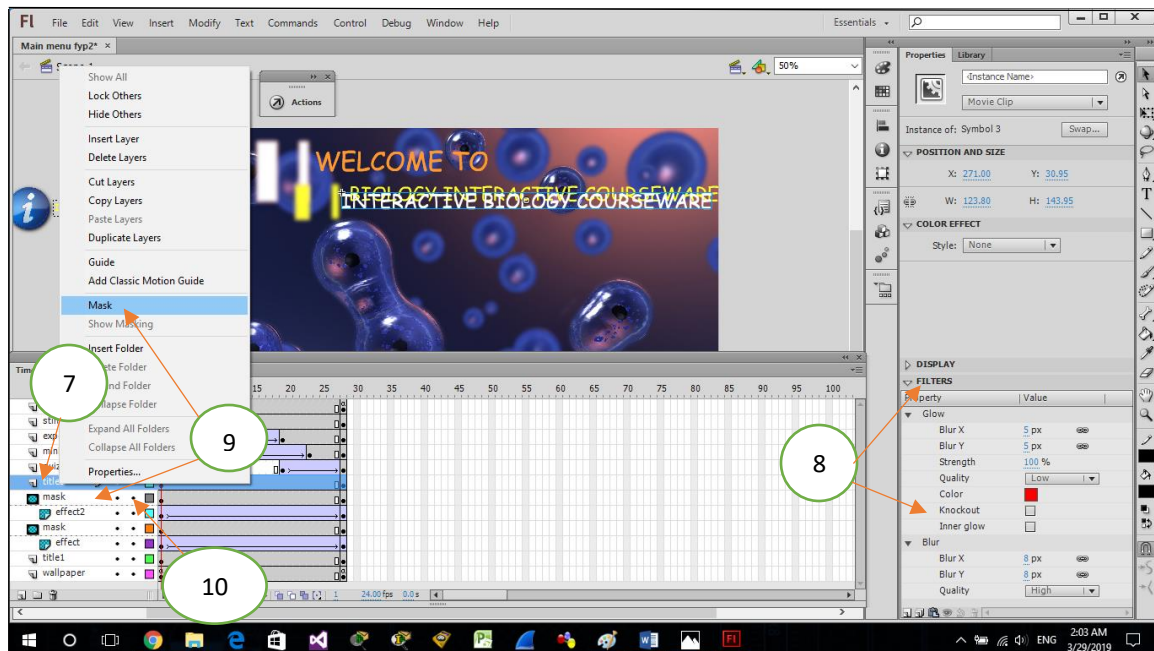*Figure 4.17 Create classic tween effect for button*

Figure 4.18 Mask the text and to create text changing color effect

The main menu is also created using adobe flash. First open the file and import all photos, button prototypes image, audio and so on. In order to create a button, first need to create a page and drag in button image prototype from the library as shown in figure 4.16 (label 1). Then right on click graphics to select convert to symbol, then to select the type of symbol to convert as button (label 2).

After the button is created, in order to achieve the button mouse over effect, double-click the created button again to add the Keyframe on mouse over frame and to drag in the second graphics (label 3), manufacture complete. After completing all the button steps, then start to create classic tween effect for button as shown in figure 4.17. First, add layer in timeline for each button (label 4), then insert Keyframe to create the illusion of movement for each layer, each Keyframe length is based on different display timings to make adjustment shifts (label 5). After complete inserted Keyframe, then continue right-on click the Keyframe and select create classic tween to maintained in animate primary for transition purposes (label 6).

Lastly, create the effect of font color conversion as shown in figure 4.18. First, to add layer in timeline and insert Keyframe (label 7), then double-click the font and select to

adjust the filter quality (label 8). Then go to timeline right on click to select text layer as mask (label 9), then lock all the text layers to complete the production (label 10).

The action scripts command has used:

fscommand("fullscreen", "true");   ① 1

stop();   ① 2

The action scripts command label 1 is used to make the main menu become full screen mode display. The action script command label 2 is stop(); is the function used to stop looping of the work.
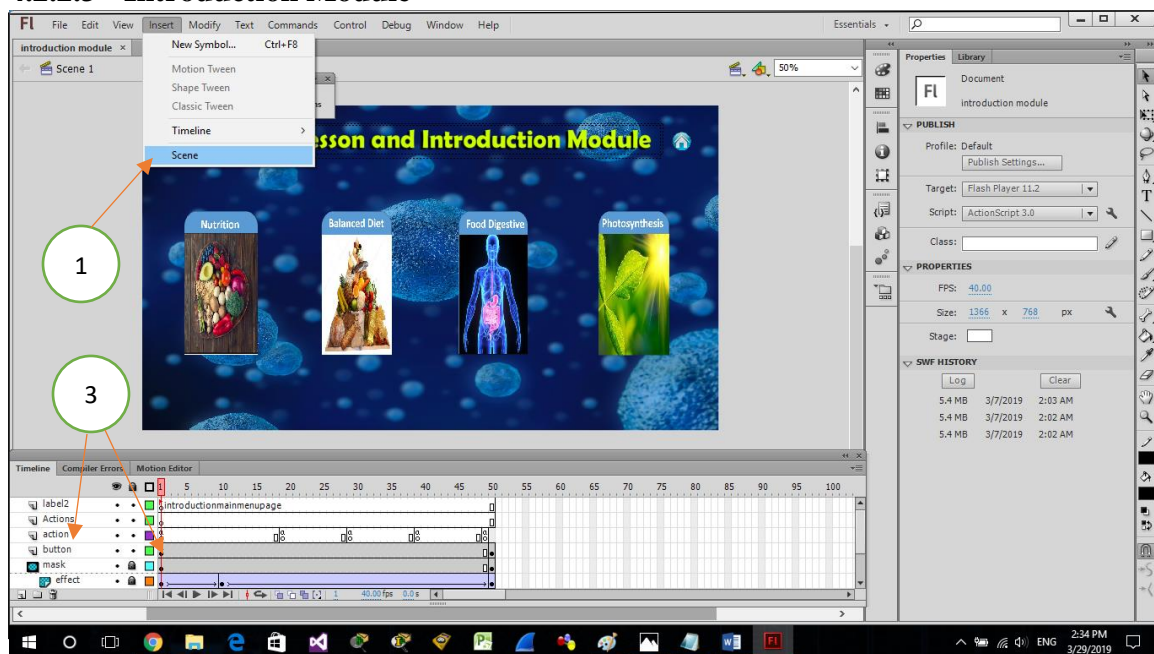
4.2.2.3 Introduction Module

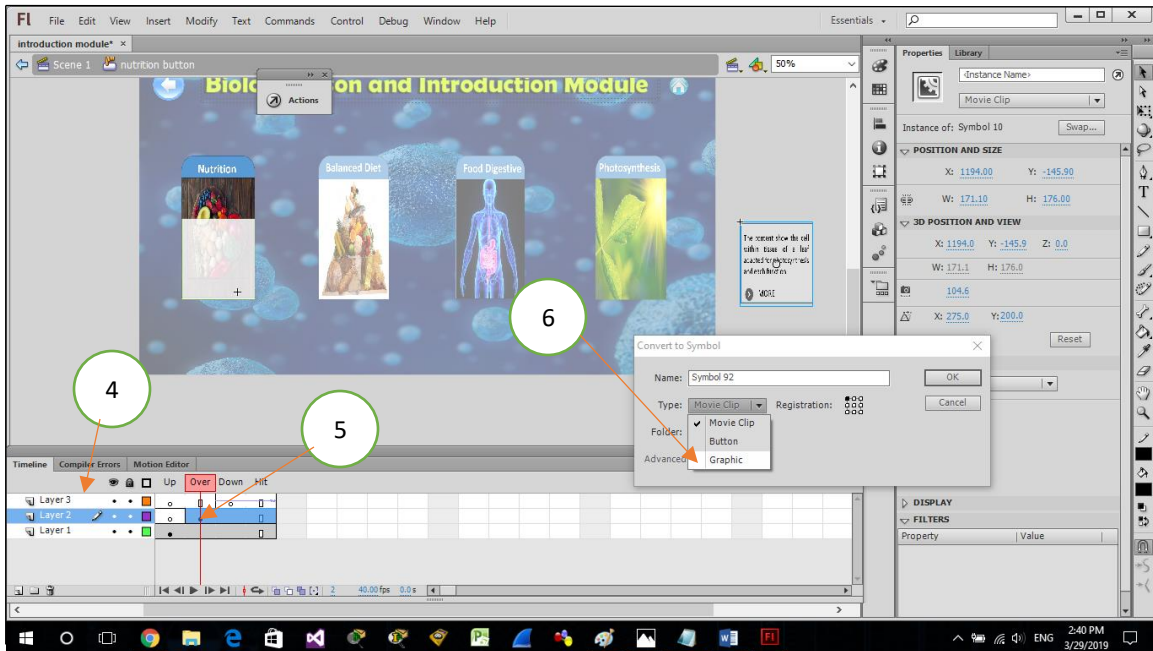*Figure 4.19 Create home page of introduction module*

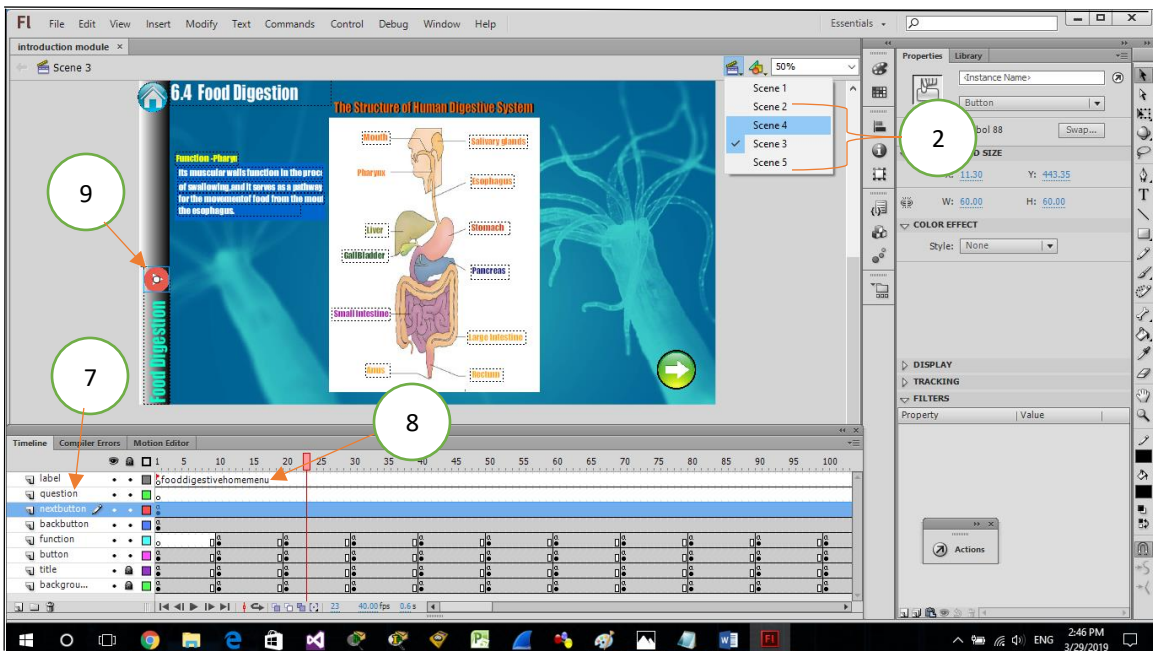*Figure 4.20 Create home page button with mouse over effect*

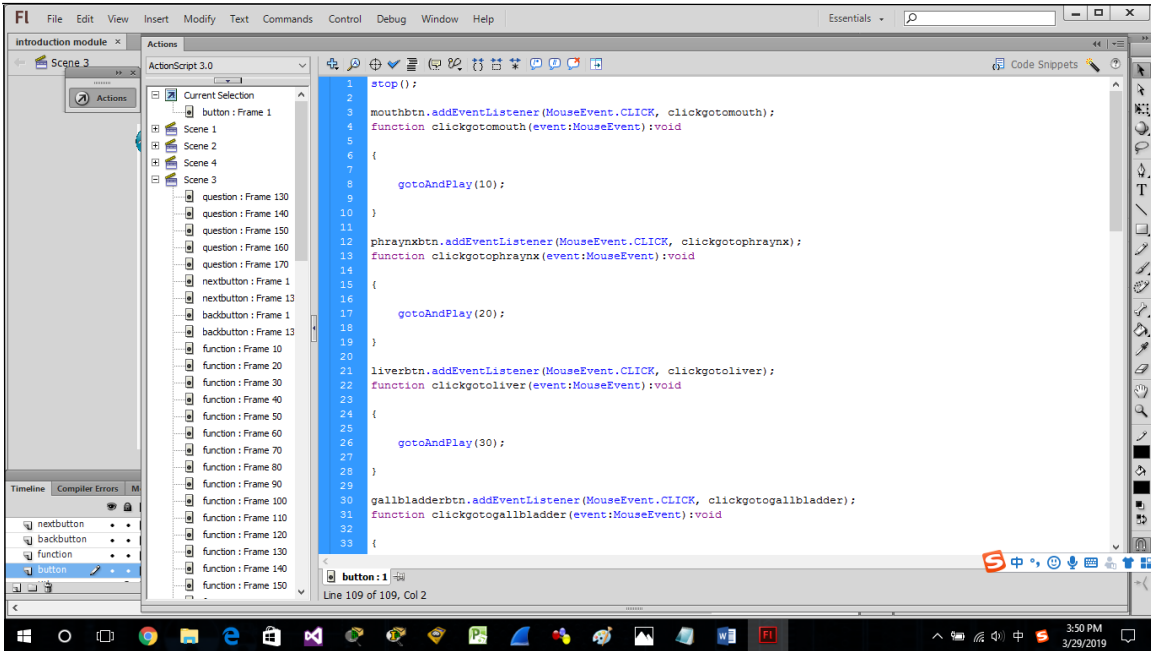*Figure 4.21 Create sub-chapter content of introduction module*

Figure 4.22 Enter action script command for linking and prevent looping problem
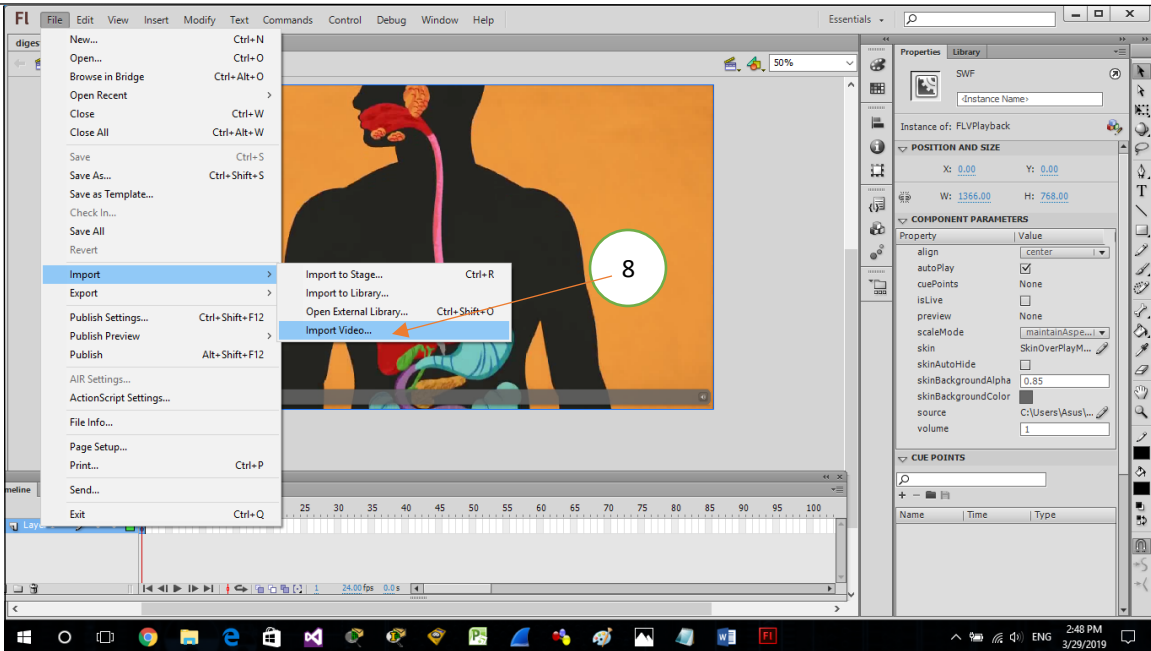

Figure 4.23 Create video function for each sub-chapter content of the module

The introduction module is also created using adobe flash. First, open the file in the top left corner and import all the images, audio and button image prototypes are used for the next production. To create a home page of introduction module, need to add scene for each sub-chapter content to linking together as shown in figure 4.19 (label 1). Because the

introduction module has 4 sub-chapter content, so that have to add 4 scene with different scene name as shown in figure 4.21 (label 2).

The steps to create a button link chapter on the home page are to drag in the button image prototype from library, then add new layer for each imported image in timeline, then insert Keyframe on frame as shown in figure 4.19 (label 3). After completed insert the Keyframe, then right-on click the image to select symbol to convert as Button.

Next, to create the effect of the mouse over display content, double-click the created button again will display the timeline as shown in Figure 4.20. Then start to add 3 new layer (label 4), and insert Keyframe on mouse over frame for each layer (label 5). The display content is also made by using adobe flash. Then right-on click the content and to convert as graphic symbol (label 6). After complete convert as graphics symbol, then drag it into the mouse over frame to complete the effect of displaying the content.

Next, start to make each sub-chapter content of the introduction module. First, as shown in Figure 4.21, have to add scene for linking sub-chapter content (label 2). Each adding scene is very important and will be used as a sub-chapter content link home page. Next, to add all different layers such as, label layer, button layer, function layer and so on in timeline (label 7). The label layer is very important for the purpose of linking (label 8). In sub-chapter content layer, will enter the action script command for each Keyframe used to linking purpose and can prevent happen function looping problem as shown in figure 4.22.

Lastly, to create a video display function, that need to go to the top left corner select file to import video to the adobe flash as shown in figure 4.23 (label 8). The format of the video must conform to flv.format, so to use the online video format converter in order to meet the format requirements. After all the conversion is complete, then continue to add new layer again in the timeline and then drag it to video button and the link to the sub-chapter content page as shown in figure 4.21 (label 9).

The action scripts command has used:

```
1.)                    fscommand("fullscreen", "true");

2.)                        stop();

3.)    balanced_btn.addEventListener(MouseEvent.CLICK, balanceddiet);

       function balanceddiet(e:MouseEvent) {

       gotoAndStop("fooddigestivehomemenu","Scene 3");

       }

4.)    type1btn.addEventListener(MouseEvent.CLICK, clickgotonutrition_3);

       function clickgotonutrition_3(event:MouseEvent):void

       {

        gotoAndPlay(30);

       }
```

The action scripts command label 1 is used to make the introduction module become full screen mode display. The action script command label 2 is stop(); is the function used to stop looping of the work. The action script command gotoAndStop(); as shown in label 3 which are used move to the specified label and stop the play head, such as linking the sub-chapter content with home page by click on the button. "fooddigestivehomemenu" is the label name of digestive sub-chapter module, while the scene name is called "Scene 3". The action script command gotoAndPlay(); as shown in label 4 which are used to send the play head to the specified frame label and let it play from there.

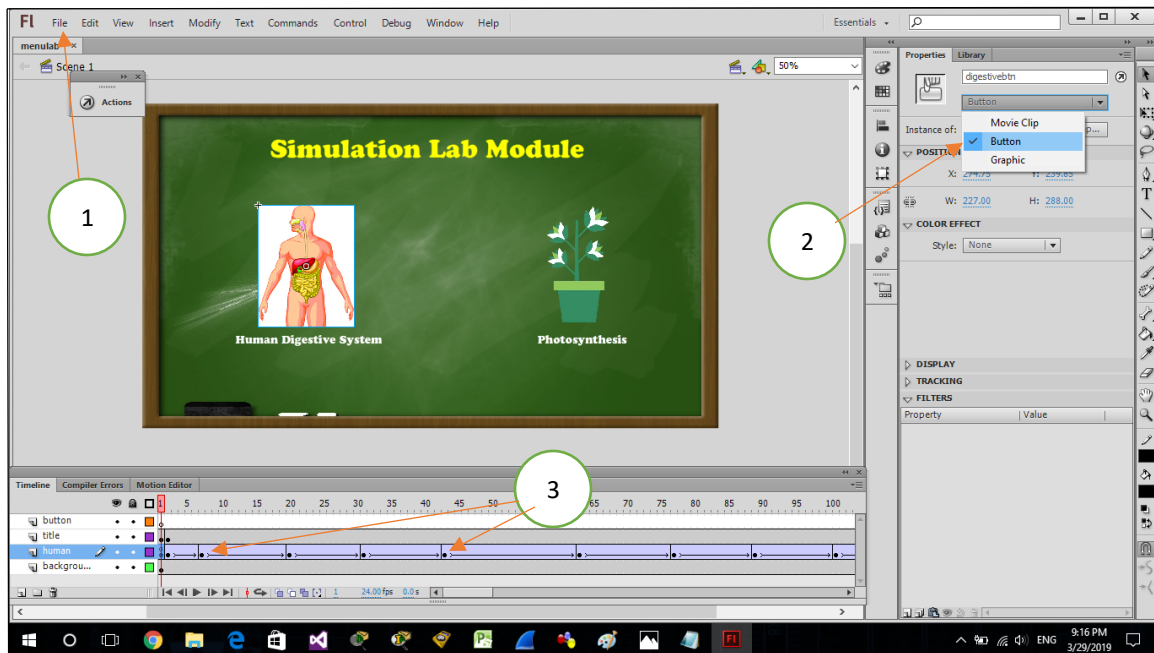### 4.2.2.4   Simulation Lab Module

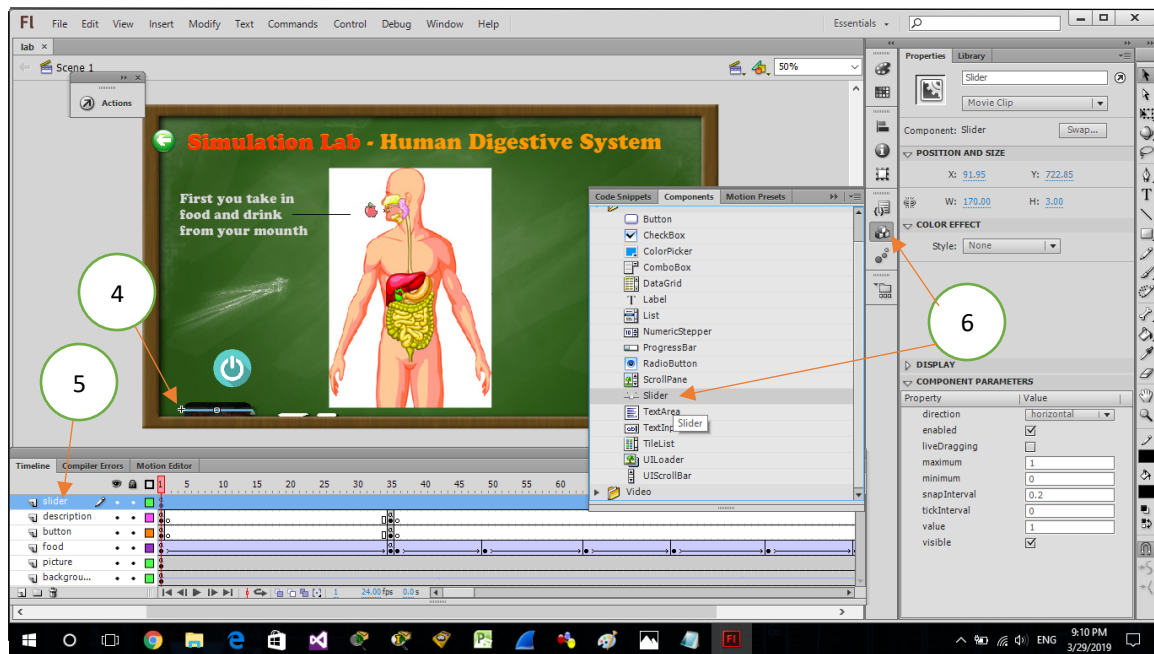*Figure 4.24 Create home page of simulation lab*

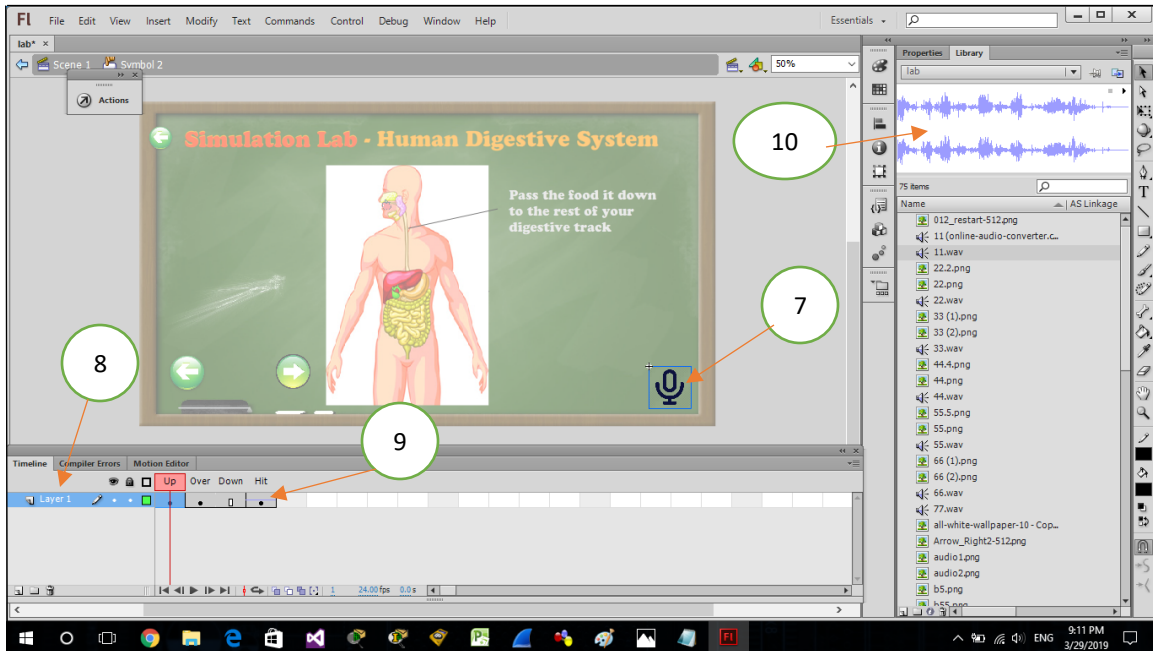*Figure 4.25 Create audio volume control slider feature*

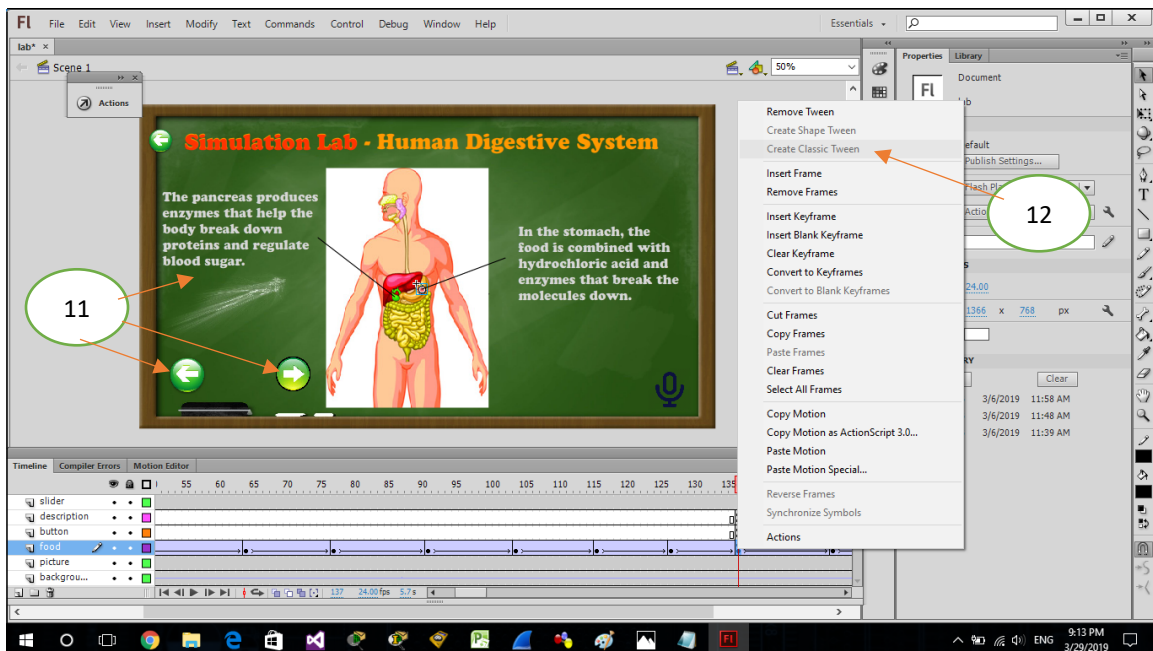*Figure 4.26 Create audio button for describe and introduce content*

Figure 4.27 Create description content with classic tween effect

Use adobe flash to complete the simulation lab module. Start creating the simulation lab home page, first go to open the upper left corner file and select import graphics, audio, button image prototype and so on as shown in figure 4.24 (label 1). Next, add new layer and set the name as button, then continue to drag in the image prototype into edit page from

the library. Next, right-on click the image and select convert symbol as button (label 2). Next, to insert Keyframe on button layer frame, then continue right-on click the button Keyframe and select to create classic tween for button in order to create the illusion of movement for each layer. Each Keyframe length is based on different display timings to make adjustment shifts (label 3).

Next, start creating the volume control slider function to control the audio volume as shown in figure 4.25 (label 4). First, add the new layer and set the layer name as slider in timeline (label 5), then open the component tool to select sliders and drag it into edit page (label 6). The volume control slider function must be created by enter the required action script command and the audio will save into the background.

Then, start creating the audio button function as shown in figure 4.26 (label 7), which is used as an audio function to introduce and describe the content. First, import the audio button image prototype and select to convert it as button, then double-click the button to add new layer in timeline (label 8) and then insert Keyframe on mouse hit frame (label 9). Next, to select and click the mouse hit Keyframe first and then to drag in the recorded audio from the library into the audio button (label 10), in order to complete the audio function.

Lastly, start creating the description text, back and next button as shown in figure 4.27 (label 11). First, drag text box into page and edit the content. Next, to select create classic tween for text contents in order to create the illusion of movement for each layer (label 12). For the back and next button, use the action script command to complete the function.

The action scripts command has used:

1.)   fscommand("fullscreen", "true");

2.)   stop();

3.)   digestivebtn.addEventListener(MouseEvent.CLICK, clickgotonextframe_1);

    function clickgotonextframe_1(event:MouseEvent):void{

    gotoAndPlay(2); }

4.)   import fl.events.SliderEvent;

```
    import flash.media.SoundTransform;

    var voltransform:SoundTransform = new SoundTransform();

    Slider.addEventListener(SliderEvent.THUMB_DRAG,changevol);

    function changevol(event:SliderEvent):void{

voltransform.volume = Slider.value;

SoundMixer.soundTransform = voltransform

    }
```

The action scripts command label 1 is used to make the simulation lab module become full screen mode display. The action script command label 2 is stop(); is the function used to stop looping of the work. The action script command gotoAndPlay(); as shown in label 3 which are used to send the play head to the specified frame label and let it play from there. The action script command as shown in label 4, is used to create the audio volume control slider feature. First, compulsory to import fl.events.SliderEvent; and flash.media.SoundTransform;. Then continue to create the function variable for the slider as shown in label 4.

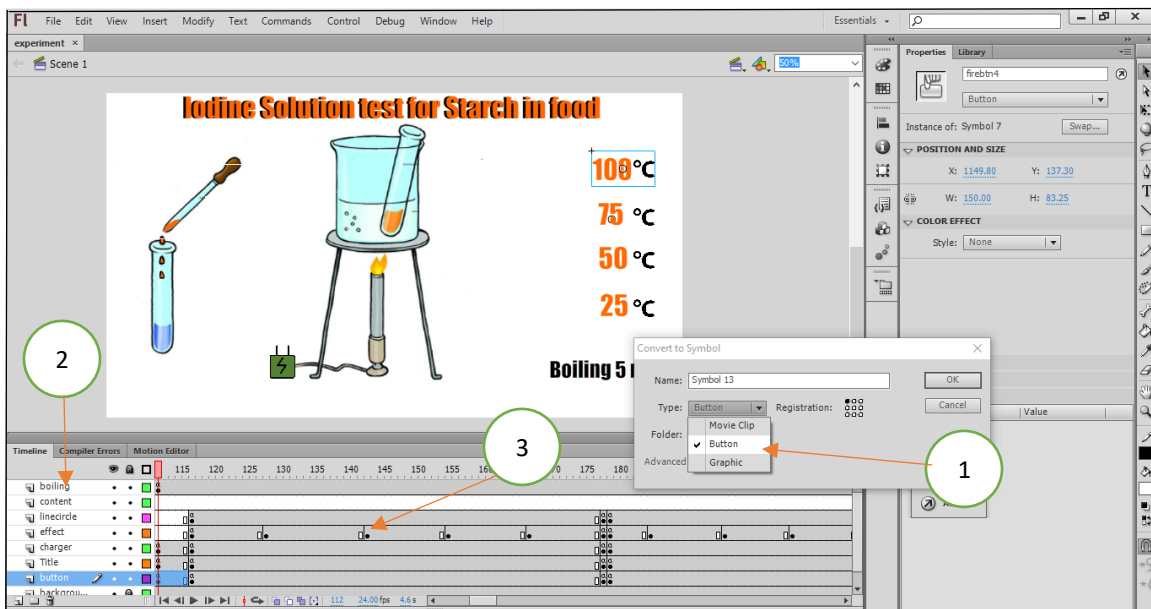### 4.2.2.5   Experiment Module

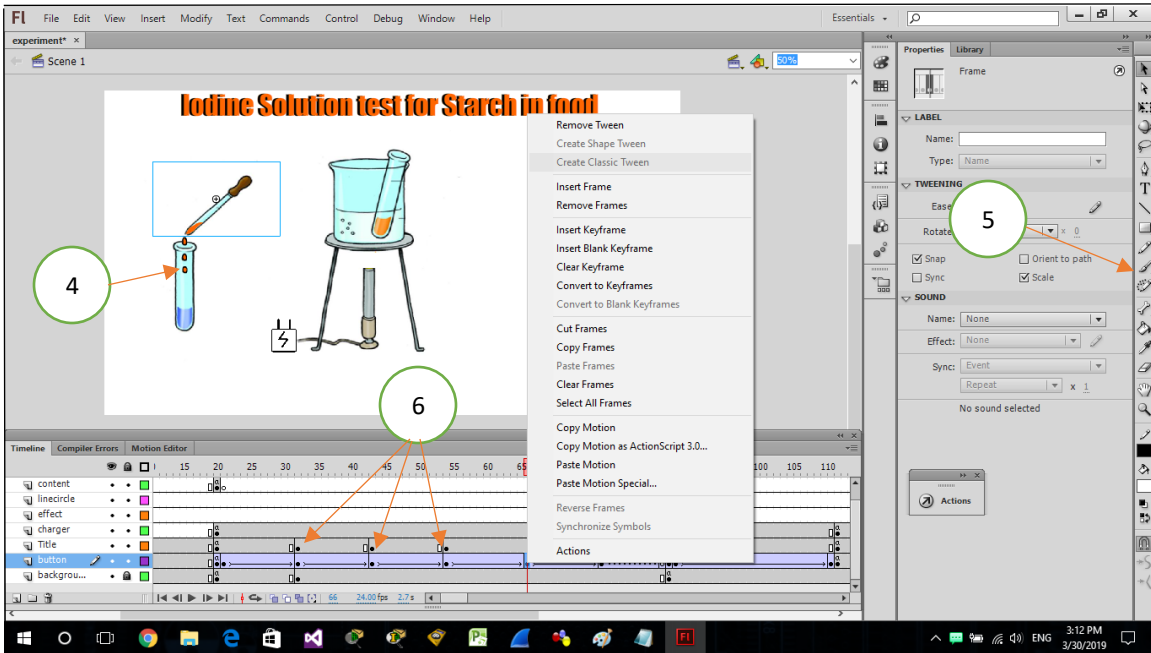*Figure 4.28 Create temperature effect button*

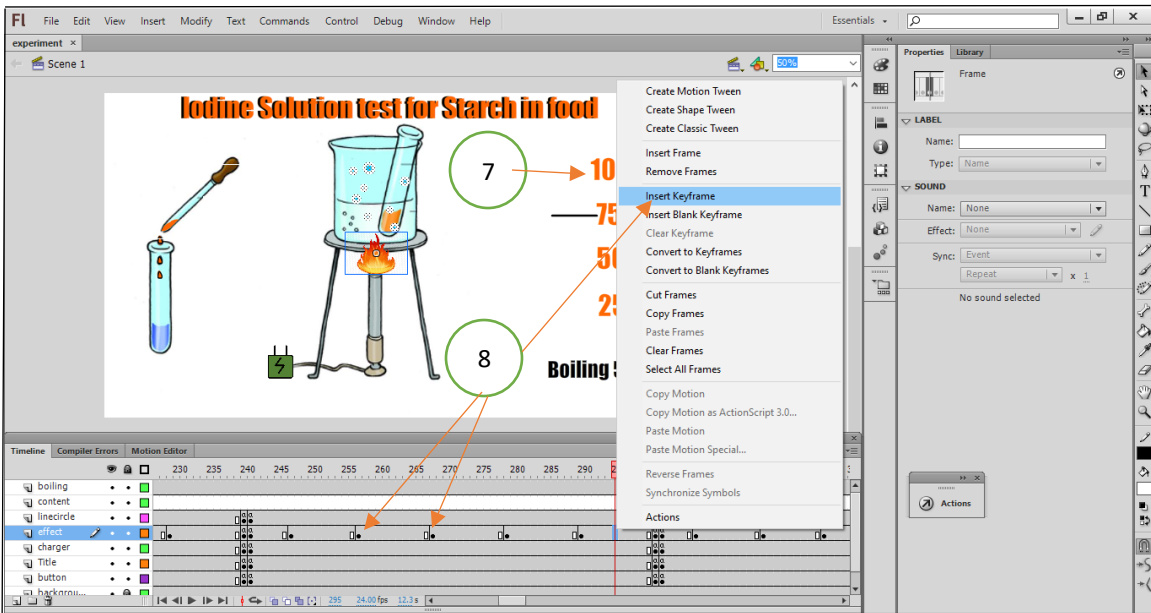*Figure 4.29 Create classic tween effect for liquid*

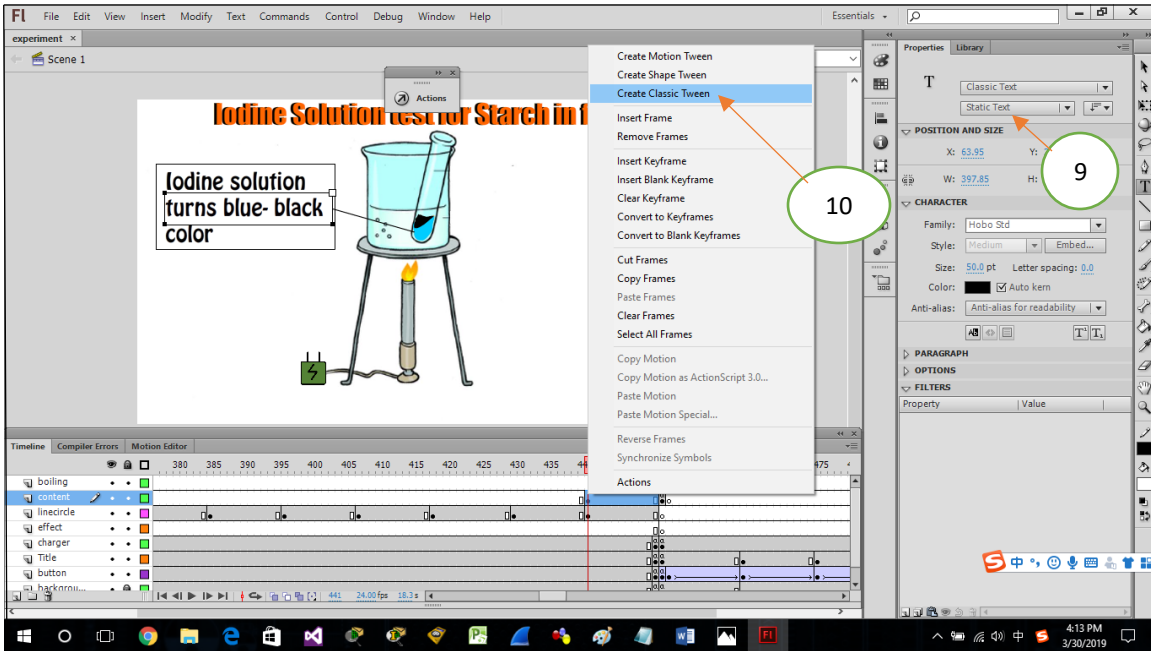*Figure 4.30 Create classic tween effect for fire and temperature*

Figure 4.31 Create description content with classic tween effect
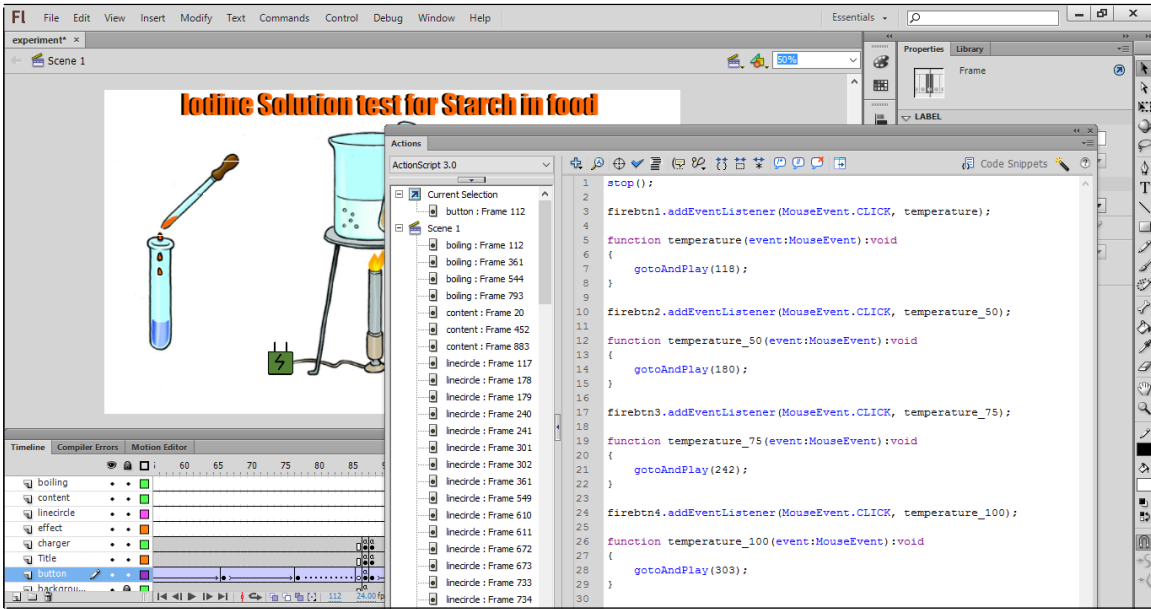

Figure 4.32 Create classic tween effect with required action script command

Use adobe flash to complete the experiment module. In order to make an interactive experiment module, first need to create a button that provides an interactive scene. The same go to import button image prototype from library, then select convert the symbol as

button as shown in figure 4.28 (label 1). Next add new layer in timeline for each button (label 2). Then, add Keyframe on frame based on the scene timing and length (label 3).

Then start to create the water drop effect as shown in figure 4.29 (label 4). First, add new layer to set the name as effect and insert the Keyframe on frame. Then, right click the effect Keyframe to select create classic tween, and then use the brush to paint the water drop pattern (label 5). During drawing the water drop effect, that need continuous insert Keyframe to achieve the desired effect (label 6). In order to prevent looping problem, compulsory to enter necessary action script command such as stop();.

Next, start creating the temperature selection button for the fire as shown in figure 4.30 (label 7). First, the same button needs to be created, then add new layer and set the name as effect in timeline. Then add the Keyframe with enter the necessary action script command on the effect frame. The purpose of insert Keyframe on here is to create a special effect of the fire transformation (label 8). In order to achieve the special effect of the fire transformation, so that must to enter the necessary action script command to complete the creation as shown in Figure 4.32.

Lastly, create description content with classic tween effect as shown in figure 4.31. The same use the text box and drag into the page, then start to edit the text content and then select the content to convert it as static text (label 9). Then, right click and select create classic tween to complete (label 10).

The action scripts command has used:

```
1.)                    fscommand("fullscreen", "true");

2.)                         stop();

3.)    firebtn2.addEventListener(MouseEvent.CLICK, temperature_50);

       function temperature_50(event:MouseEvent):void

       {

        gotoAndPlay(180);

        }
```

The action scripts command label 1 is used to make the experiment module become full screen mode display. The action script command label 2 is stop(); is the function used to stop looping of the work. The action script command gotoAndPlay(); as shown in label 3 which are used to send the play head to the specified frame label and let it play from there.
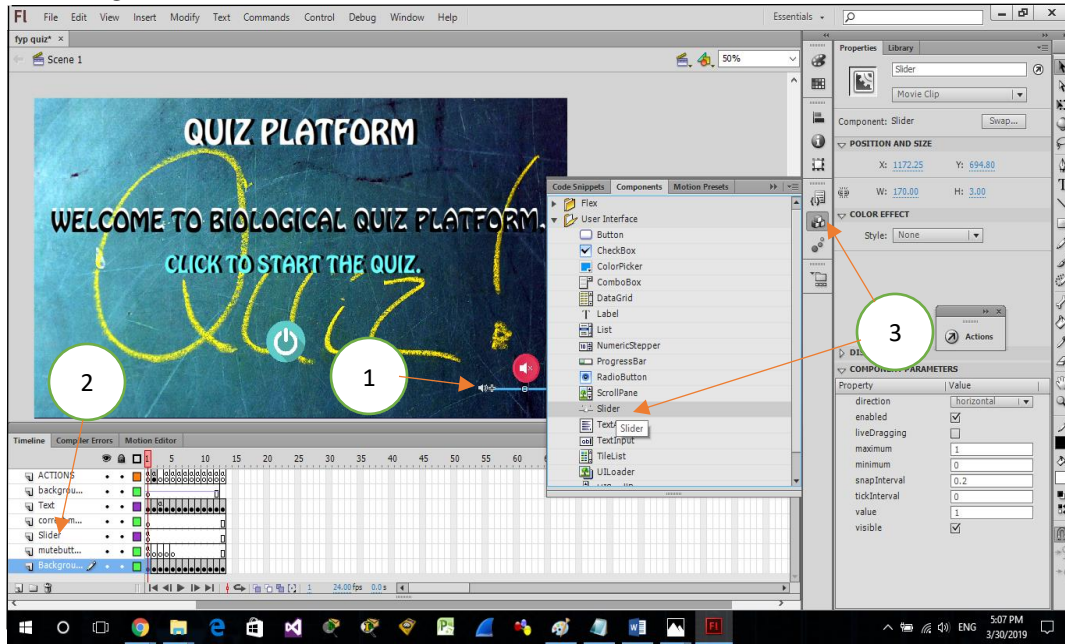
4.2.2.6　Quiz Module

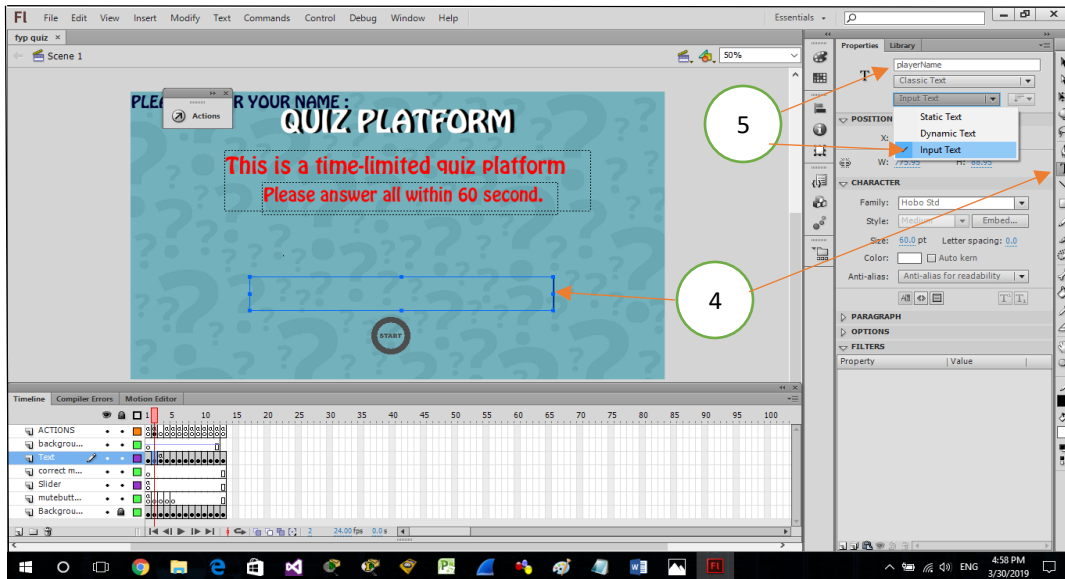*Figure 4.33 Create audio volume control slider feature*

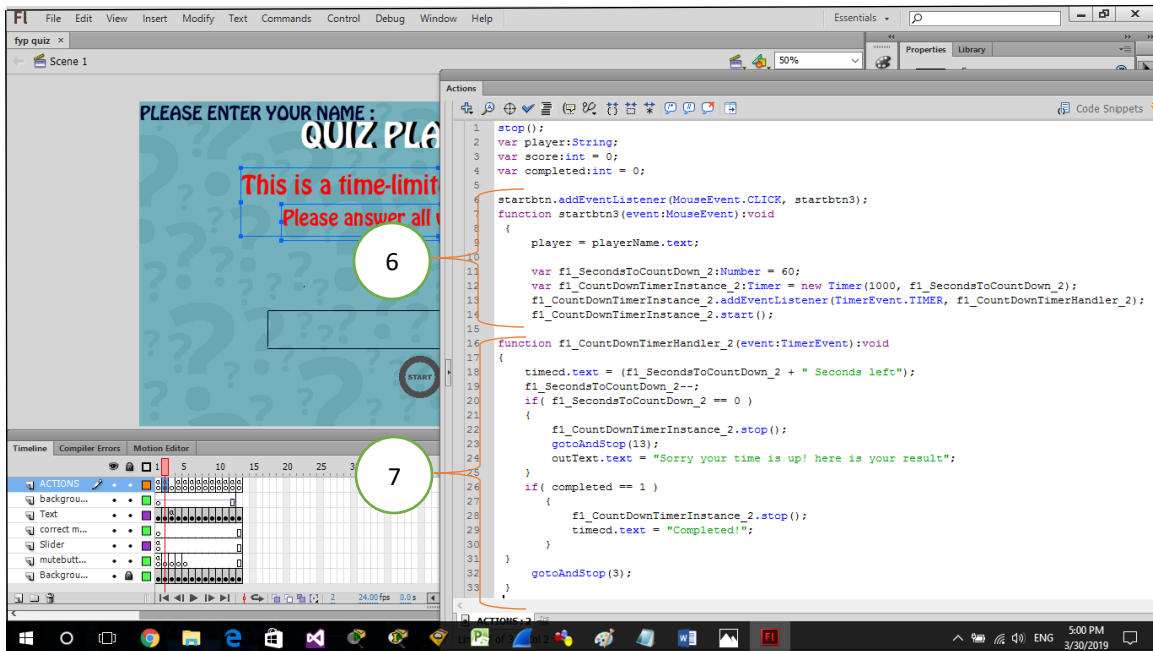*Figure 4.34 Create login page with input text*

Figure 4.35 Action script command used to create username login, timing and scores function
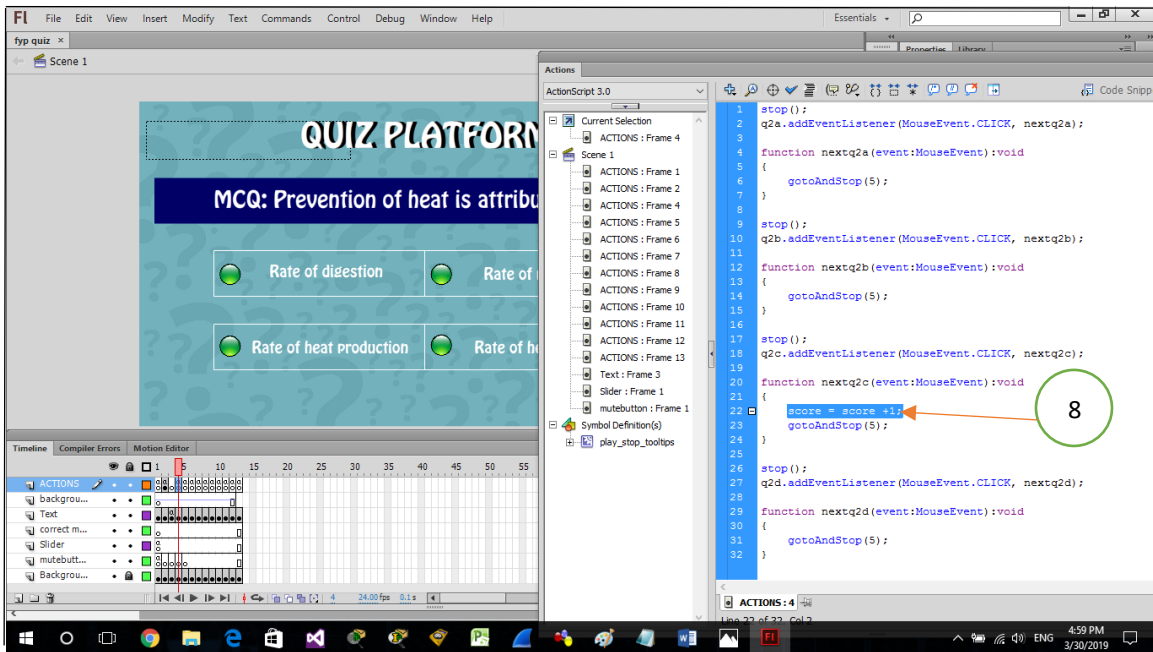

Figure 4.36 Action script command used to detect and count for each correct answer
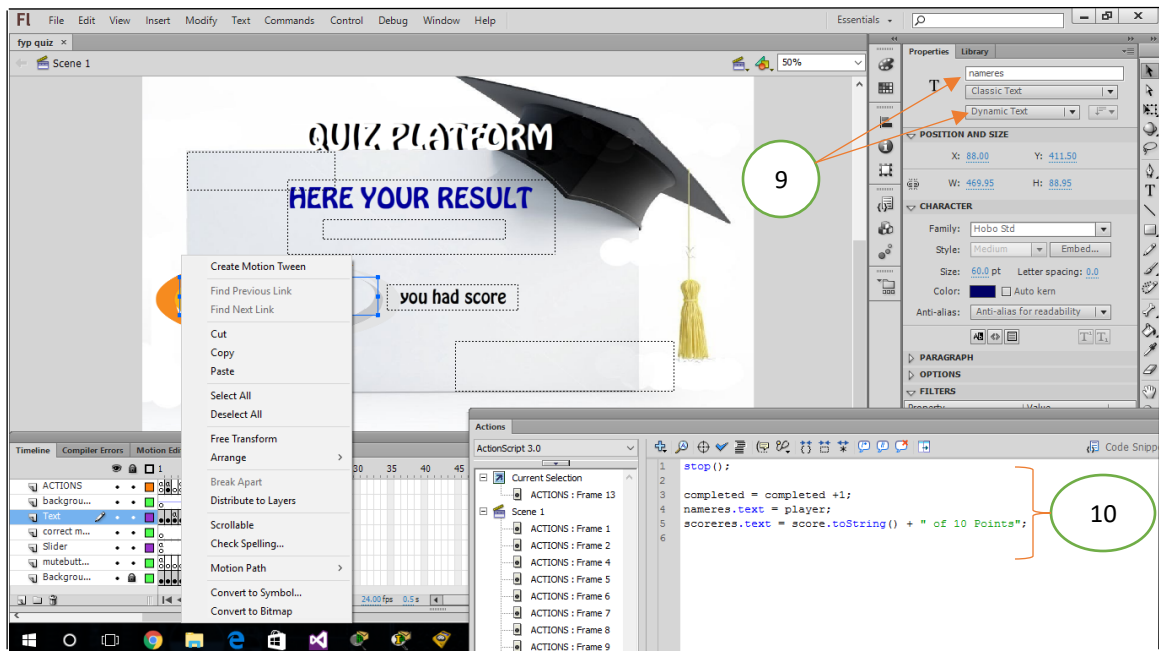
Figure 4.37 Action script command used to call out the username, scores and timing function at result page

Use adobe flash to complete the quiz module. First, start creating the volume control slider function to control the background music and audio volume as shown in figure 4.33 (label 1). First, add the new layer and set the layer name as slider in timeline (label 2), then open the component tool to select sliders and drag it into edit page (label 3). The volume control slider function must be created by enter the required action script command and the audio will save into the background.

Furthermore, start creating the username login as shown in figure 4.34. First, to add new layer and set the name as action in timeline, then continue insert the Keyframe on the frame. Next, select text box and drag into the page (label 4), then enter instance name for the text and select to set as input text (label 5). Next, create a login button for text input with enter the required action script command as shown in figure 4.35 (label 6), in order to call the function out at result page.

In addition, start creating the timing function. First, go to drag text box into the page and set as static text. Then, use the action script command to create the timing function and import to the static text as shown in figure 4.35 (label 7). Moreover, enter the required action script command in the Keyframe of each question page, in order to count scores and

detect for each correct answer as shown in figure 4.36 (label 8). The scores result will be called and display at result page. Lastly, to create the result page as shown in figure 4.37. First, select text box and drag into the page, then enter the instance name for each text box and set as dynamic text (label 9). Then, to enter the action script command to call out the username, timing and scores function and display on this page (label 10).

The action scripts command has used:

```
1.)                    fscommand("fullscreen", "true");

2.)                        stop();

3.)    q2a.addEventListener(MouseEvent.CLICK, nextq2a);

       function nextq2a(event:MouseEvent):void{

       gotoAndStop(5);}

4.)    import fl.events.SliderEvent;

       import flash.media.SoundTransform;

       var voltransform:SoundTransform = new SoundTransform();

       Slider.addEventListener(SliderEvent.THUMB_DRAG,changevol);

       function changevol(event:SliderEvent):void{

       voltransform.volume = Slider.value;

       SoundMixer.soundTransform = voltransform}

5.)    var f1_SecondsToCountDown_2:Number = 60;

6.)    score = score +1;
```

The action scripts command label 1 is used to make the simulation lab module become full screen mode display. The action script command label 2 is stop(); is the function used to stop looping of the work. The action script command gotoAndPlay(); as shown in label 3 which are used to send the play head to the specified frame label and let it play from there. The action script command as shown in label 4, is used to create the audio volume control slider feature. First, compulsory to import fl.events.SliderEvent; and flash.media.SoundTransform;. Then continue to create the function variable for the slider as shown in label 4. Label 5 is function variable of timing with 60 second. Label 6 used to scores correct answer at each question page.

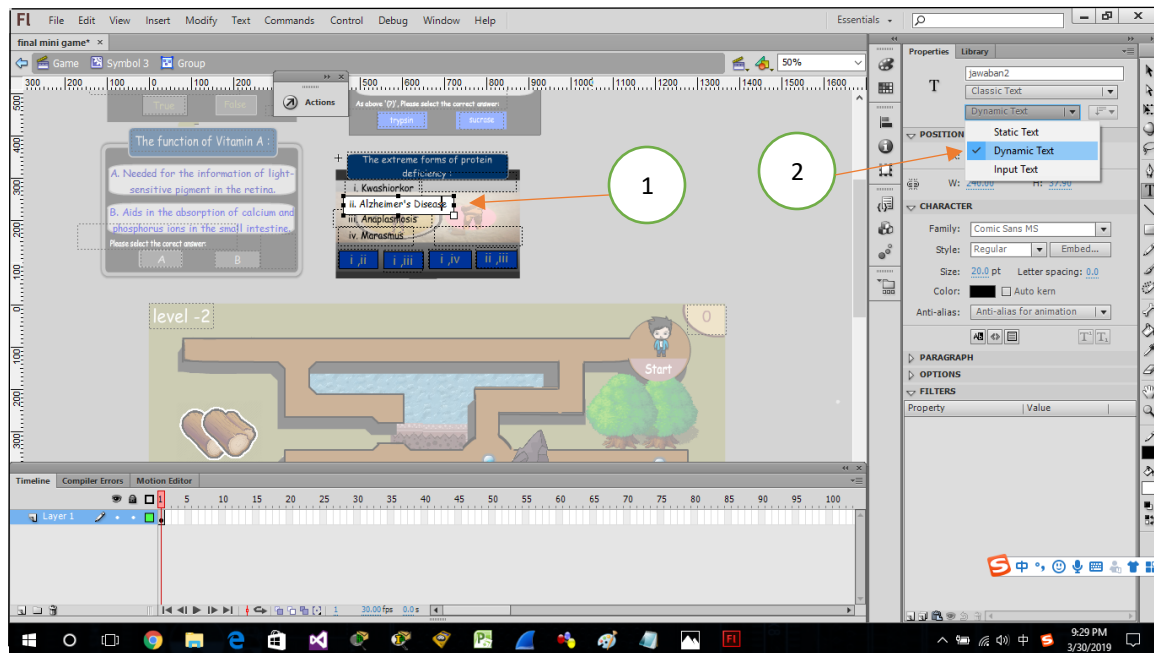### 4.2.2.7 Mini Game Module

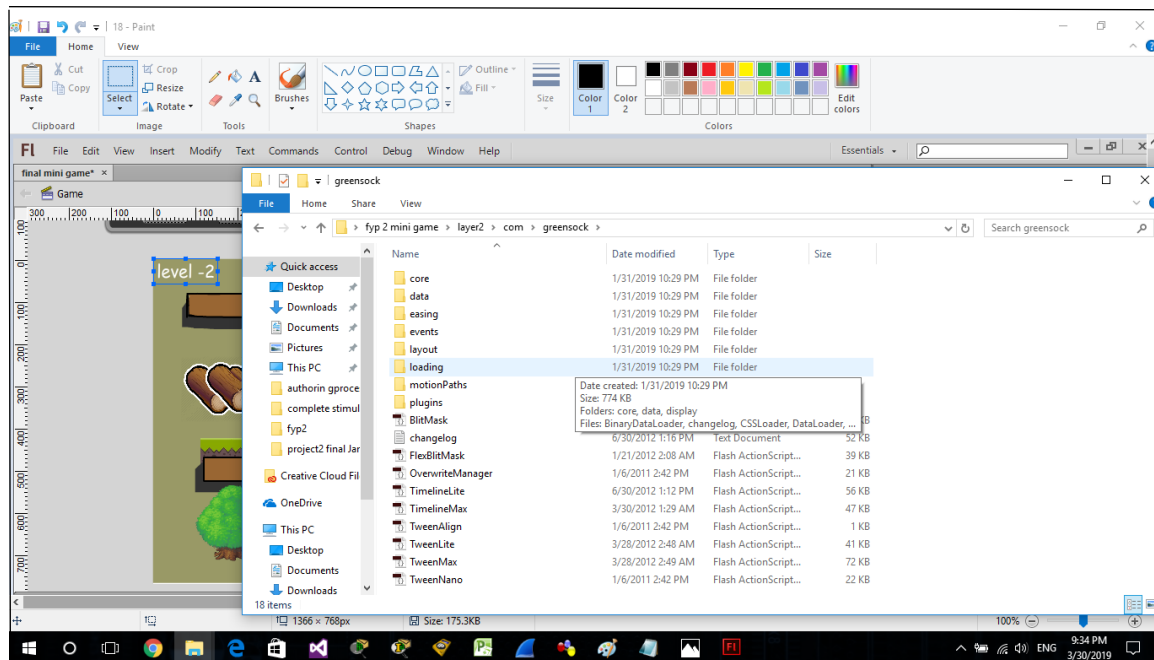
Figure 4.38 Create question by used of text tool

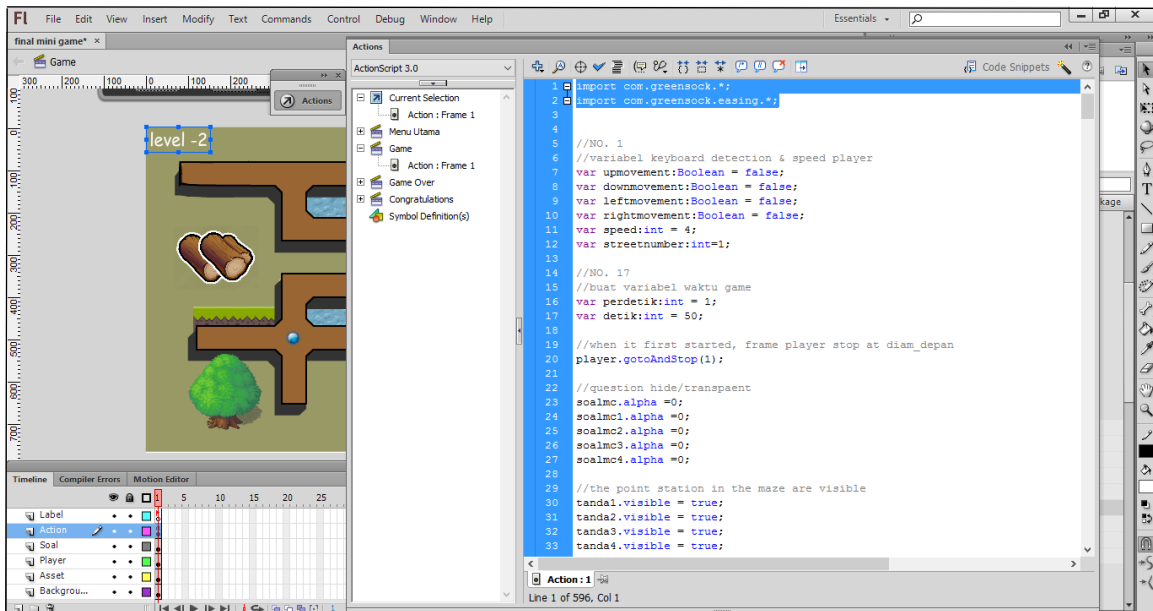*Figure 4.39 Place all Greensock js files into project file directory*

Figure 4.40 To create function variable and import GreenSock js file into action scripts command to create animation game
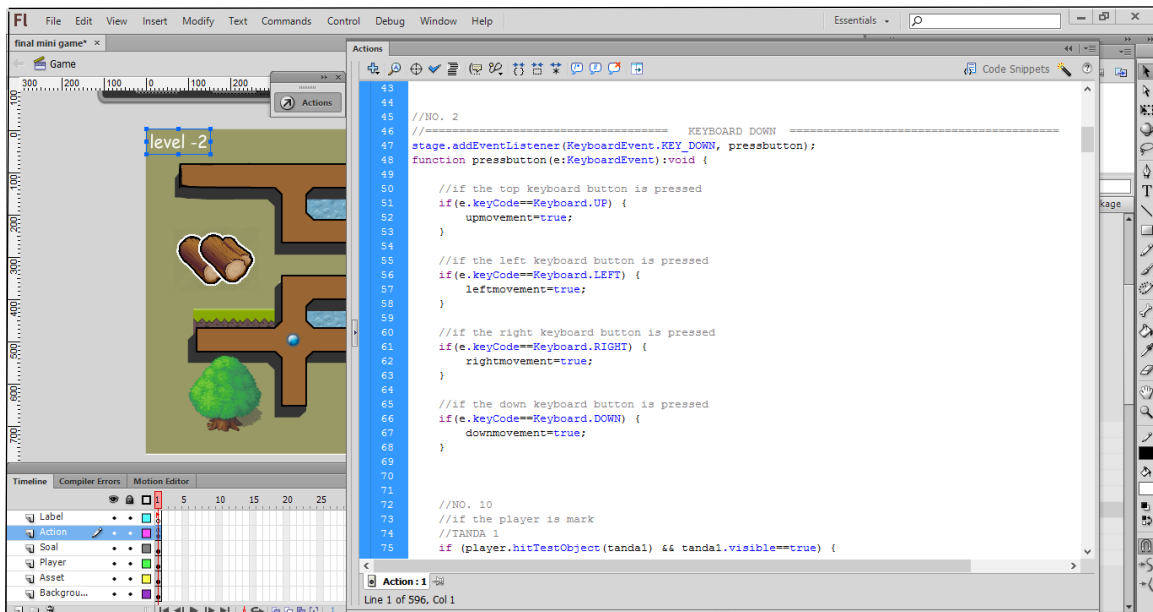
Figure 4.41 Action script command used for control animation movement by keyboard
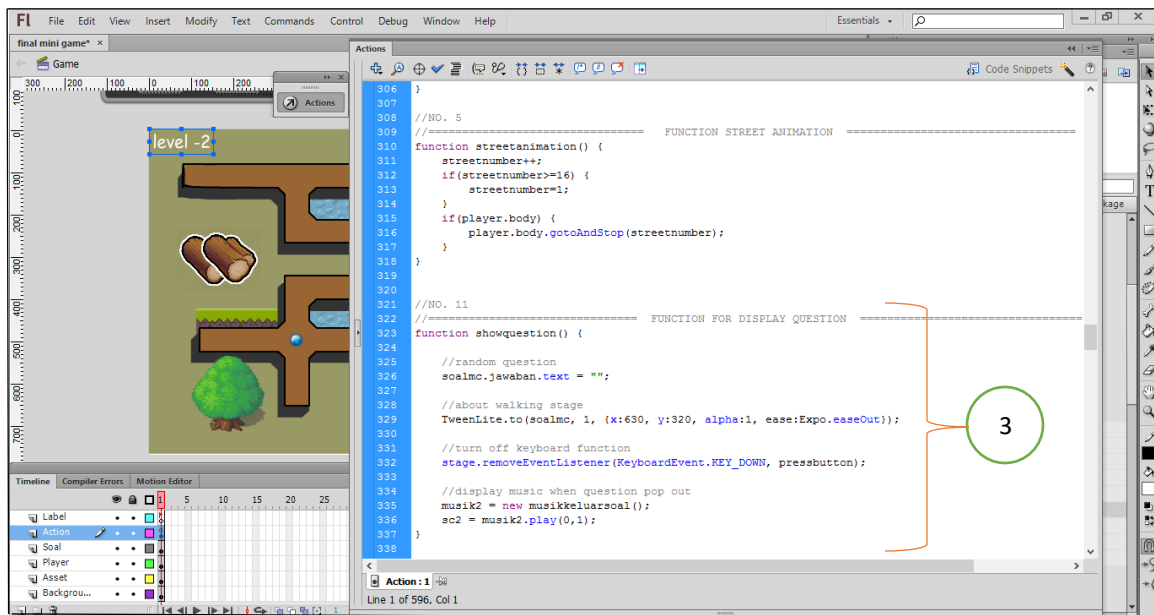
Figure 4.42 Create a function for animation street movement and display question
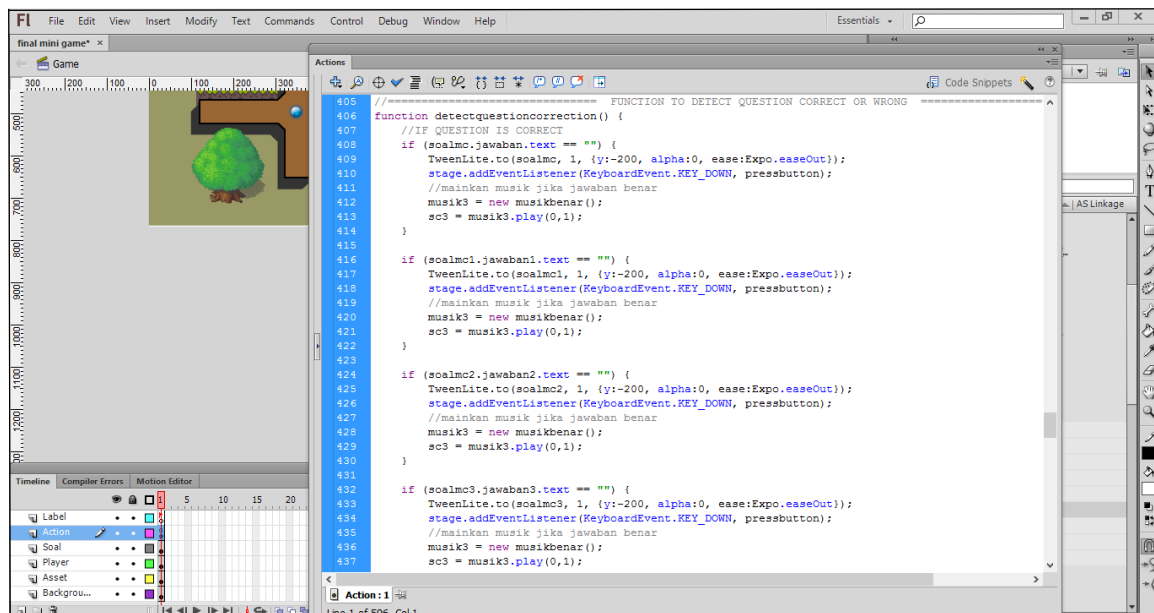
Figure 4.43 Create a function to detect question correct or wrong

Creating a mini game is the most complicated and difficult of this system. First of all, to create a mini game by using adobe flash, then import the previously created image and animate player prototype and so on. Next, start creating questions with pop out effect. First, select text box to drag into the page and start to edit the content as shown in figure

4.38 (label 1). After completed the edit, then select all the text to modify as group. Next, right-on click the text again and select as dynamic text (label 2), then import the button into the group. The action script command is used to complete the production as shown in Figure 4.42 (label 3).

Next, start creating animation game. First, need to download greensock's js file such as Tweenmax, TimelineLite or other related js files from the Internet and place them in the project file directory as shown in figure 4.39. In the adobe flash, drag in the produced animated prototype and arrange it neatly, layout and navigation very important for create an animation movement successful. Then add new layer for each image such as animated character, maze prototype, station prototype and so on. Then continue enter instance name for each image and insert Keyframe on frame of each layer. Next, right-on click the Keyframe to select actions, add the compositionReady, animated movement, question display function and so on as shown in figure 4.42.

Next, import the greensock related js file and associate it with the custom function init(). When all js file is import complete, execute all function. Add the custom function var(boolean = false) to create variable for keyboard detection & speed player or var distance = player.width/4 to create distance player variable with maze as shown in figure 4.40 and any required variable to complete the custom Tweenmax effect, play and create custom animation easing and moving effects here. Create an animate game with mouse and keyboard control function such as mouse used as to click answer questions, then use the keyboard to control the animated character movement as shown in figure 4.41. All animation movement processes and maze games station design all are very dependent on the control and input of the action script command. Input errors command will cause debug errors, so this is the most difficult module to create.

The action scripts command has used:

1.)   fscommand("fullscreen", "true");

2.)   stop();

3.)   var upmovement:Boolean = false;

4.)   var perdetik:int = 1;

```
        var detik:int = 35;
5.)     player.gotoAndStop(1);
6.)     soalmc.alpha =0;
7.)      tanda1.visible = true;
8.)     var topdistance = player.width/100;
9.)     stage.addEventListener(KeyboardEvent.KEY_DOWN, pressbutton);
        function pressbutton(e:KeyboardEvent):void {
        if(e.keyCode==Keyboard.UP) {
                upmovement=true; }
10.)    showquestion4();
11.)    TweenLite.to(soalmc2, 1, {x:470, y:250, alpha:1, ease:Expo.easeOut});
12.)    if (soalmc.jawaban.text == "") {
         TweenLite.to(soalmc, 1, {y:-200, alpha:0, ease:Expo.easeOut});
         stage.addEventListener(KeyboardEvent.KEY_DOWN, pressbutton); }
13.)    import com.greensock.*;
        import com.greensock.easing.*;
14.)    while (mazemc.hitTestPoint(player.x, player.y-topdistance, true)) {
                player.y++; }
```

The action scripts command label 1 is used to make the simulation lab module become full screen mode display. The action script command label 2 is stop(); is the function used to stop looping of the work. Label 3 is used as variable keyboard detection & speed player. Label 4 is used as variable of timing. Label 5 which are used move to the specified label and stop the play head. Label 6 is function to hide and make question transparent. Label 7 is function to make point station become visible effect. Label 8 is used as variable to create distance player variable with maze. Label 9 is keyboard control movement function. Label 10 is used to call out the display question function. Label 11 is the function of display question. Label 12 is function to detect answer correct or wrong. Label 13 is used to import greensock js files. Label 14 is function to detect animated hit station point distance.

4.2.3 Post-authoring Process
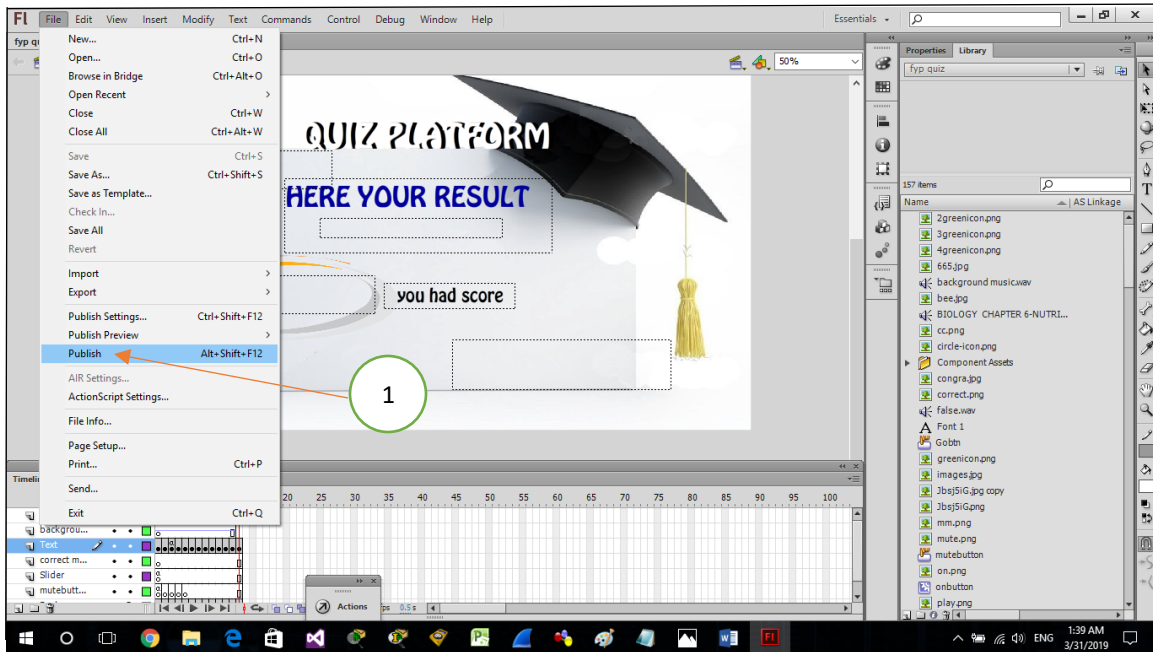
Figure 4.44 Select to publish the completed job module by Adobe Flash
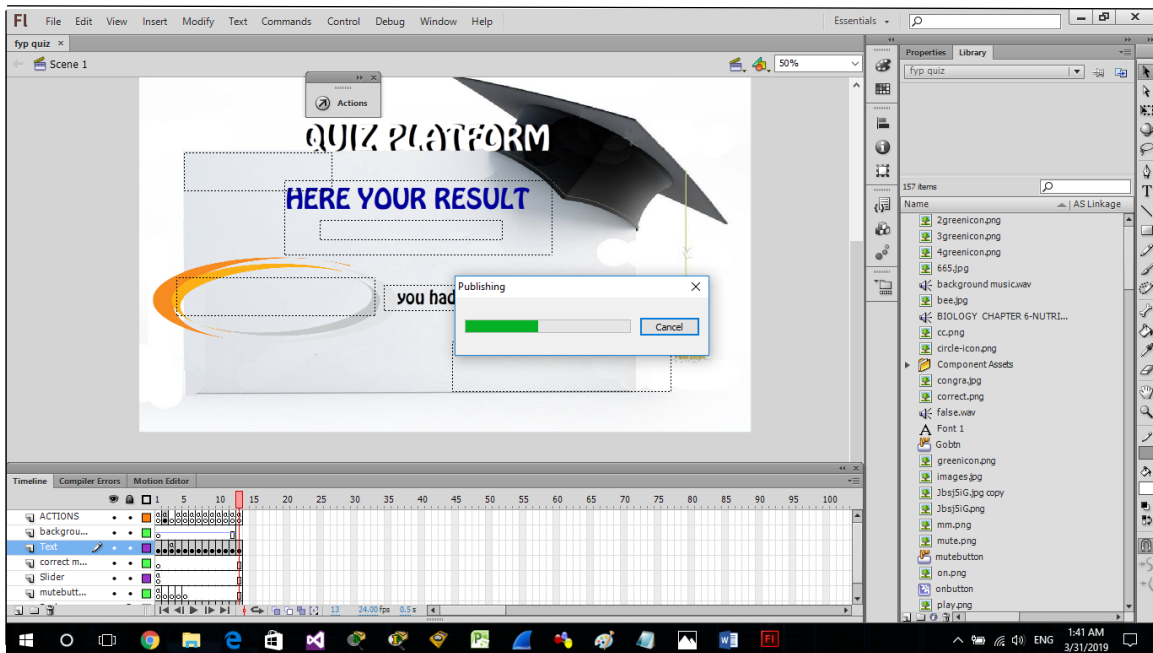
Figure 4.45 Publishing the job module by Adobe Flash and save as flash.swf into desktop

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Figure 4.46 Used Adobe Director to do module combination and linking
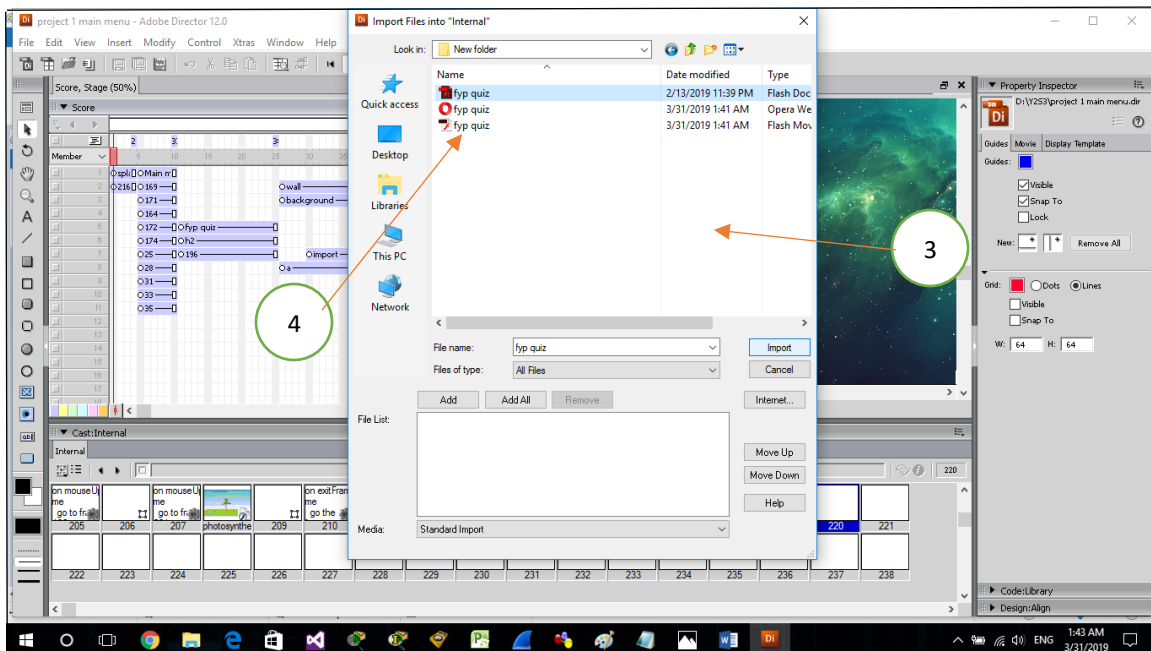
Figure 4.47 Select to import the flash.swf file from desktop into Adobe Director to do combination
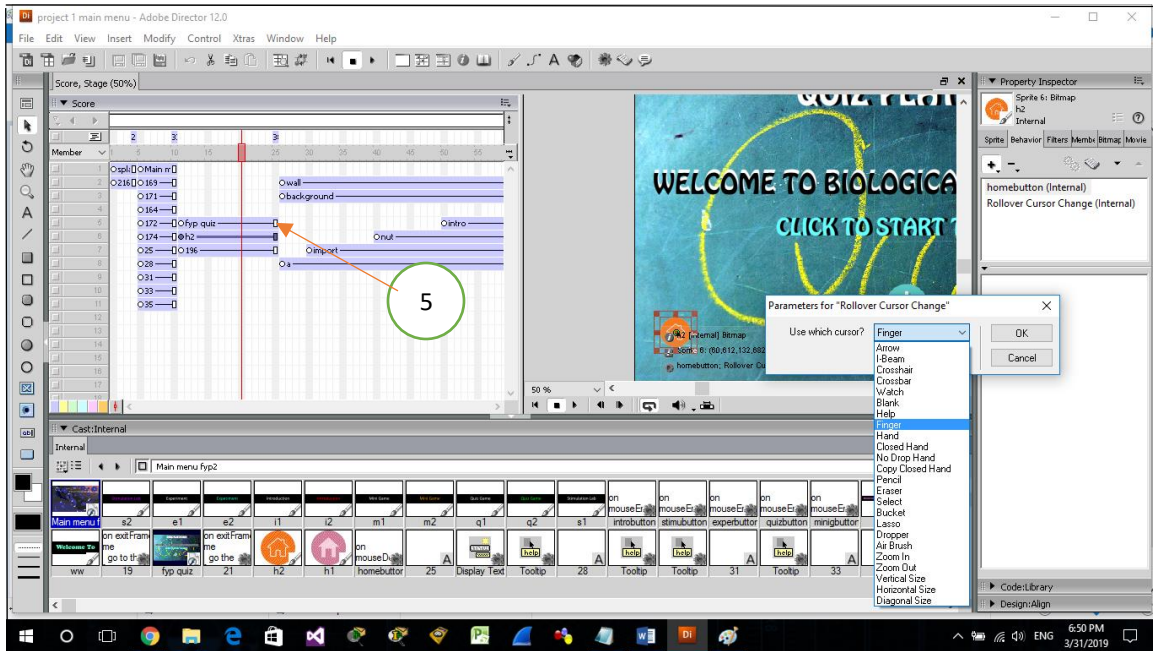
Figure 4.48 Drag in the imported flash.swf file into the score window and create the rollover finger cursor effect for button
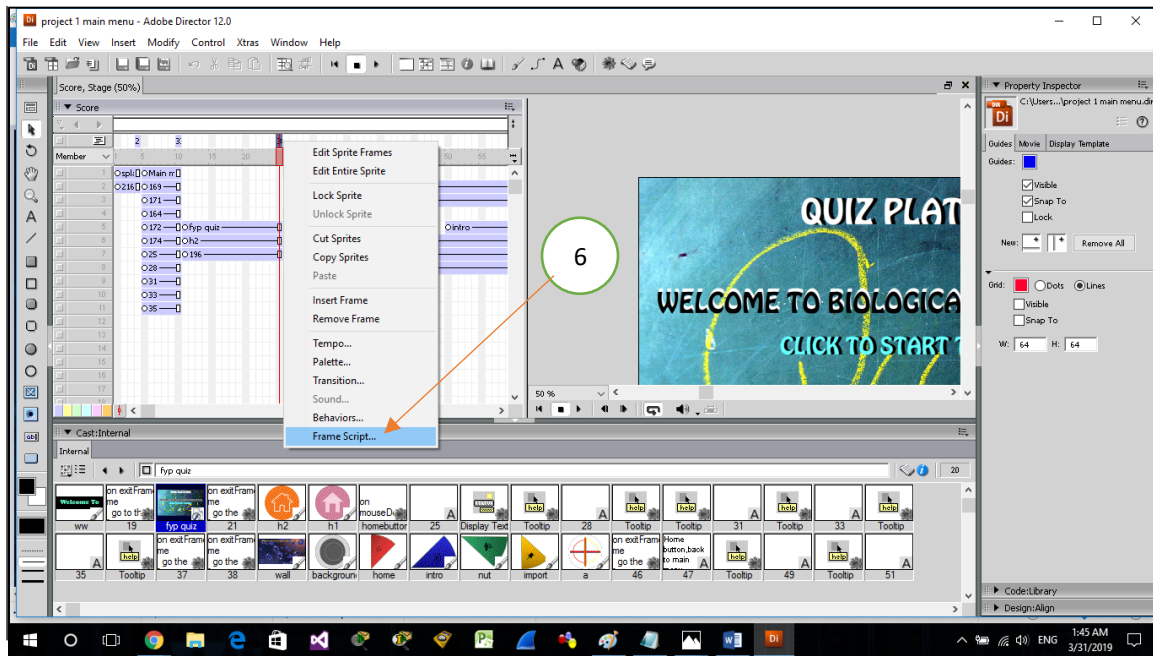
Figure 4.49 Right click on playback head to select frame script in order to enter script command
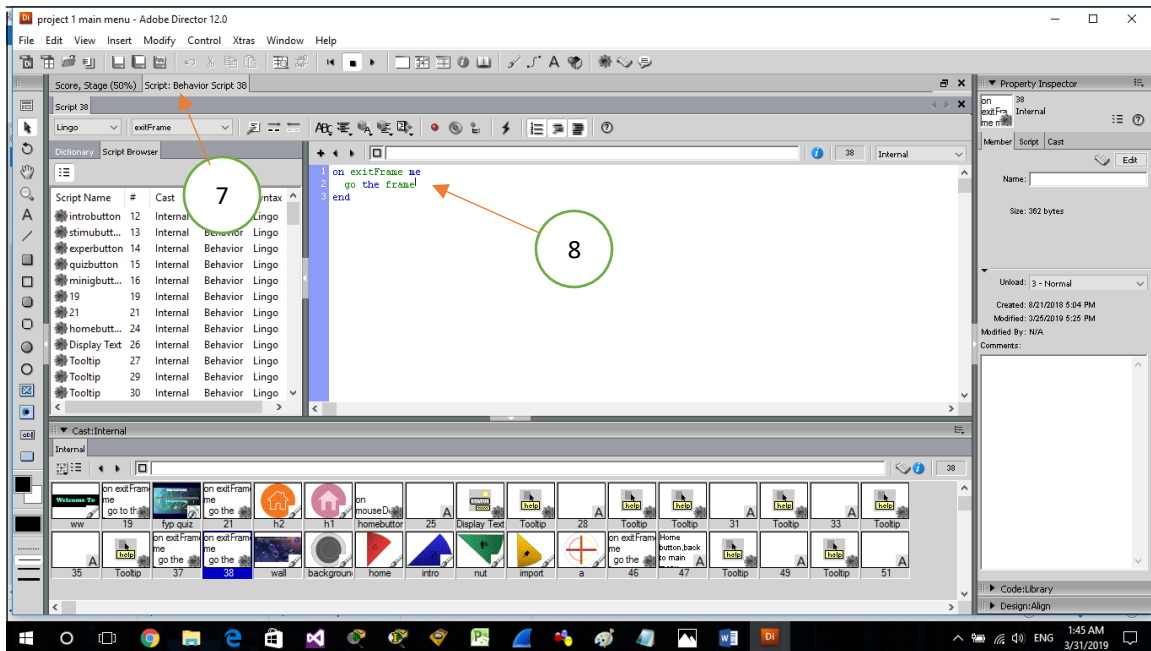
Figure 4.50 Behavior script window display and enter required script command to stop looping error
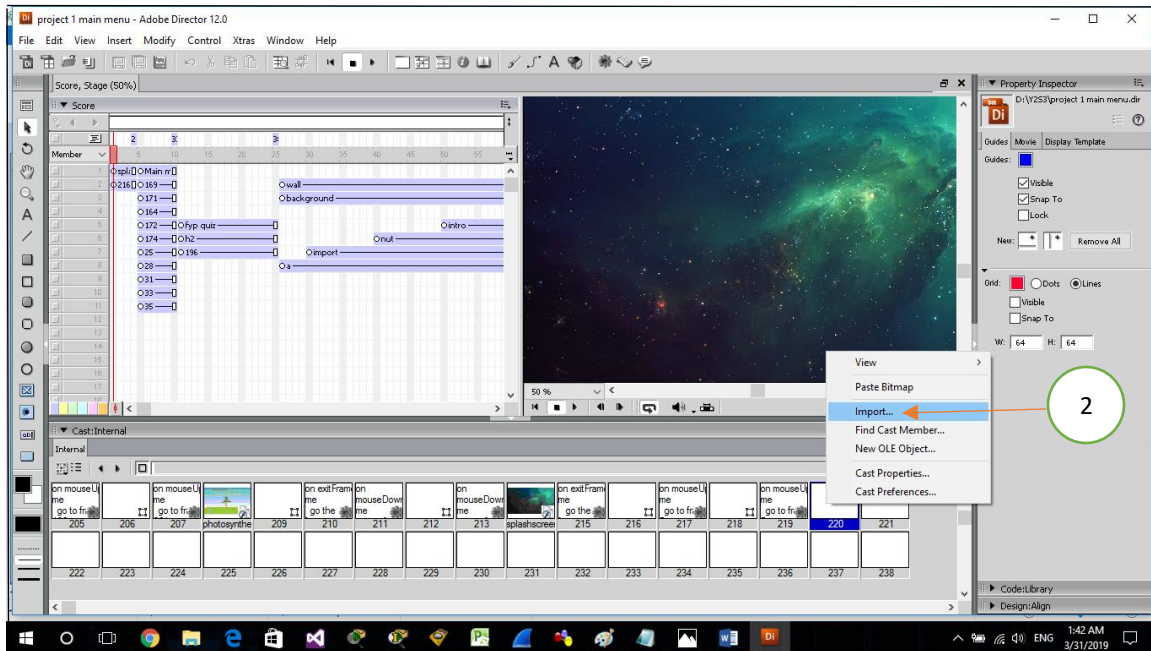

Figure 4.51 Select to publish the complete job by Adobe Director

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Figure 4.52 Publishing the complete job by Adobe Director and save as application.exe

All modules of this multimedia application is done by using adobe flash. Therefore, in order to combine all the modules together to make a complete courseware, adobe director used as the software to do the modules combination. First, save the created flash modules, then click on the file and select to publish as shown in figure 4.44 (label 1). The system will automatically publishing as flash.swf file and save into the desktop as shown in figure 4.45.
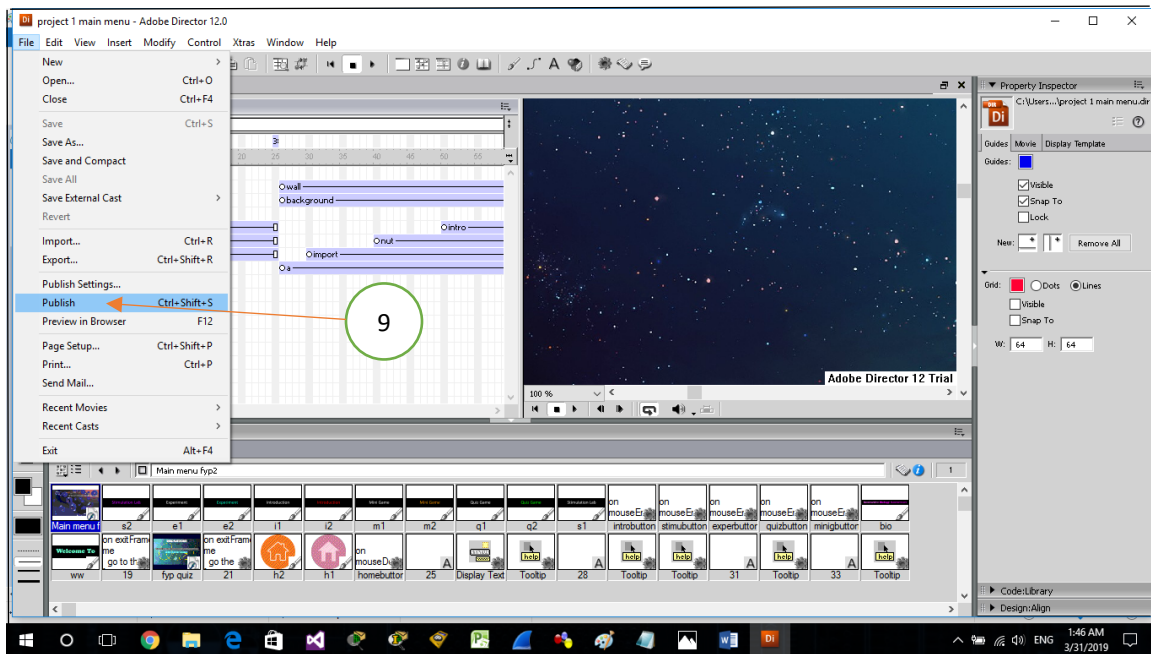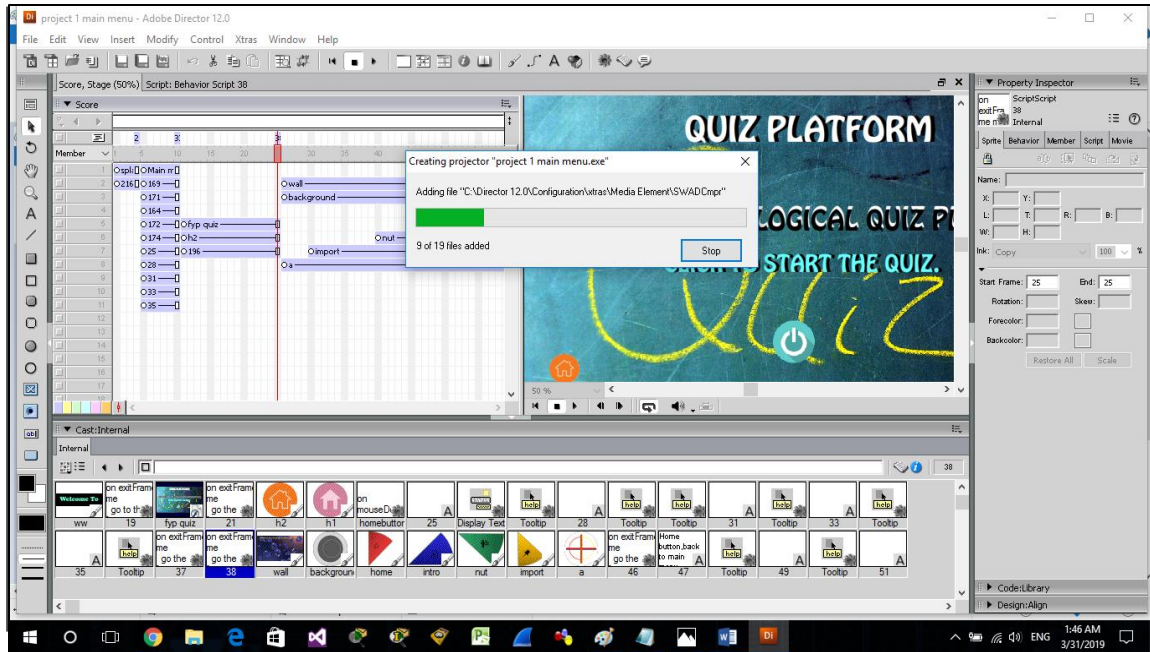
Next, to open the adobe director and start to do the flash modules combination. First, select a cast in the cast internal window and right click to select import as shown in figure 4.46 (label 2), then the import file window will pop up as shown in figure 4.47 (label 3). Next, choose to import the created flash.swf file into the cast internal window to start combine the modules (label 4). After complete imported the flash.swf file, to select the flash.swf file and drag into the score window as shown in figure 4.48 (label 5). Next, continue right click on playback head to select frame script as shown in figure 4.49 (label 6), the behavior script will display as shown in figure 4.50 (label 7) and need to enter required script command in order to prevent file looping error problem during combination (label 8). In addition, to complete the linking, such as the next button, also need to enter the script command to complete the creation.

Lastly, all the linking and modules combination are completed, then start to click on the file and select to publish the job as shown in figure 4.51 (label 9). The adobe director will publishing the job as application.exe and save into the desktop as shown in figure 4.52, here are the post-authoring process to complete the multimedia application.

The scripts command has used:

```
on exitFrame me
    go the frame
end                                    1

on mouseUp me
    go to frame 5
end                                    2

on mouseDown me
    go to frame 5
end                                    3

on mouseEnter me
    set the member of sprite the currentSpriteNum to member "h1"    4
end

on mouseLeave me
    set the member of sprite the currentSpriteNum to member "h2"    5
end
```
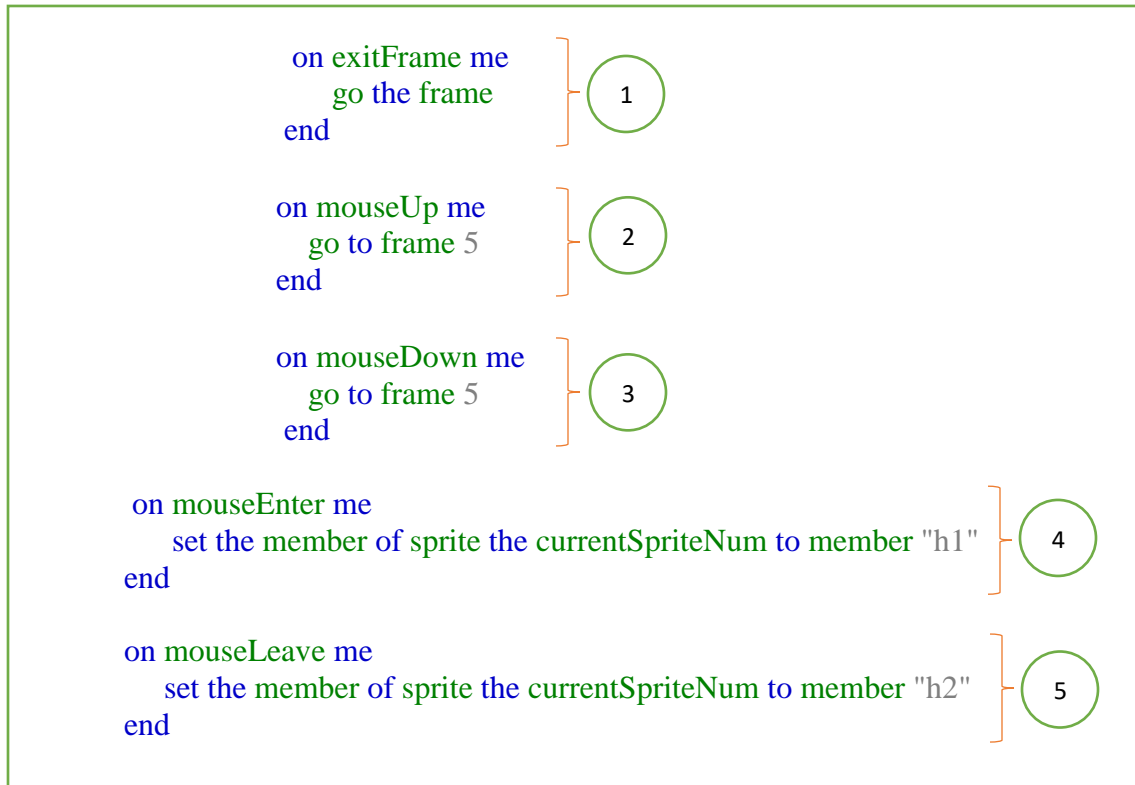
The scripts command label 1 is sent to the frame script when it is time to move to the next frame and to stop each module looping error. Label 2 used as event fires when releases the mouse button. Label 3 used as event fires when depresses the mouse button and cursor click the button go to the next frame. Label 4 to create mouse over effect when the cursor enters the area of a sprite. Label 5 to create mouse over effect when the cursor leaves the area of a sprite.

Chapter 5 TESTING, RESULTS AND DISCUSSION

5.1Overview

System testing is very important to create a perfect multimedia application. The purpose of system testing is to ensure that to create a system that meet the user requirement and detecting whether there is a vulnerability in the system. Conduct a series of evaluation tests and validation tests on the system in the actual operating environment. For an example, using the survey questionnaire for system testing is to find out where the software does not conform to or contradict the system definition by comparing with the system requirement definition or provide the questionnaire to evaluate the system. The following will show the Testing, Results and discussion included method of testing, testing analysis and results and discussion.

5.2Method of Testing

System testing is an essential part of system development. The test phase can be used in projects such as the planning phase, the requirements analysis phase, the coding phase, the summary design and the detailed design phase. A good system is bound to be accompanied by an excellent testing process. Hence, survey questionnaire used as a method of testing this multimedia application. The survey questionnaire is also called a questionnaire or an inquiry form, used to investigate content by asking questions. There are several advantages to use survey questionnaire for system testing. Firstly, can save time, manpower and physical strength. Secondly, the results of the survey are easier to quantify. The survey questionnaire method is a structured survey method. The form of the survey, the sequence of the questions and the answers are fixed. All of them are expressed in the form of words. Therefore, this method can be well quantified. Thirdly, the results of the questionnaire method are easier to statistically process and analyze. Can use analysis software for data analysis which is very simple. Lastly, the advantage of the survey questionnaire method is the ability to conduct large-scale investigations. Regardless of whether the respondents participated in the survey, can understand the thoughts, attitudes, and behaviors of the respondents from the questionnaire. In conclusion, the survey questionnaire used as a method of system testing is very useful. It not only has many benefits but also has a very important essential part in system development. This is a good choice.

5.3 Testing Analysis
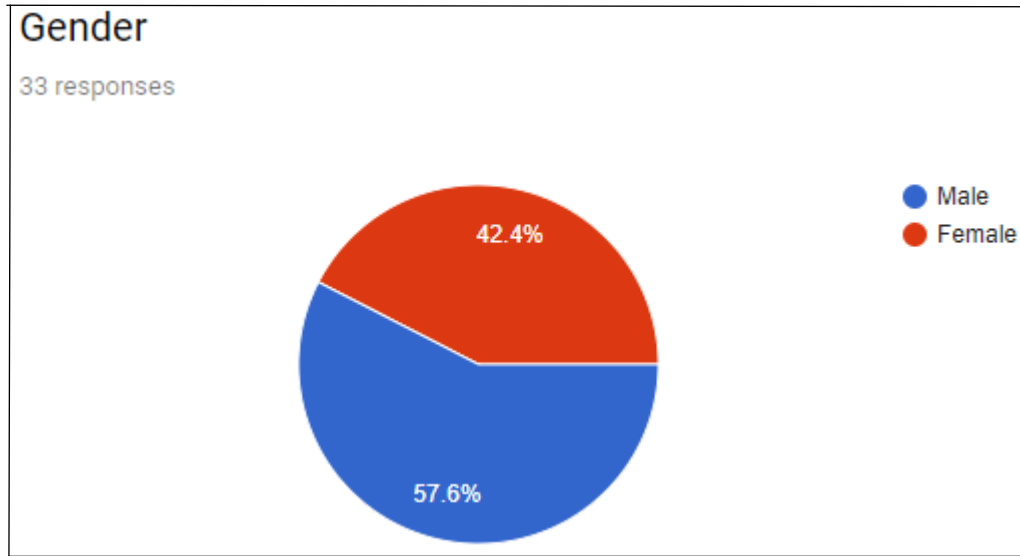
Figure 5.1 Gender of Respondents

As refer to Figure 5.1, it can be identified that majority of the respondents are male, up to (57.6%), the female only (42.4%).

Introduction module

Figure 5.2 Introduction module design performance

As refer to Figure 5.2, it can be identified that respondents evaluated an introduction module design performance of this multimedia application. The interesting graphic design occupies the highest satisfaction within overall design performance, but instead the font size and color design occupies the lowest satisfaction.

Figure 5.3 Introduction module convenience performance

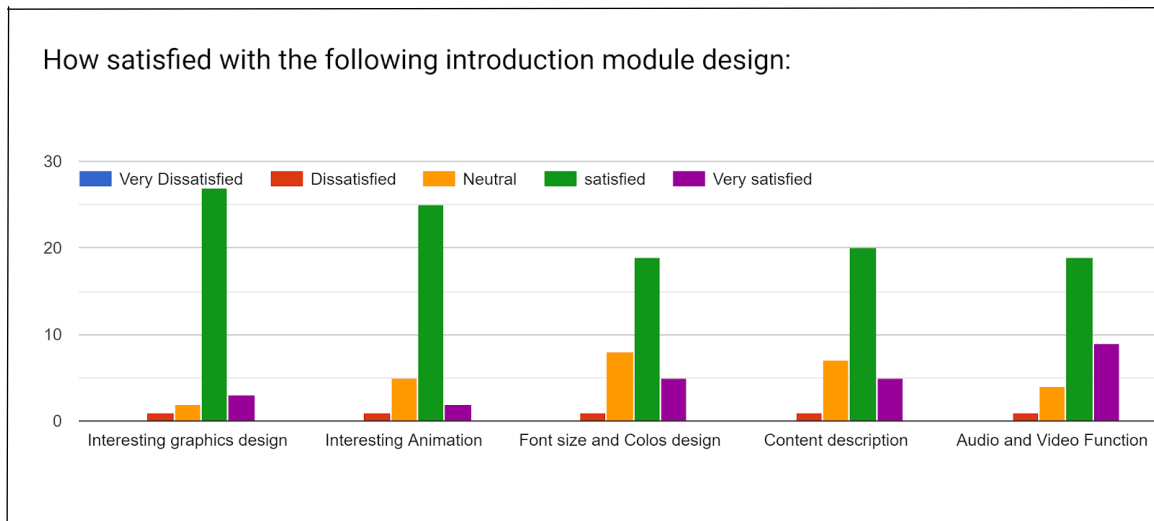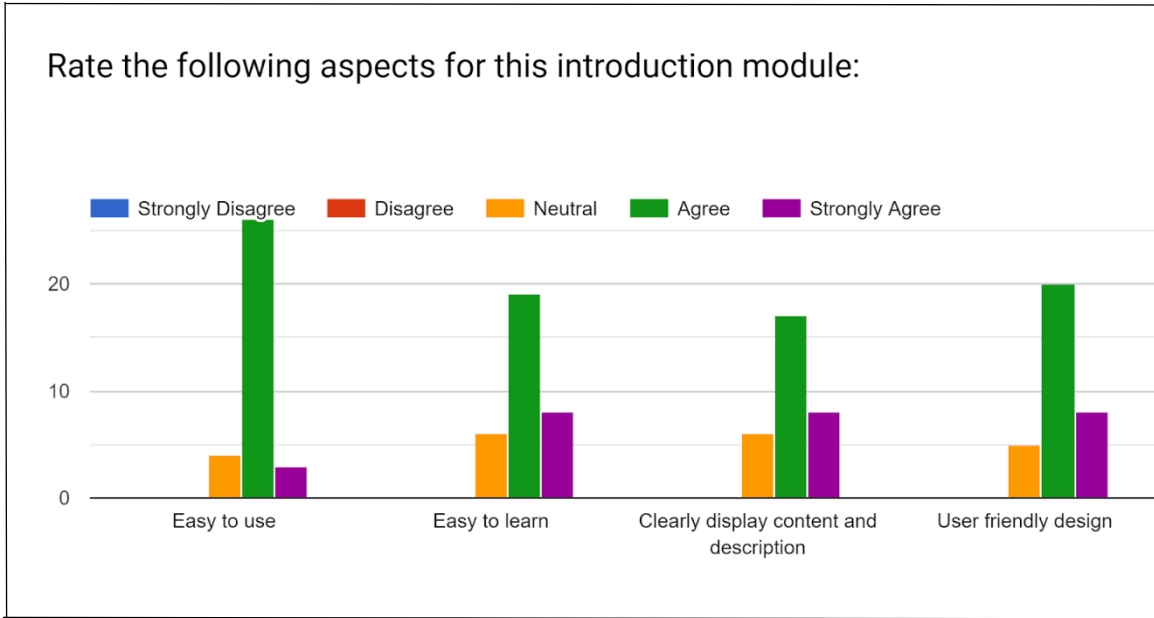As refer to Figure 5.3, it can be identified that respondents evaluated an introduction module convenience performance of this multimedia application. The easy to use occupies the highest satisfaction within overall convenience performance, but instead the clearly display content and description occupies the lowest satisfaction within the overall.

Figure 5.4 Introduction module overall performance

As refer to Figure 5.4, it can be identified that respondents had rate an introduction module overall performance of this multimedia application. It can be determined that up to (81.3%) of the respondents gave this module 4 out of 5 points. The other 3 points and 5 points each occupied (9.4%).

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Simulation lab

How satisfied with the following simulation lab module design:

Figure 5.5 Simulation lab module design performance

As refer to Figure 5.5, it can be identified that respondents evaluated an simulation lab module design performance of this multimedia application. The interesting graphic design occupies the highest satisfaction within overall design performance, but instead the interesting animation occupies the lowest satisfaction.

Rate the following aspects for this simulation lab module:

Figure 5.6 Simulation lab module convenience performance

As refer to Figure 5.6, it can be identified that respondents evaluated an simulation lab module convenience performance of this multimedia application. The easy to use occupies the highest satisfaction within overall convenience performance, but instead the easy to learn occupies the lowest satisfaction.
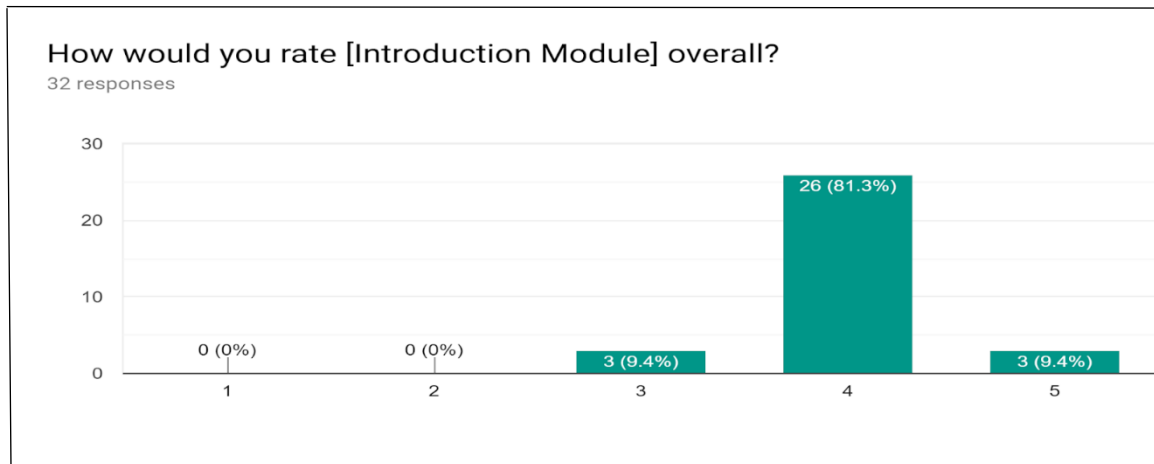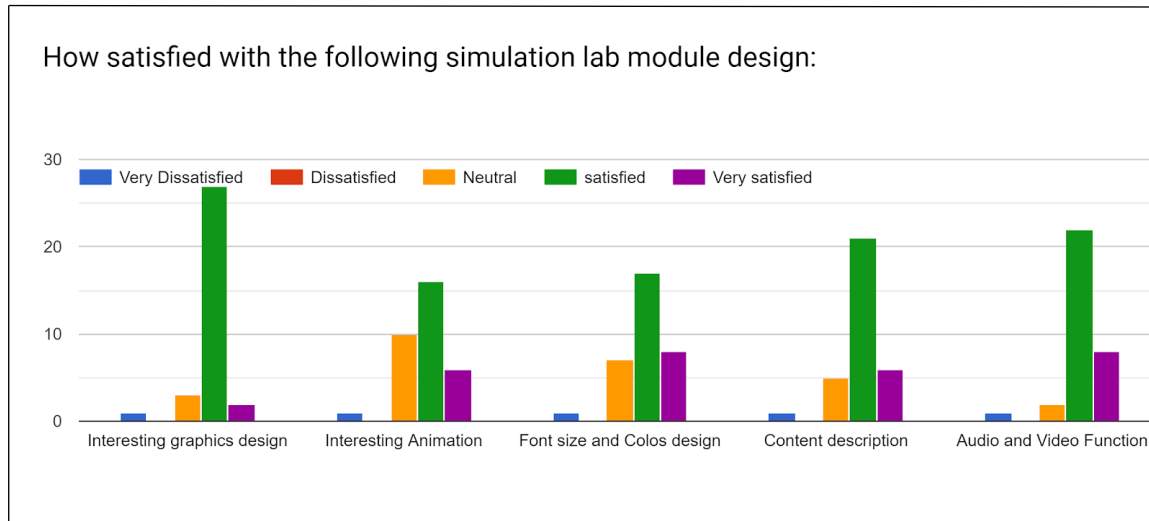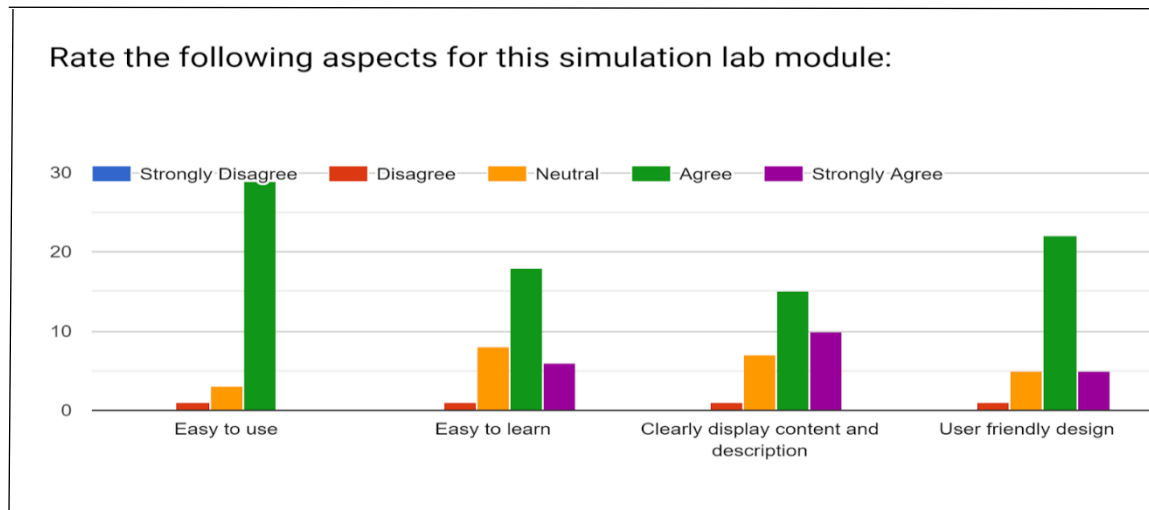
Figure 5.7 Simulation lab module overall performance

As refer to Figure 5.7, it can be identified that respondents had rate an simulation lab module overall performance of this multimedia application. It can be determined that up to (66.7%) of the respondents gave this module 4 out of 5 points. The 5 points had occupied (18.2%) and 3 points had occupied (15.2%).

Experiment module

Figure 5.8 Experiment module design performance

As refer to Figure 5.8, it can be identified that respondents evaluated an experiment module design performance of this multimedia application. The interesting graphic design occupies the highest satisfaction within overall design performance, but instead the audio and video function occupies the lowest satisfaction.

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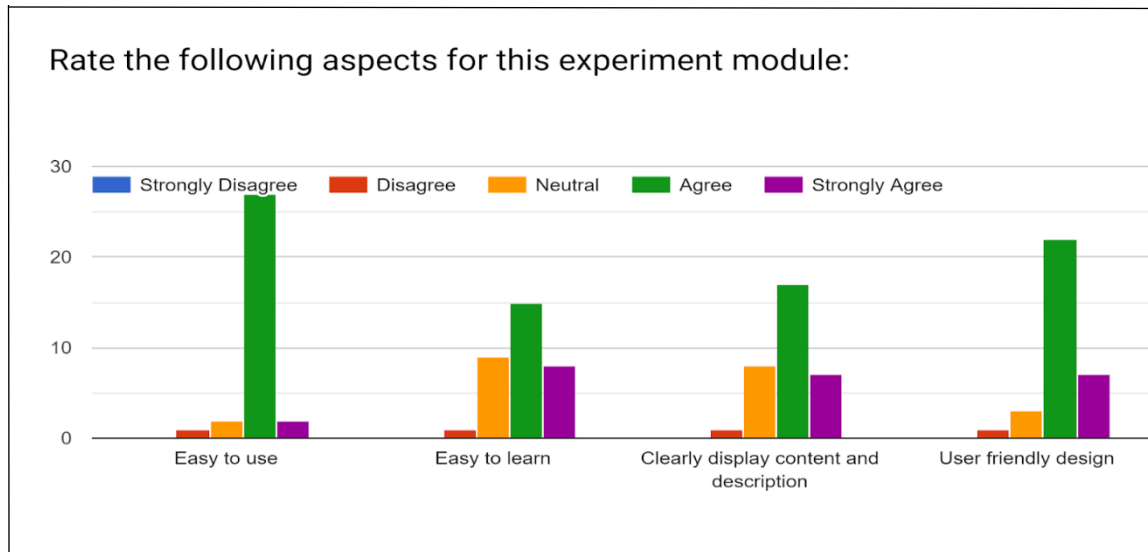
Figure 5.9 Experiment module convenience performance

As refer to Figure 5.9, it can be identified that respondents evaluated an experiment module convenience performance of this multimedia application. The easy to use occupies the highest satisfaction within overall convenience performance, but instead the easy to learn occupies the lowest satisfaction.
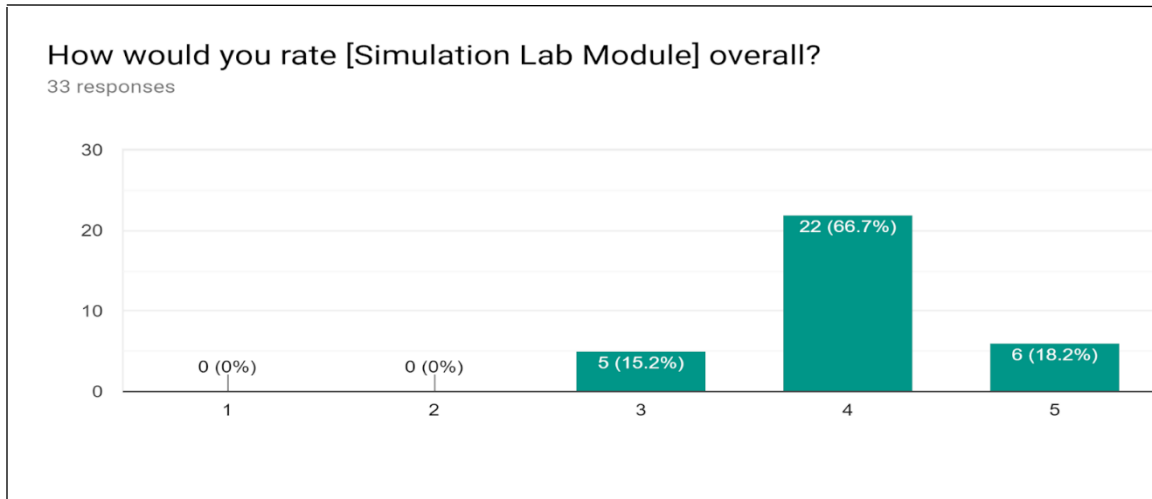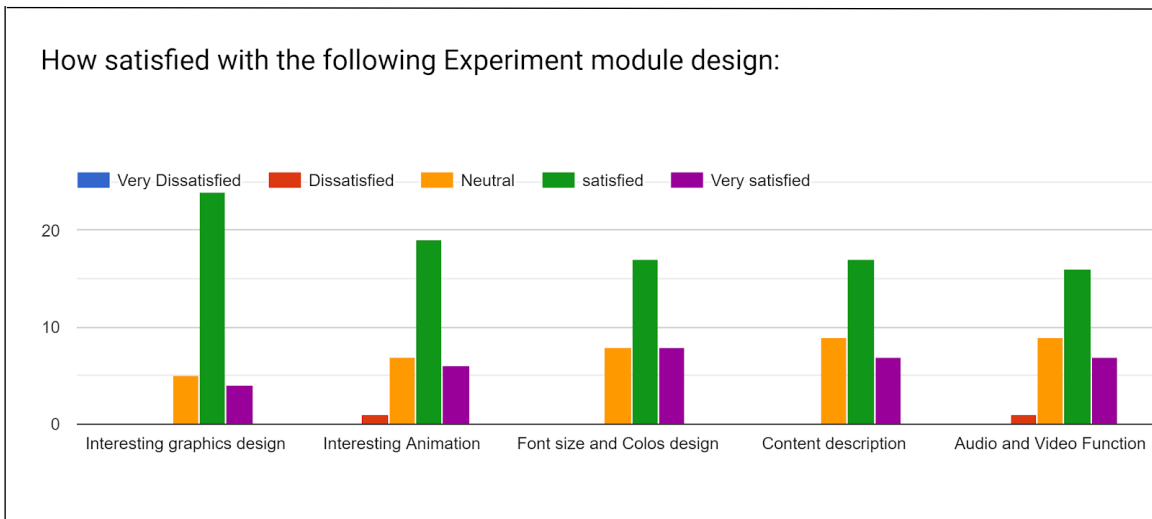

Figure 5.10 Experiment module overall performance

As refer to Figure 5.10, it can be identified that respondents had rate an experiment module overall performance of this multimedia application. It can be determined that up to (65.6%) of the respondents gave this module 4 out of 5 points. Up to (21.9%) gave 3 out of 5 points and (9.4%) gave 5 out of 5 points and the rest 2 points had occupied (3.1%).

Quiz module

Figure 5.11 Quiz module design performance

As refer to Figure 5.11, it can be identified that respondents evaluated an quiz module design performance of this multimedia application. The content description occupies the highest satisfaction within overall design performance. Moroever, the font size and color design had occupied the highest very satified, but instead the interesting animation occupies the lowest satisfaction within the overall design performance.

Figure 5.12 Quiz module convenience performance

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As refer to Figure 5.12, it can be identified that respondents evaluated an quiz module convenience performance of this multimedia application. The easy to use occupies the highest satisfaction within overall convenience performance, but instead the clearly display content and description occupies the lowest satisfaction.
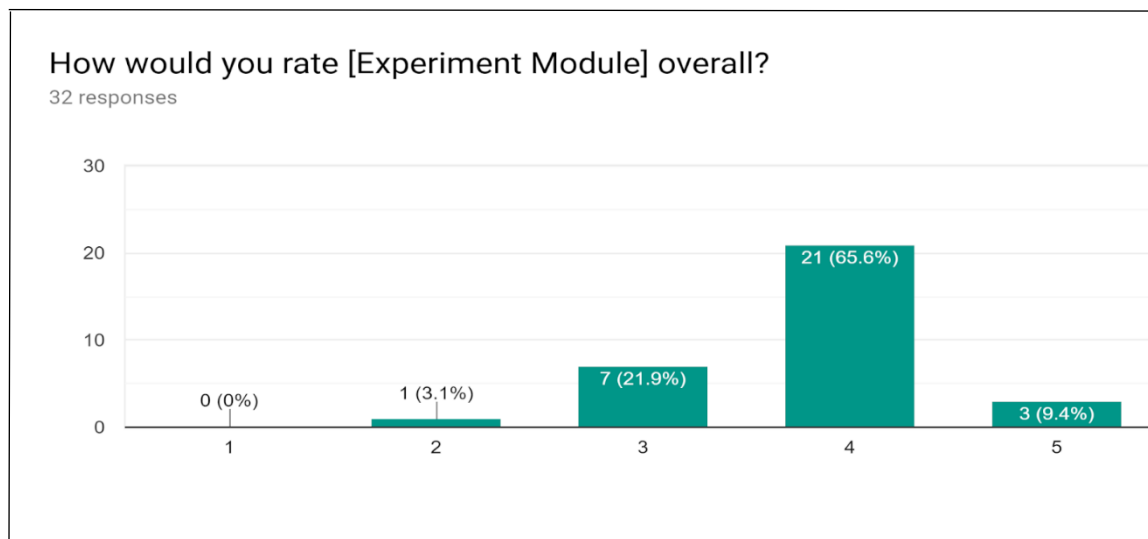

Figure 5.13 Quiz module overall performance

As refer to Figure 5.13, it can be identified that respondents had rate an quiz module overall performance of this multimedia application. It can be determined that up to (72.7%) of the respondents gave this module 4 out of 5 points. Up to (24.2%) gave 5 out of 5 points and the rest only (3%) gave 3 out of 5 points.

Mini game module
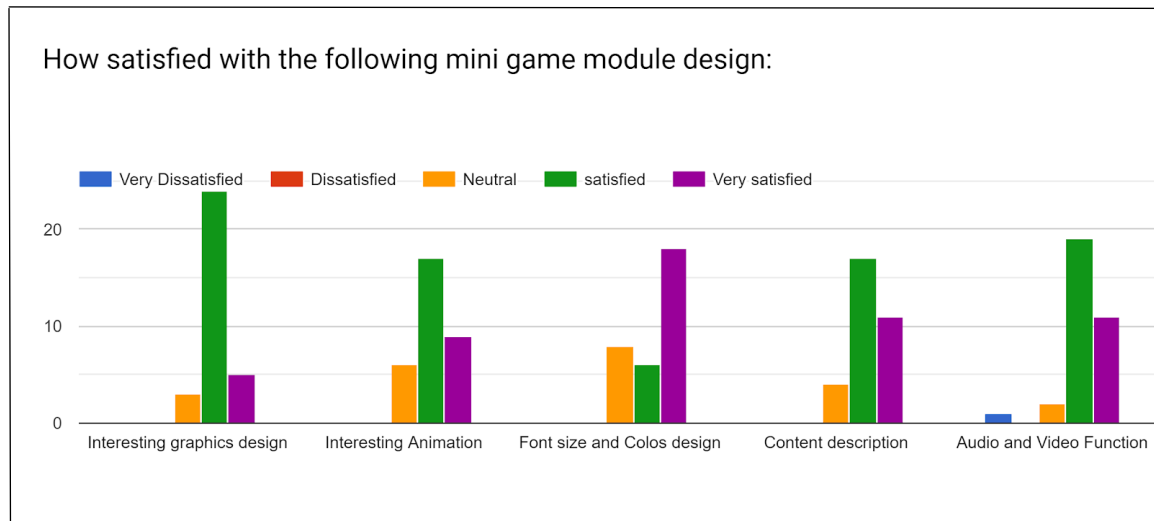
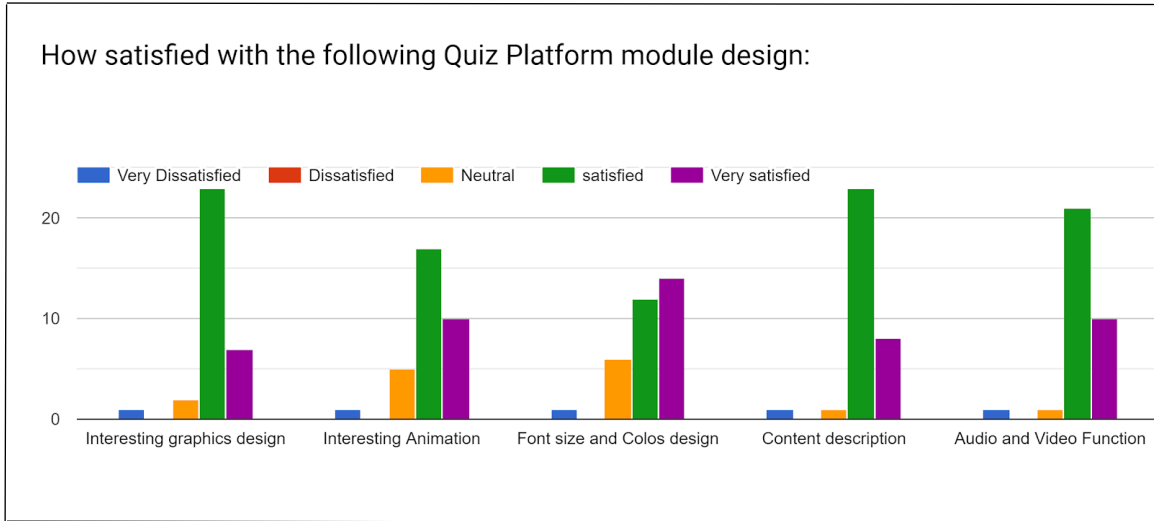*Figure 5.14 Mini game module design performance*

As refer to Figure 5.14, it can be identified that respondents evaluated an mini game module design performance of this multimedia application. The interesting graphics design occupies the highest satisfaction within overall design performance. Moroever, the font size and color design had occupied the highest very satified evaluation, but instead the interesting animation occupies the lowest satisfaction within the overall design performance.
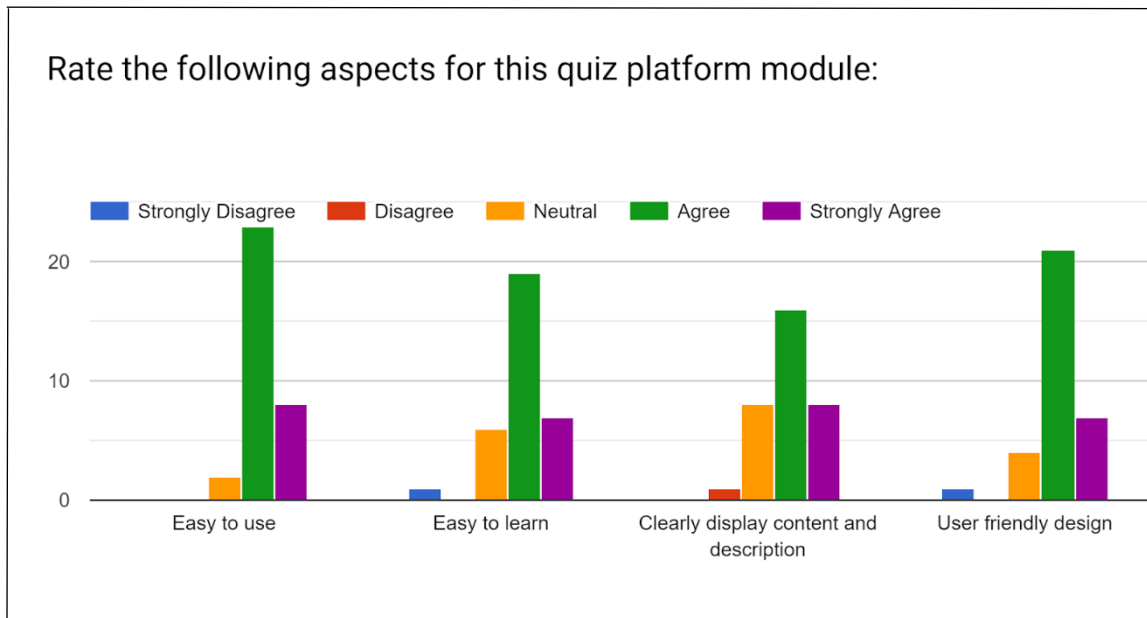

Figure 5.15 Mini game module convenience performance

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As refer to Figure 5.15, it can be identified that respondents evaluated an mini game module convenience performance of this multimedia application. The easy to use occupies the highest satisfaction within overall convenience performance. Moreover, most of the respondents strongly agree that this mini game module has user friendly design, but instead the easy to learn occupies the lowest satisfaction within the overall convenience performance.
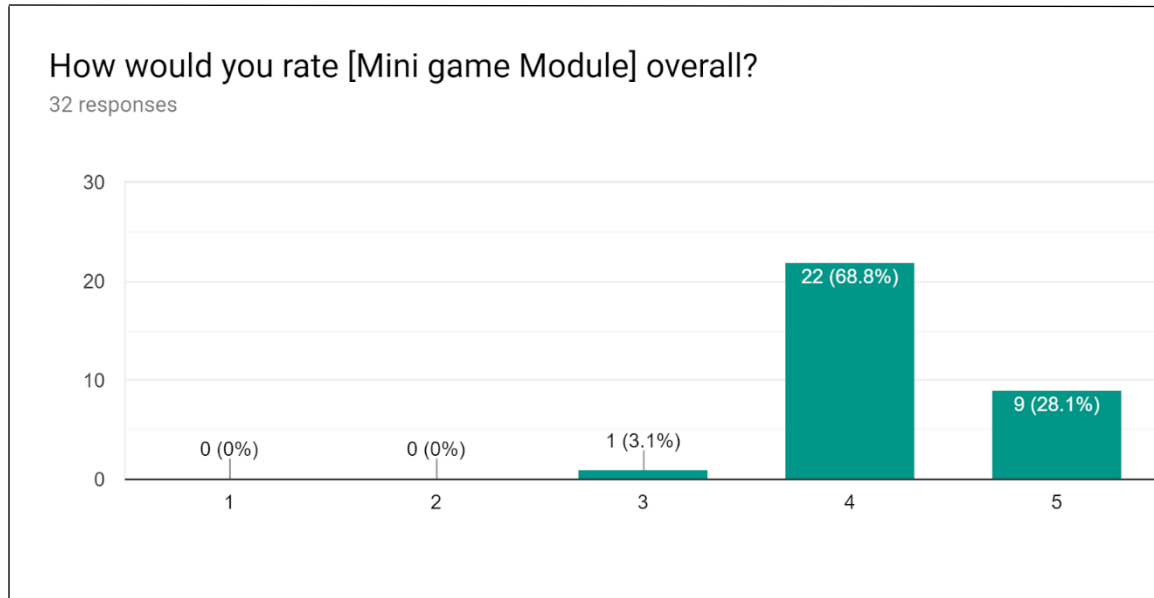
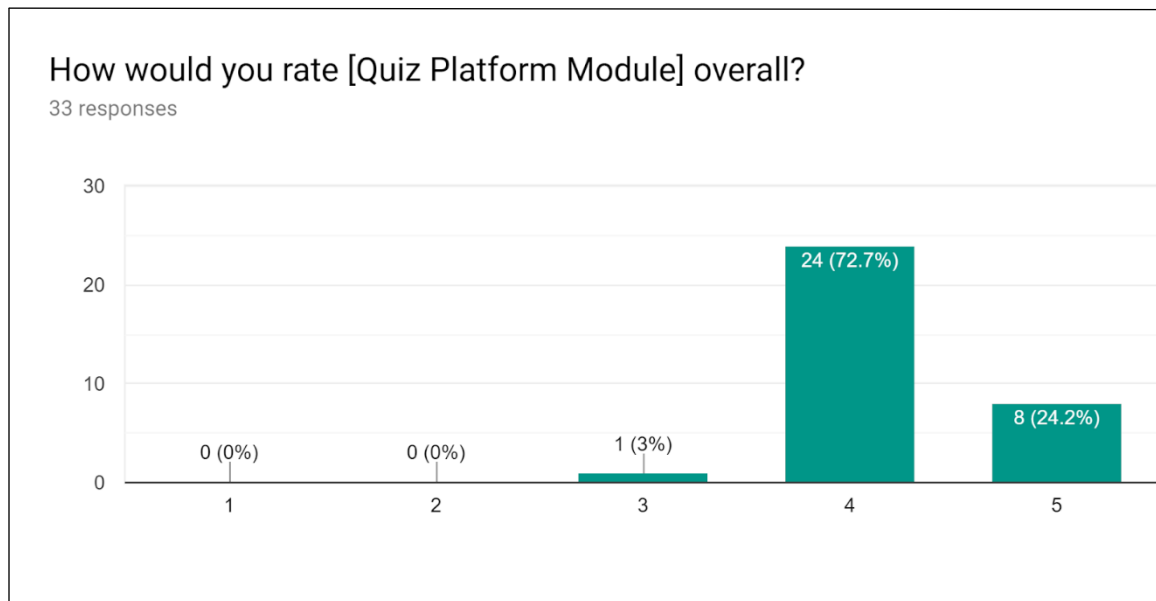*Figure 5.16 Mini game module overall performance*

As refer to Figure 5.16, it can be identified that respondents had rate an mini game module overall performance of this multimedia application. It can be determined that up to (68.8%) of the respondents gave this module 4 out of 5 points. Up to (28.1%) gave 5 out of 5 points and the rest only (3.1%) gave 3 out of 5 points.
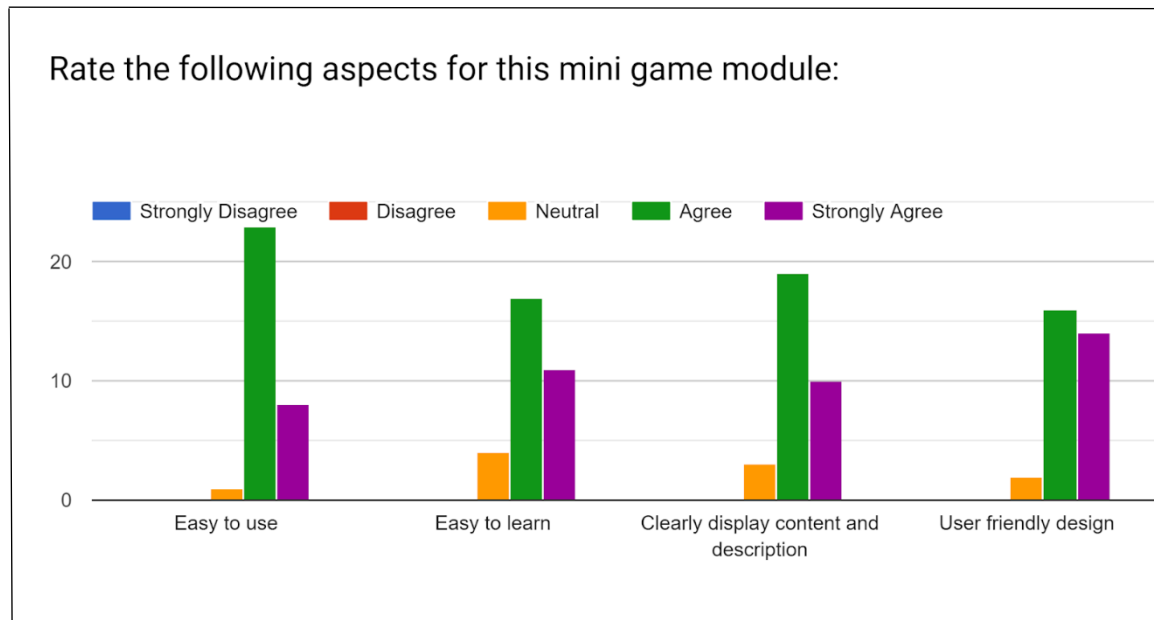
Overall performance
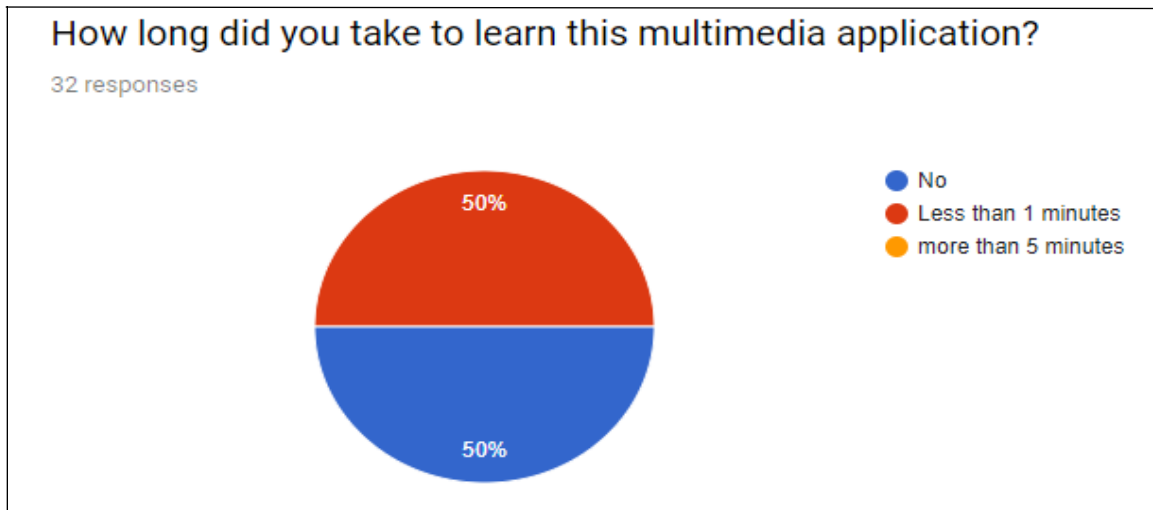
Figure 5.17 The opinion of respondents on how long take to learn on this multimedia application

As refer to Figure 5.17, it can be identified that up to (50%) of respondents no need to take the time to learn to use this multimedia application. Moreover, the rest (50%) of respondents take less than 1 minutes to learn to use this multimedia application.
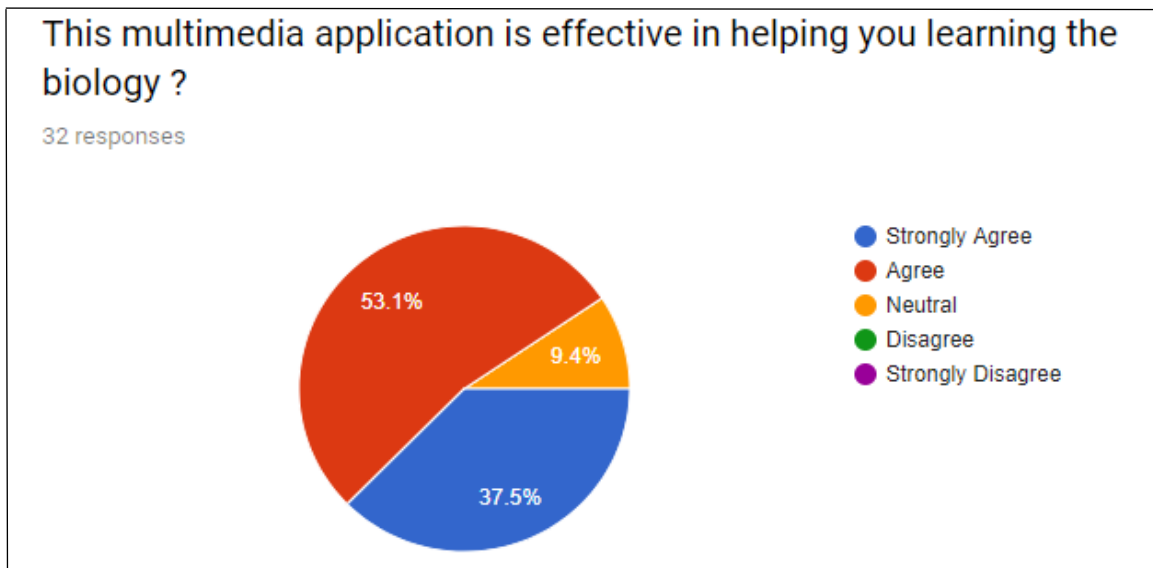
Figure 5.18 The opinion of respondents on whether this multimedia application helping in learning the biology

As refer to Figure 5.18, it can be identified that up to (53.1%) of respondents agree that this multimedia application is effective to help in learning the biology, (37.5%) of respondents strongly agree on this and only (9.4%) of respondents stay in neutral.
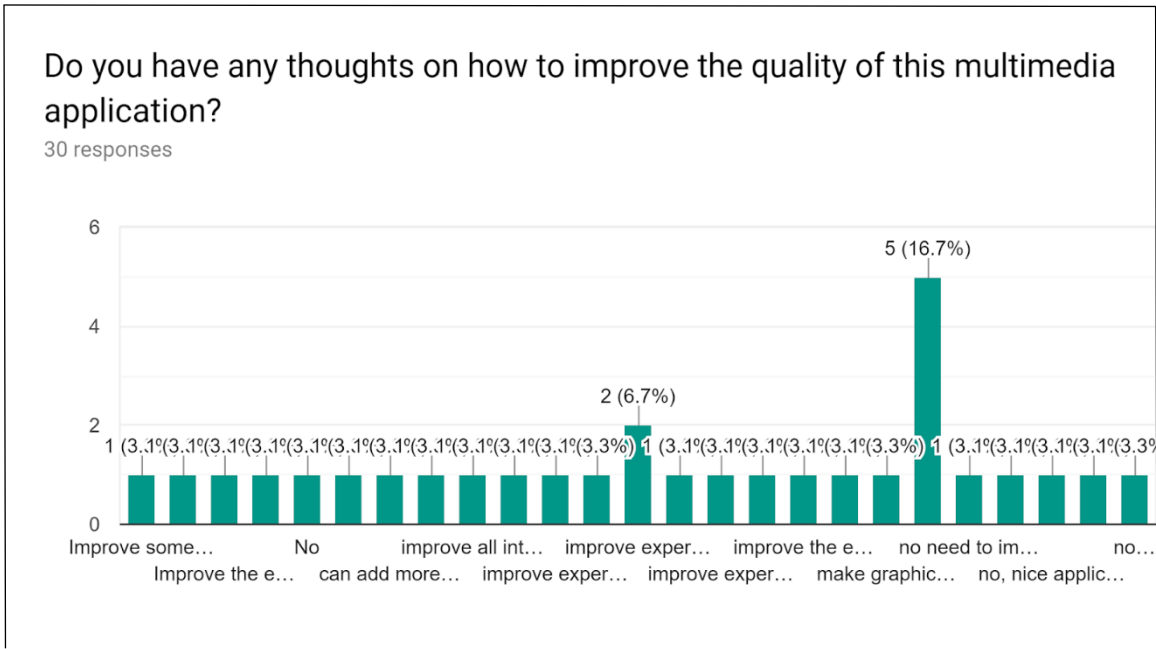
Figure 5.19 The opinion of respondents on whether have any thoughts to improve the quality of this multimedia application

Respondents provide any thoughts on how to improve the quality of this multimedia application. The following is the responses from respondents.

Improve some graphic design.
Improve experiment module make it more interactive.
Improve experiment module, provide some animation.
Make text layout more clean.
Add more animation features.
Can add more function into quiz module.
Improve introduction module, may provide user manual function.
Improve animation design.
Improve some interactive feature.
Improve simulation lab module, make more perfect.
Improve text color used.
Make graphic design more clearer.
No.
No need to improve anymore.
No, overall is good.
No need to improve anymore.
Lack of 3D graphic, can provide it
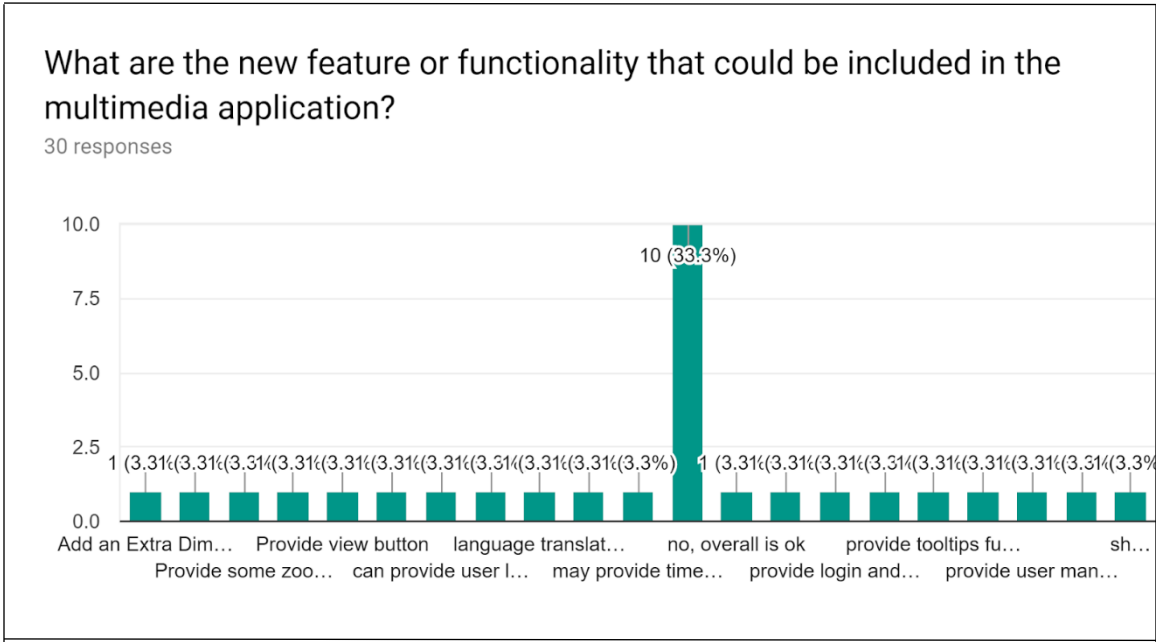
Figure 5.20 The opinion of respondents on whether have any new feature or functionality could be included in this multimedia application

Respondents provide suggestion on what new feature or functionality that could be included in the multimedia application. The following is the responses from respondents.

Add an extra dimension into slideshow.
Provide some zoom in and out function.
Provide tooltips button.
Provide view button.
Provide login time and date function.
Can provide some login features.
Can provide user manual tools, teach user how to use this system.
Provide languages translate function.
No.
May provide time and date features.
Provide answer record or history.
Provide login and playing history features.
Provide some 3d graphic functionality.
Provide tooltips function.
Provide user login profile, make it more professional.
Provide user manual function for users.
Provide drawing tool function.

5.4 Results and Discussion

Survey questionnaire used as testing method in order to collect data and gain users perception and satisfaction with the development of this multimedia application. In addition, the collection of data can help to determine whether weaknesses or vulnerabilities exist in the system so that can be improved in a timely manner. In order to achieve a satisfactory user demand and perfect system. Therefore, has successfully collected 30 respondents opinions and evaluation on the results of this multimedia application testing by using survey questionnaire testing method. Through the overall statistics of the data, possible to determine the results of the system testing is very successful. User satisfaction with this multimedia application is also obviously to all. The respondents evaluates each module in the application and the data obtained are all above the satisfaction, this is very helpful for the formal development of courseware. Respondents not only evaluate each module, but also evaluate the overall design and usability of the multimedia application. Through the survey questionnaire, also successfully collected user opinion and suggestion on how to improve the quality of this multimedia application and whether to add any new features and functionality. For an example, some respondent suggest to provide language translate function, this is a very good suggestion, which can effectively translate some esoteric biological vocabulary and language, helping users to understand clearly. This new feature suggestion and other respondents ideas will be taken into consideration of new feature development. In addition, all suggestions on how to improve the quality of multimedia application will also be taken into consideration. Seriously face the respondents suggestions in order to improve the quality of the application and develop a perfect multimedia application that meet the user satisfaction and requirement.

Chapter 6 CONCLUSION

6.1 Overview

To develop a perfect educational courseware, that need to investigate the academic problems faced by students, understand the student needs for courseware and make improvements to the courseware in order to meet the students requirement. The following will discuss the conclusion included research finding, problem faced, knowledge gained, limitation and future enhancement.

6.2 Research Findings

Based on survey finding, found that some respondents commented that the educational courseware should be available in multiple languages and versions. The main purpose is that some deeper biological vocabulary may cause users do not understand. Therefore, providing multi-language and versions of courseware can help different ethnic groups learn differently in their native language.

In addition, some respondents commented that more videos and interactions should be added to the courseware. The user interface is an important element of the courseware. It is very important to develop a courseware with a greater contract and easy navigation for learners. It not only helps learners learn the biology, but also provides a different learning experience. The overall survey found that respondents are very concerned about the attraction, interactivity, user friendly, clearer description and content of the courseware.

Moreover, survey found that project development of such educational courseware must be implemented and developed within the project objective and target range. Based on project objectives to integrate multimedia elements into courseware to enhance students learning experience. Besides that, to design an interesting courseware of the biology content to attract user attention. Lastly, to develop a user-friendly learning courseware for biology science students instead of using traditional learning ways. Therefore, in order to achieve user satisfaction and to use, that must develop a perfect courseware based on the above requirements.

6.3 Problem Faced

The main problem encountered during the development phase is how to understand the used of action script commands of Adobe director and flash and used of tools in the software. Since have never learned and used these software before, so that there are some unintelligible situations will occur in the process of use.

For an example, how to use of the adobe director and flash action script commands, how to enter commands or where to use them. These are the problems that are often encountered, because the use of these software is unfamiliar and new contact technology. These methods and coding was not been learned before. Therefore, the knowledge of the adobe director and flash action script commands may not be fully understood. To avoid the continued trouble of these problems, have reviewed many related offline and online materials in order to establish a deep foundation for the development of this courseware and finally successfully completed the production of the courseware.

In addition, the tools used in adobe director and flash are also very unfamiliar, that need to constantly review teaching materials or information and learn to use. Moreover, faced also the problem of limited multimedia technology skills and there are limited ideas for design. Therefore, many related offline and online information is referred in order to compensate for these problems.

6.4 Knowledge Gained

This courseware will provide students in Form 4 with knowledge about biology. This can help them build a stronger foundation before entering form 5, which is much more difficult than the Form 5 syllabus. By completing this educational courseware, had gained a lot of knowledge and realized that being a developer should actively absorb the latest technology and be brave enough to face the possibility of failure.

In addition, had gained a lot of knowledge and skills on how to use a series of development software to create a multimedia application, such as learned to use of adobe director and flash with action script command. In addition, the use of such rich multimedia technology has possible to understand the necessity and importance of learning multimedia

technology. In addition, also learned some of the knowledge that have never learned before and have realized the shortcomings that have existed and gained a deep experience.

Lastly, through the experience of this courseware development, understand that the era of rapid development of multimedia technology nowadays, the application of multimedia technology learning has become more important. Hence, actively study these knowledge and technologies and fully mastery of new technology.

6.5 Limitations

In conclusion, developing a system normally has some limitations. For an example, although the interactive function has been successfully included in this educational courseware, but some modules may have some limited on the interaction, which may not completely attract to users satisfaction.

Users have a great requirement to visible interactions. An educational courseware with a perfect interactive feature that can attract to users interests and use. Because of the limited design concept and the knowledge of multimedia technology skills, some modules may have some limited on the interaction functionality, but the overall is not bad and had successfully presented the interactive function.

Lastly, the colour used of the courseware and design of the graphics are not totally perfect. Based on the survey finding, some respondents provide any thought on how to improve the quality of the courseware. For an example, some respondents suggest that make some improve to the graphic design and colour used, that could be another small limitation, but also presented more innovation than existing courseware.

6.6 Future Enhancement

Some future enhancement can be made on this educational courseware. Enhancing function and keep courseware up-to-date that can make students continue do their revision using this courseware. In addition, keep on to improve this courseware ensures that the courseware able to catch up with current trends in multimedia technology teaching. These enhancement are as follows:

1. More interesting, sound effect, better interactive functionality, better graphics and animation.

2. Provide deeper nutritious knowledge about daily life because the courseware focus on nutrition chapter.

3. Can support multiple version or language to choose such as Chinese and Malay. This is because nowadays textbooks and test papers prepared by the government is now a bilingual versions of English and Malay.

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Appendices

APPENDICES

Final Year Project 1: Technology Assisted Learning Courseware for Biological Science

To design and develop an interactive multimedia oriented course contents for elementary education using discovery learning approach

1. **Gender**
   Mark only one oval.

   ◯ Male

   ◯ Female

2. **Race**
   Mark only one oval.

   ◯ Chinese

   ◯ Malay

   ◯ India

   ◯ Other: _____

Survey Questionnaire

3. **What are the problems faced when learning biology science?**

   _____

   _____

   _____

   _____

   _____

4. **Do you ever aware or used biology courseware before?**
   Mark only one oval.

   ◯ Yes   *Skip to question 9.*

   ◯ No   *Skip to question 5.*

Stop filling out this form.

Continue Question.

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5. **If the biological courseware is introduced in the classroom, Do you think it is suitable to assist students learning?**
Mark only one oval.

○ Strongly Disagree

○ Disagree

○ Neutral

○ Agree

○ Strongly Agree

6. **Please state the reason why you choose that answer.**

_____

_____

_____

_____

_____

7. **If you have the chance, would you like to use the biological courseware?**
Mark only one oval.

○ No

○ Not Likely

○ Neutral

○ Likely

○ Most Likely

8. **Please state the reason why you choose that answer.**

_____

_____

_____

_____

_____

Stop filling out this form.

Continue Question.

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9. **Do you think the courseware provide a good learning environment for learning the biology content?**
   Mark only one oval.

   - ( ) Strongly Disagree
   - ( ) Disagree
   - ( ) Neutral
   - ( ) Agree
   - ( ) Strongly Agree

10. **Do you think the technology assisted learning courseware will support to your study?**
    Mark only one oval.

    - ( ) Strongly Disagree
    - ( ) Disagree
    - ( ) Neutral
    - ( ) Agree
    - ( ) Strongly Agree

11. **Do you think the courseware can help you to understand biological content better than the existing traditional learning method?**
    Mark only one oval.

    - ( ) Strongly Disagree
    - ( ) Disagree
    - ( ) Neutral
    - ( ) Agree
    - ( ) Strongly Agree

12. **Multimedia Performance:**
    Mark only one oval per row.

	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Interesting graphics design	( )	( )	( )	( )	( )
Interesting Animation	( )	( )	( )	( )	( )
Font size and Colos design	( )	( )	( )	( )	( )
Content description	( )	( )	( )	( )	( )
Audio and Video Function	( )	( )	( )	( )	( )

13. **Do you have any thoughts on how to improve the quality of biological courseware?**

    _____

    _____

    _____

    _____

    _____

Appendices

Final Year Project 2: Technology Assisted Learning Courseware for Biological Science

To designed and developed an interactive multimedia courseware to replace traditional classroom teaching and traditional reading textbook. The main objective of developed this courseware is to integrate mastery and cooperative learning approaches together with an interactive multimedia technology to enhance students high order thinking skills and learning interest. Moreover, to provide an effective technology assisted learning courseware to help students in their learning and improve academic performance. It is interactive and modular, attract students to learn biological contents and provide student with different learning environments and fields.

1. **Gender**
   Mark only one oval.

   ◯ Male

   ◯ Female

Evaluate for the following five modules：

Introduction Module

2. **How satisfied with the following introduction module design:**
   Mark only one oval per row.

	Very Dissatisfied	Dissatisfied	Neutral	satisfied	Very satisfied
Interesting graphics design	◯	◯	◯	◯	◯
Interesting Animation	◯	◯	◯	◯	◯
Font size and Colos design	◯	◯	◯	◯	◯
Content description	◯	◯	◯	◯	◯
Audio and Video Function	◯	◯	◯	◯	◯

3. **Rate the following aspects for this introduction module:**
   Mark only one oval per row.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Easy to use	◯	◯	◯	◯	◯
Easy to learn	◯	◯	◯	◯	◯
Clearly display content and description	◯	◯	◯	◯	◯
User friendly design	◯	◯	◯	◯	◯

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4. **How would you rate [Introduction Module] overall?**
Mark only one oval.

	1	2	3	4	5	
Poor	◯	◯	◯	◯	◯	Excellent

Simulation Lab Module

5. **How satisfied with the following simulation lab module design:**
Mark only one oval per row.

	Very Dissatisfied	Dissatisfied	Neutral	satisfied	Very satisfied
Interesting graphics design	◯	◯	◯	◯	◯
Interesting Animation	◯	◯	◯	◯	◯
Font size and Colos design	◯	◯	◯	◯	◯
Content description	◯	◯	◯	◯	◯
Audio and Video Function	◯	◯	◯	◯	◯

6. **Rate the following aspects for this simulation lab module:**
Mark only one oval per row.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Easy to use	◯	◯	◯	◯	◯
Easy to learn	◯	◯	◯	◯	◯
Clearly display content and description	◯	◯	◯	◯	◯
User friendly design	◯	◯	◯	◯	◯

7. **How would you rate [Simulation Lab Module] overall?**
Mark only one oval.

	1	2	3	4	5	
Poor	◯	◯	◯	◯	◯	Excellent

Experiment Module

8. **How satisfied with the following Experiment module design:**
Mark only one oval per row.

	Very Dissatisfied	Dissatisfied	Neutral	satisfied	Very satisfied
Interesting graphics design	◯	◯	◯	◯	◯
Interesting Animation	◯	◯	◯	◯	◯
Font size and Colos design	◯	◯	◯	◯	◯
Content description	◯	◯	◯	◯	◯
Audio and Video Function	◯	◯	◯	◯	◯

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9. **Rate the following aspects for this experiment module:**
Mark only one oval per row.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Easy to use	◯	◯	◯	◯	◯
Easy to learn	◯	◯	◯	◯	◯
Clearly display content and description	◯	◯	◯	◯	◯
User friendly design	◯	◯	◯	◯	◯

10. **How would you rate [Experiment Module] overall?**
Mark only one oval.

	1	2	3	4	5	
Poor	◯	◯	◯	◯	◯	Excellent

Quiz Platform Module

11. **How satisfied with the following Quiz Platform module design:**
Mark only one oval per row.

	Very Dissatisfied	Dissatisfied	Neutral	satisfied	Very satisfied
Interesting graphics design	◯	◯	◯	◯	◯
Interesting Animation	◯	◯	◯	◯	◯
Font size and Colos design	◯	◯	◯	◯	◯
Content description	◯	◯	◯	◯	◯
Audio and Video Function	◯	◯	◯	◯	◯

12. **Rate the following aspects for this quiz platform module:**
Mark only one oval per row.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Easy to use	◯	◯	◯	◯	◯
Easy to learn	◯	◯	◯	◯	◯
Clearly display content and description	◯	◯	◯	◯	◯
User friendly design	◯	◯	◯	◯	◯

13. **How would you rate [Quiz Platform Module] overall?**
Mark only one oval.

	1	2	3	4	5	
Poor	◯	◯	◯	◯	◯	Excellent

Mini Game Module

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14. **How satisfied with the following mini game module design:**
Mark only one oval per row.

	Very Dissatisfied	Dissatisfied	Neutral	satisfied	Very satisfied
Interesting graphics design	◯	◯	◯	◯	◯
Interesting Animation	◯	◯	◯	◯	◯
Font size and Colos design	◯	◯	◯	◯	◯
Content description	◯	◯	◯	◯	◯
Audio and Video Function	◯	◯	◯	◯	◯

15. **Rate the following aspects for this mini game module:**
Mark only one oval per row.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Easy to use	◯	◯	◯	◯	◯
Easy to learn	◯	◯	◯	◯	◯
Clearly display content and description	◯	◯	◯	◯	◯
User friendly design	◯	◯	◯	◯	◯

16. **How would you rate [Mini game Module] overall?**
Mark only one oval.

	1	2	3	4	5	
Poor	◯	◯	◯	◯	◯	Excellent

Evaluate for overall multimedia application

17. **How long did you take to learn this multimedia application?**
Mark only one oval.

◯ No

◯ Less than 1 minutes

◯ more than 5 minutes

18. **This multimedia application is effective in helping you learning the biology ?**
Mark only one oval.

◯ Strongly Agree

◯ Agree

◯ Neutral

◯ Disagree

◯ Strongly Disagree

19. **Do you have any thoughts on how to improve the quality of this multimedia application?**

_____

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20. **What are the new feature or functionality that could be included in the multimedia application?**

Powered by

Google Forms

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POSTER

TECHNOLOGY ASSISTED LEARNING COURSEWARE FOR BIOLOGICAL SCIENCE

UNIVERSITI TUNKU ABDUL RAHMAN
BACHELOR OF INFORMATION SYSTEMS (HONS)

LIM HWA YAN   ID: 16ACB06544

1) Background

Multimedia technology is an information technology that integrates graphic and audio images. It has a good effect on biology teaching, can make biology teaching intuitive, improve students interest in learning, help students understand and grasp difficult points, and improve classroom efficiency. Moreover, content and classroom efficiency can foster student creativity. However, multimedia courseware also has some limitations. Teachers should use multimedia courseware in a timely manner to optimize their teaching.

4) Project Scope And Objectives

This interactive multimedia courseware aims to provide an effective learning platform for Form 4 and 5 students in learning the biology subject. The student will be at least gain a better understanding of the content in this biology subject and have easy access to knowledge.

Project Scope Diagram

Project Objectives

❖ To design an interesting courseware of the biology content to attract user attention.
❖ To integrate multimedia elements into courseware to enhance students learning experience.
❖ To develop an user-friendly learning courseware for biology science students instead of using traditional learning ways.

2) Problem Statement

Below are the problem statements identified from the existing educational courseware in the current market.

❖ **The unappealing content in existing educational courseware.**
There are some existing educational courseware, it was found out that are lack of innovation and boring. This is due to a general misconception about courseware development.

❖ **The existing complex scientific theory.**
To guide students to use scientific theoretical knowledge and to explore the underlying scientific concepts is also a major challenge in courseware design. Some of the students are not willing to explore the basic biology science concepts because they feel bored, difficult to understand and lack of interest.

❖ **The problem of a complex interface design in existing educational courseware**
There are a lot of existing educational courseware do not have a user-friendly interface design for the students and the content lacks of motivational elements that to serve as usability strategies

5) Methodology

The ADDIE model is basically a method of systematically developing teaching. (Ed Forest, 2018). Mainly include the formulation of learning objectives, the use of learning strategies and to judge the learners have reached learning effectiveness.

6) Development

- Development Process
  - Pre-authoring Process
  - Authoring Process
  - Post-authoring Process

ADDIE methodology

3) System Design (Storyboard Design)

The author is going to develop an interactive multimedia courseware. In the system design, Designed 5 module storyboard

❖ **Biology Lesson and Introduction Module**
This module will show basic lesson and introduction such as, name, component, function, description and so on.

❖ **Stimulation Lab Module**
This module is provide interactive features to enhance the attractiveness, increase the fun but also enhancing students learning initiative.

❖ **Quiz Module**
This module is to provide some simple questions for users to test their understanding of the biology science after reviewing this interactive multimedia courseware.

❖ **Experiment Module**
This module will provide an experiment which is one of the most important part in scientific laboratory biology education.

❖ **Mini Game Module**
This module allows students to learn knowledge in a fun way and at the same time there is a higher chance that students will use this project as their revision material.

System Flow Diagram

7) Testing, results and discussion

- Overview
- Method of Testing
- Testing Analysis
- Results and discussion

This multimedia application is effective in helping you learning the biology ?
32 responses

37.5%
53.1%
9.4%

Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree

Pie Chart- Survey responds

Rate the following aspects for this mini game module:

Strongly Disagree Disagree Neutral Agree Strongly Agree

Histogram- Survey Respond

PLAGIARISM CHECK RESULT

TECHNOLOGY ASSISTED LEARNING COURSEWARE FOR BIOLOGICAL SCIENCE

ORIGINALITY REPORT

2%	2%	0%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.chs.moe.edu.sg Internet Source	1%
2	isuramu.org Internet Source	1%

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		

Plagiarism Check Result

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Full Name(s) of Candidate(s)	LIM HWA YAN
ID Number(s)	16ACB06544
Programme / Course	FICT / IA
Title of Final Year Project	TECHNOLOGY ASSISTED LEARNING COURSEWARE FOR BIOLOGICAL SCIENCE

Similarity	**Supervisor's Comments** **(Compulsory if parameters of originality exceeds the limits approved by UTAR)**
Overall similarity index:_____% **Similarity by source** Internet Sources _____ % Publications: _____ % Student Papers: _____ %	
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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: ___DR. LEE CHEN KANG___

Date: _____8 April 2019_____

_____
Signature of Co-Supervisor

Name: _____

Date: _____8 April 2019_____

DIA (Hons) Information Systems Engineering Faculty of Information and Communication Technology (Kampar Campus), UTAR

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF INFORMATION & COMMUNICATION TECHNOLOGY (KAMPAR CAMPUS)

CHECKLIST FOR FYP2 THESIS SUBMISSION

Student Id	16ACB06544
Student Name	LIM HWA YAN
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	Signed Report Status Declaration Form
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	Acknowledgement
	Abstract
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	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)
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*Include this form (checklist) in the thesis (Bind together as the last page)

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