Computer Aided Instruction (CAI) for Biology Curriculum

(Learner Centered Approach)

By

Phan Kar Yu

A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF INFORMATION SYSTEMS (HONS)

INFORMATION SYSTEMS ENGINEERING

Faculty of Information and Communication Technology

(Kampar Campus)

May 2020

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Date: _____10-9-2020_____   **Date**: _____10/9/2020_____

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DECLARATION OF ORIGINALITY

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Name   :   Phan Kar Yu

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Abstract

This project is an multimedia design project for academic purpose. A multimedia courseware will be developed to deliver the information of biology to the students. The multimedia courseware is the methodology of combining the method of teaching and the form of game in order to attract the students and increase their interests in study. The multimedia courseware will be focus on the topic of endangered ecosystem in the form 4 biology and the target audience is form 4 students. The objectives of this project is to design a highly interactive multimedia courseware in order to increase the engagement for user to learn the biology. The learning-centered approach had been used to develop the multimedia courseware so that it can place the learner at the center of the learning. Moreover, it also can help the user to solve the problems and relect on what they are learning. The multimedia courseware consists of 5 modules which are learning module, experiment note module, quiz module, past year paper module and game based learning module. Each modules has its functionalities and specialization to provide the information of the endangered ecosystem for the user. The multimedia courseware also consists of multimedia elements such as texts, graphic, audio, video and animation to increase the user experiences. Hence, it can motivate the students to learn the biology when compared to the traditional way of study. The theory and main points of the endangered ecosystem will be provided in the learning module and the knowledge of experiment will be provided in the experiment note module. User also can increase their understanding by answering the questions in the quiz module and the questions of paper 1, paper 2 and paper 3 in the past year paper module. The creative game based learning module can allows user to interact and engage in the game. As a result, user can explore the knowledge of biology and they can understand the biological concept from these 5 module in the multimedia courseware. The methodology for this multimedia project is ADDIE model. It consists of 5 phases which are analysis, design, development, implementation and evaluation phases. The unrealistic requirements, cause of problems and the possible solutions will be identified during the analysis phase. Furthermore, the storyboards and the survey questionnaire will be done in the design phase. Next, the system will be developed in the development phase. After that, it will be delivered to the target audience and the feedbacks will be collected in the implementation phase. Lastly, the system will be tested and improved in the evaluation phase. Each of the phase will be gone through to produce the multimedia courseware successfully.

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CHAPTER 1 INTRODUCTION

1.1 Introduction

Biology is a natural science that studies the life and living of organisms such as the structure, fuction, growth, origin, evolution and distribution of living organisms (Mary Bagley, 2017). The biology is an interesting subject and it has been intriguing the scientific minds for several centuries (Prerna J, 2016). Biology is an important subject for the students because it involves the study of life and the natural world. It also provides in-depth understanding of how all living and nonliving organisms are interact with each other for the students. The knowledge of biology is very useful and it can help to solve some problems in human life.

However, most of the students percieved that the biology subject is difficult and boring. It is because they need to know the theory of biology and it is difficult to understand the meaning of the theory. Some students also hard to understand and remember the keywords of the biology. It causes the students less of interest in study the biology subjects. Hence, an edutainment courseware is designed specialized for the form 4 students to study the biology. It provides the useful and updated information of biology to the students. Students will find the learning of biology subject is interesting and fun through the multimedia courseware. It also helps students to gain the knowledge of biology and used it to prepare for their examination.

1.2 Background

Technology is everywhere and it had entwined in almost every part of our life. Nowsadays, the effective and powerful of technology had been greatly access to the education and it used for teaching and learning. It also allows user to has distance learning and the user can access to massive amount of information by just one's fingertips. The educational technology uses both of the software and hardware to provide a lot of information for the user. There are different types of educational technology to facilitate the user in their learning process. For example, computer-aided instruction (CAI), information and communication technology (ICT), online education, computer-based training and so on. Through the educational technology, the students can learn the things in an easier, faster and more accurate way and become an active learner.

Technology is a powerful tool as it can transform and support education in many ways by making easier for the teachers to create instructional materials and enable the students to

learn things together. This project is to develop a multimedia courseware in order to provide learning opportunities for the user to learn biology. The multimedia courseware will provide the interactive and attractive user interface for the user. Hence, it can increase the user's engagement with the multimedia courseware. Furthermore, user also can increase their interest in learning with the edutainment courseware instead of using a traditional way of study such as reading a biology textbook. The multimedia elements such as the images, graphics, audio and animation can let user learn it in a fun way. Furthermore, the images and diagrams also showed in color to attract the user's attention.

The multimedia courseware is an integrating technology which can be used in the classroom to deliver the information of biology. It is an effective way to connect with the students of all learning styles and it also provides an opportunity for the students to enhance the interaction with the classmates and their instructors. There are 5 modules in the multimedia courseware which are learning module, experiment note module, quiz module, past year paper module and learning based module. Each of the module can increase the user experiences in the learning process.The learning module provides detailed information for the user to gain knowledge. On the other hand, the experiment note module provides the experiment knowledge for the user. User can increase their critical thinking skills from the quiz module. Moreover, the experiment note also provides the paper1, paper 2 and paper 3 for the user to answer. Lastly, the game based module can increase the user's interest towards the biology.

1.3 Problem Statement

i) The explanation and examples provided from the topic of the biology is limited and not detailed.

The information provided in the topic is summary and the details are limited to those necessary for a clear explanation. The examples given are less and the keywords of biology are not clearly explained. It will cause the user cannot gain more information from the topic and do not know the meaning of difficult keywords of biology. Karehka Ramey (2012) supported that the information should be easy to understand and satisfied the user requirements. Hence, it is important to provide clearly information to the user. Furthermore, the biology experiments also do not provide. Some diagrams and pictures showed in the topic also do not fully explain and it will cause user confuse about it. It will cause the user need to find a relevant information from a textbook and search online to gain a complete understanding about the topic. Hence, it

will take more user's time to learn and understand it. According to Eugine Dychko (2016), the content in the application should provide relevant and valuable information to the target audience. It is because a fully and detailed information in the system can increase the user's knowledge and their learning ability.

ii) Lack of multimedia elements such as audio, video and animation to present the information.

A lot of existing system usually use text or images to present the information of biology. As a result, user cannot learn the biology through listening but visual learning only. The application also does not have the integration of text, graphic, audio, video and animation to deliver the information to the user. As a result, it cannot provide a fully and complete information to the user. The 2-D and 3-D animation also do not implement in the existing system to provide learning for user. It will cause user cannot gain the detailed information of biology. Jagannath D (2017) said that the multimedia elements have been widely used in the sector of education to deliver information. It can prove the powerful of multimedia elements to be used to transfer information to the user. Furthermore, the font size is small and the diagram is showed in black and white colour also have reduce the interest of user to study biology. According to Michael (2012), simple interactive items such as images, audio and videos will increase the user experiences. Hence, it is important to include the multimedia elements in the learning process of the system such as the images, audio, video and animation in order to increase the interest of user to study biology.

iii) The learning process of biology is static and lack of interactive for the user.

The design of the user interface in the existing system is lack of interactive. User cannot click on the images or items in the content of the biology. It will cause the user cannot involve in the process of learning. It also does not provide quiz or game to increase the engagement of the user. Users become a passive participant in the learning process because they do not think deeply about the question. John Kleeman (2012) supported that the test and quiz can help user to retrieve knowledge and motivate them to study. It is because the quiz and game can make user enjoy the process. Moreover, some question paper is fixed and it does not allow user to edit and fill in the answer in the blank space. Hence, it will reduce the user's motivation to learn the biology. According to Bill Cushard (2019), motivation is important for learners to keep them continue to learn. Thus, the interactivity between the user and the system can motivate and increase the user's interest to learn biology.

iv) The answer provided in the question of the test and quiz does not provide description and explanation.

The answer provided in the quiz does not provide specific description and just simply put it. The user will curious about the meaning of the answer provided in the question after they answer the question wrongly. Hence, it will cause user cannot get a throughout understanding about the question. It also reduces the learning outcome of the lesson for the user. Megan Smith (2016) said that the quiz and test can help students to retrieve the information that they learned and bring it to mind. Hence, the answer in the quiz and test should provide the explanation in order to increase the understanding of the user about the question. The answer in the quiz and test also does not provide images and graphics to explain and deliver the information to the user. According to Trang (2018), user will review the answer of the question in order to obtain the important information in the quiz or test before moving to the next section. As a result, it is better to explain the answer of the question by using different approaches such as text, image, audio and video to deliver the information to the user.

1.4 Objectives

i) To analyse animation and image approaches used for studying biology concept in our life.

The image and animation approaches used in the interactive edutainment courseware can provide the biology knowledge and it can catch the user's attention. User will be attracted by the animation because the animation makes user creates interest on it and distracts from the stationary surroundings. User will find the content of biology particularly eye catching and it will increase their interest to study it. The colour of the image also can enhance the visibility experience for the user. Hence, animation and image approaches can deliver the biology information in a simple and fun way. The animation is suitable for students because they can be amused by the animation and makes them want to pay attention on details of biology.

ii) To design a highly interactive edutainment courseware to increase the engagement for user to learn biology.

Interactive edutainment courseware can transform an educational experience to learner instead of using traditional ways of learning such as reading textbooks and listening to in-class lecture. It allows user to think and analysis the lesson of biology when they are highly

interacting with the edutainment courseware. Hence, it can improve the efficiency of learning and increase the level of understanding to the user. The quiz and game in the edutainment courseware can increase the interactive engagement of user to learn biology. It also can produce useful informative feedback to increase the motivation of user to learn. Hence, user will become an active learner by using the edutainment courseware. The more the engagement of user in the edutainment courseware, the more the user can retain the information.

iii) To evaluate the effectiveness of the edutainment courseware to learn biology concept through benchmarking with similar leading apps.

Nowadays, edutainment courseware has been widely used by a lot of people to learn and gain information. The edutainment courseware uses various creative methods to deliver the message and knowledge to user to let them learn in an interesting and fun way. It consists of several multimedia elements such as text, image, audio, video or animation to deliver the biology information. Hence, it can increase the interaction between the edutainment courseware and the user. User can learn the biology and challenge the quiz according to their level. Moreover, user can get more understanding and clearly information from the edutainment courseware. Hence, it brings a lot of positive effects to the user.

1.5 Scope
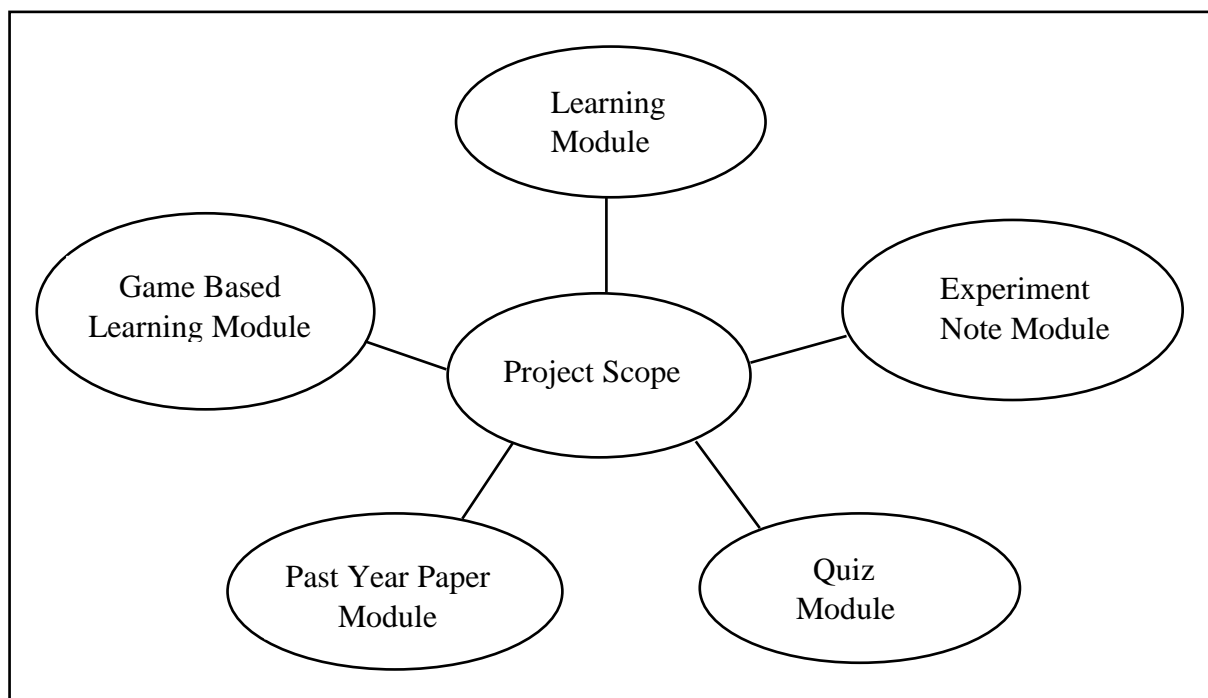
Figure 1.1: Project scope.

A biology edutainment courseware will be developed to deliver the knowledge of biology. It consists of 5 modules which are learning module, experiment note module, quiz module, past year paper module and game based learning module. Some users felt that the biology is a complex and difficult subject. Through this edutainment courseware, users will learn biology in an easier and fun way although they find it challenging. It provides the tips and strategies for user to study and learn biology. User will explore new knowledge and understand the biological concept and lesson through this edutainment courseware.

1.5.1 Learning Module

Learning module is a module that provides the useful and compact information of biology to the user. It provides the main points and summary of the biology lesson to deliver the important information to the user. Moreover, this learning module contains the attractive image and animation to let user learn it in an interesting and fun way. As a result, it increases the attention of user to study biology. It also provides explanation and description for the diagram and specialized keywords of the biology. User can learn many study skills and guides from this learning module. Hence, they can get the information of biology instead of reading a biology textbook.

1.5.2 Experiment Note Module

Experiment note module is a module that provides the biology experiment's knowledge. Experiment is a practical and necessary part of biology which is different from the theory of biology. The information of experiment such as the steps, objective, problem statement, hypothesis, variables, material and apparatus will be provided in the experiment note module. It provides the effective way to learn biology and enhance the experience and knowledge of the user. User will more understands the theory of biology which is proved from the experiment.

1.5.3 Quiz Module

Quiz module is a module to test the understanding and knowledge of the user about the biology lessons. Questions are provided in the quiz module to test the user. It can help to train the user's brain to retrieve information when doing the quiz. As a result, user can recall the

lesson and concept of biology when they are doing the quiz. Moreover, it also provides clear explanation for each answer in the question. When user answers the question incorrectly, the answer and explanation will be given so that the users can understand the question. In short, quiz module is one of the effective ways to learn biology.

1.5.4 Past Year Paper Module

The best way to learn biology is to do the past year questions. It can test the knowledge of user about the concept of biology. User can know the latest format of past exams such as the essay and multiple-choice questions. It also provides answer and explanation for each question in the past year paper. Moreover, user can identify the major concepts that are find in the past exam and use it to prepare for their exam. It will become a long-term memory for the user when they review and do the past year question. The more the user practices, the more the user can remember it.

1.5.5 Game Based Learning Module

Game based learning module is a good starting point of people who dislike the biology subject to learn biology. It can discover and increases the interest of the user to study biology. Moreover, it also allows user to interact and engage in the game. The game provides challenge to the user which is related to biology so that the user can learn it in a funny and interesting way. User will pay attention and concentration to solve the problems in order to achieve the objectives in the game. Furthermore, it can improve the problem-solving skills of the user and enhance their memory toward the biology.

1.6 Contribution and Significance

The contribution and significance of the edutainment system is the experiment note module and the past year paper module. The experiment note module provides the information of the experiment such as the objectives, experimental procedures and so on. Hence, user can strengthen their understanding about the related theoretical aspects of the experiment. Furthermore, the experiment note module developed by using the animation approach to attract the users. It can increase their interesting to study the experiment compared with the traditional

ways of study. The experiment note module will show the outcome of the experiment for the students. Hence, it can increase their users' knowledge about the experiment and produce a good learning outcome to them.

On the other hand, the past year paper module of the edutainment system will be created for the users. The past year paper module of the edutainment system consists of the 3 paper which is paper 1, paper 2 and paper 3. The past year paper module will be designed for the latest questions of the examination paper in the edutainment system. The multiple-choice questions are designed for the paper 1 and the structured questions are designed for the paper 2 and paper 3 in the edutainment system. The questions in the past year paper module can challenge the user to answer it. Furthermore, the past year paper module of the edutainment system will consist of the marking scheme for the user to check their questions' answer. Hence, users can check which question they answer wrongly. Lastly, the answer for each question in the past year paper module will be included the explanation for the users to increase their understanding about the question.

1.7 Target Audience

The target audience of this edutainment courseware is Form 4 students of the secondary school. Nowadays, a lot of secondary school stills applied the traditional method of teaching biology. It can be seen from the form 4 students who are taken biology subject are still using the textbook to study biology. The biology textbook is boring and lack of interactive. Furthermore, some of the students who are taken biology are no interests to study this subject because it has a lot of theories in the textbook which are needed to memories. The theories in the textbook are lack of animation and graphics. So, the biology edutainment system will be created to increase their interest to study biology subject. The edutainment system will provide the learning module for the students to increase their knowledge. The edutainment system allows students to has interactive with it and the animated graphics in the edutainment system can increase the interest of students to study biology. Moreover, the form 4 students who are taken the biology subject also need to go to the biology lab to study the experiment. Hence, the edutainment system will provide the experiment note module to the form 4 students. The experiment note module contains the detailed information can increase the Form 4 student's knowledge about the experiment. The Form 4 students will find the process of learning biology is interesting and fun through this edutainment courseware.

CHAPTER 2 LITERATURE REVIEW

2.1 Multimedia

2.1.1 Linear Multimedia

Linear multimedia is designed to be presented in a sequential manner which goes on a logical flow of starting point to an ending point. It has no interactivity for the user and lacks of features for the user to take advantage of, such as the ability to choose on different options, control the flow of the media or click on the icons (Ty Arthur, n.d.). Moreover, the linear multimedia also does not has the features of navigational for the user. It is intended for display purpose with no interaction and distraction from the user. The linear multimedia can be referred as passive multimedia and the users are passive receiver most of the time. However, some multimedia presentation would follow the linear structure because it can give the organised and chronological order in the presentation (Rosie Normanton, n.d.). The movie is an example of multimedia linear content. Although the movie uses a combination of audio, graphics and animations, but the user cannot control over the sequence of events. As a result, the audience can get more focus and concentration on the topic and it is effective when the audience can get the information well.

2.1.2 Interactive Multimedia

Interactive multimedia is a computer-delivered electronic system which allows the user to combine, control and manipulate different types of media. (Encyclopaedia Britannica, n.d.). Interactive multimedia integrates computer, data, phone, storage, and other information technologies. It is a method of communication in which the user's imput will affect the program's output and the program's output depend on the user's input (Rajeev Dhir, 2019). The users are actively involved and they can access large amounts of data through the interactive multimedia. The interactive multimedia also called as hybrid technologies because it is able to combine the storage and retrieval capacities of computer and the digital database with an advanced tool for viewing and manipulating these materials (Dragan Cvetkovic, 2019). The graphics, sound, video and large amount of text in the interactive multimedia program can present learning information to the teachers, students, and scholars in a meaningful way. Users can controls the sequence and the pacing of the materials and allow them to proceed at their own pace in a tailored learning environment.

2.2 Interative Multimedia

2.2.1 Benefits

Nowadays, a lot of people are surrounded by interactive multimedia. The interactive multimedia had been implemented in a wide variety of platforms and applications such as touch screen smartphones and tablets, as well as other interactive mediums which are created exclusively to solve a unique problem or a set of problems. The benefits of interactive multimedia is it is interactive because it can engage the user to become an antive participant (Rebecca Bull, 2016). It also allows people to communicate and share information with the people, companies or organizations. Hence, prople can exchange the ideas and information through the interactive multimedia. It is also flexible because the interactive multimedia can be easily changed to adapt the different audiences and situation. For example, the interactive multimedia includes social media, video games and applications. The interactive multimedia also is a powerful learning tool because it can let students to control of what they are learning (Khoo Cheng Choo, 1994). Hence, it can make the students become more active in their learning experience. Morever, the interactive multimedia such as the images, video and animations also can increase the student's knowledge and improve their problem solving (Randall Bass, n.d.). So, the interactive multimedia is an efficient source for acquiring learning resources.

2.2.2 Limitations

Although there are a lot of advantages from the interactive multimedia, but it also has some limitations on it. Firstly, the videos and audios of the interactive multimedia occupy a larger amount of computer storage capacity (Junaid Rehman, n.d.). The user need to have a larger storage files to store it and it also takes the time to load it. Besides, the videos also take a large bandwidth to upload to the internet. Furthermore, the interactive multimedia is information overloaded because it contains enourmous amout of information. As a result, it takes a longer time for the user to search and find the specific information that they want. Apart from that, it takes time for the people who want to edit and compile the interactive multimedia. The interactive multimedia also can be expensive because it needs a wide range of resources. Hence, user need to spend a lot of money in it. Moreover, the disadvantages of interactive multimedia is that it can be intrusive (Stuart Robertson, n.d.). For example, it will be classify

as noise pollution if the computer-generated voices are projected out in the street of some countries.

2.3 Applications of Multimedia

Multimedia applications can be used in many areas such as educations, businesses, homes and public places. The multimedia application involved programming code and multiple different types or forms of media to enhanced the user interaction. The growth in use of multimedia applications for educational purposes had increased in recent years (UK Essays, 2017). Educational multimedia applications can increase the learning effectiveness and it is more attractive than the traditional-based learning methods. The multimedia applications such as the CD-ROM based textbook, computer-aided instruction (CAI) and so on can motivate the user to learn. Hence, the educational multimedia application is an effective ways to attract the students during learning as well as increase the students learning outcomes. Furthermore, multimedia applications in business had been used widely for training, promotional material and presentation (Jotuts, n.d.). It can allow user to communicate within and outside the organization. Moreover, the multimedia entertainmet applications allow user to engage in the activities such as listening to music, playing a games, watching a video, meeting people at virtual environment and participating in an interactive story. The characteristics of higher interactivity, mobility and content awareness are existed in the multimedia entertainment applications. Hence, user can actively participate in the multimedia entertainment applications.

2.4 Multimedia in Biology

2.4.1 Biology eBook & Quiz
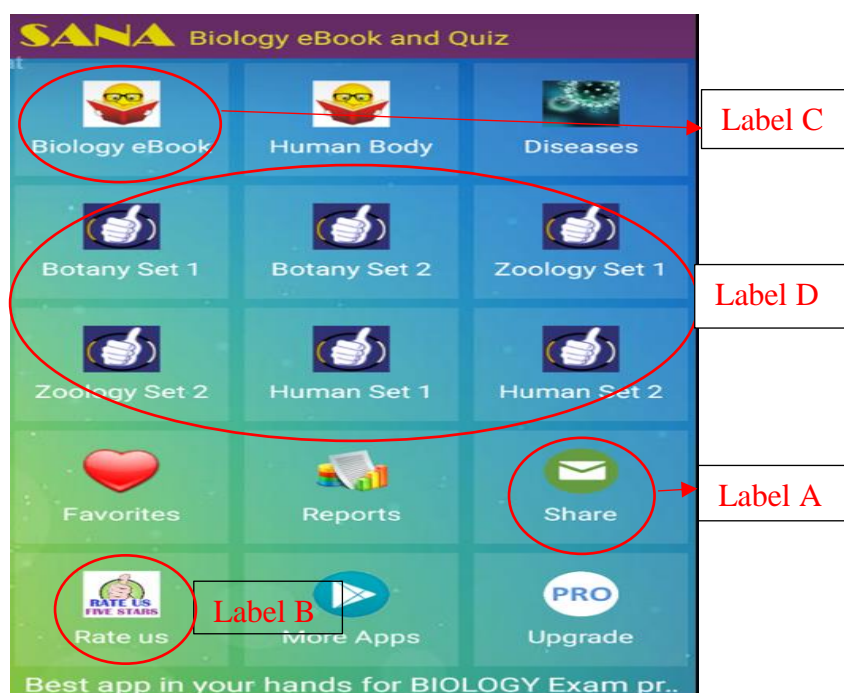
Figure 2.1: Biology eBook & Quiz (Sana Edutech, 2016).

Biology eBook & Quiz is an application which help user to get the knowledge of Biology. It provides the summary and useful information about the human body, disease, botany and zoology. User can easy to understand the content of the biology. Moreover, it provides the quiz to test the user to improve their understanding of what they learn. Label A and label B show that user can rate it and share this application with their friend if they like the application.

Strengths

This application provides visual and verbal learning such as voice read-out facility. Label C shows that the information given by the application is categorized so that the user can easy to navigate it and the content is summarized for easy to understand. Moreover, the text can be adjusted to large, medium or small font size. Label D shows that the application provides practice mode of quiz for user to learn and real timed mode of quiz to test and evaluate the level of learning of user. The quiz provide answer for user to review after answering the questions. The quiz result is stored and categorized for user to know and compare with the previous result. The application is automatic pause-resume so that the user can revisit the page of where they stop.

Weaknesses

The application has no learning level for user to choose. User cannot choose to answer low, medium or high level of quiz. Apart from that, user should have internet connection for free version. User need to upgrade for offline version in order to run the application offline. Moreover, the advertisement pops out after exit the quiz will make the user feel annoying.

2.4.2 SPM Biology
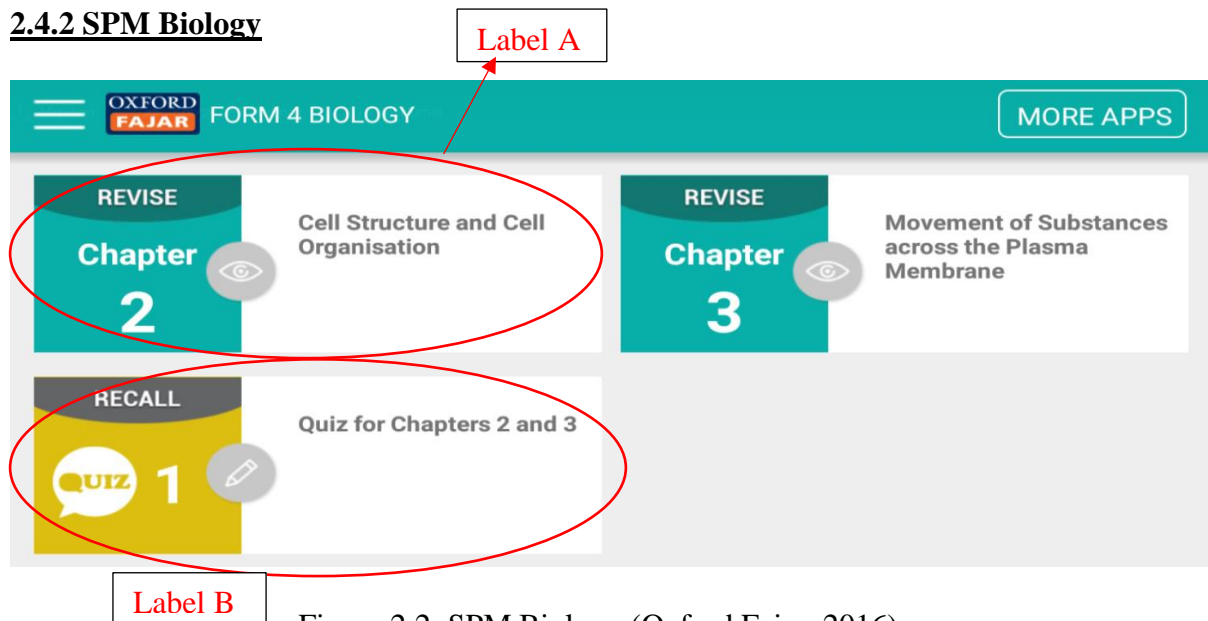
Figure 2.2: SPM Biology (Oxford Fajar, 2016).

SPM Biology is a self-study application that provide revision note of form 4 and form 5 Biology. It provides the study card and quiz of form 4 and form 5 Biology. It is a quick revision for user to recall and learn especially for form 4 and form 5 student. Users can learn it at anytime and anywhere to prepare for their exam.

Strengths

Label A shows that this application provides effective study cards to help student to revise and recall because it contains short and important syllabus. Label B shows that this application provides interactive quiz to test user. The content also provides diagrams, table, and graph which are showed in colour to deliver the information. So, user can easy to understand and gain the knowledge of biology. The keyword of the sentence also highlighted to get the attention from the user. Hence, user can learn it in an interesting way.

Weaknesses

The information provided from this application is limited because it only provides the content of chapter 2 and 3 of form 4 Biology and chapter 1 of form 5. If the user wants to get more information, they need to activate the code and pay to get the full version of form 4 and form 5 Biology. This application only provides English version but not bilingual version such as Malay language and English language.

2.4.3 3D Bones and Organs (Anatomy)
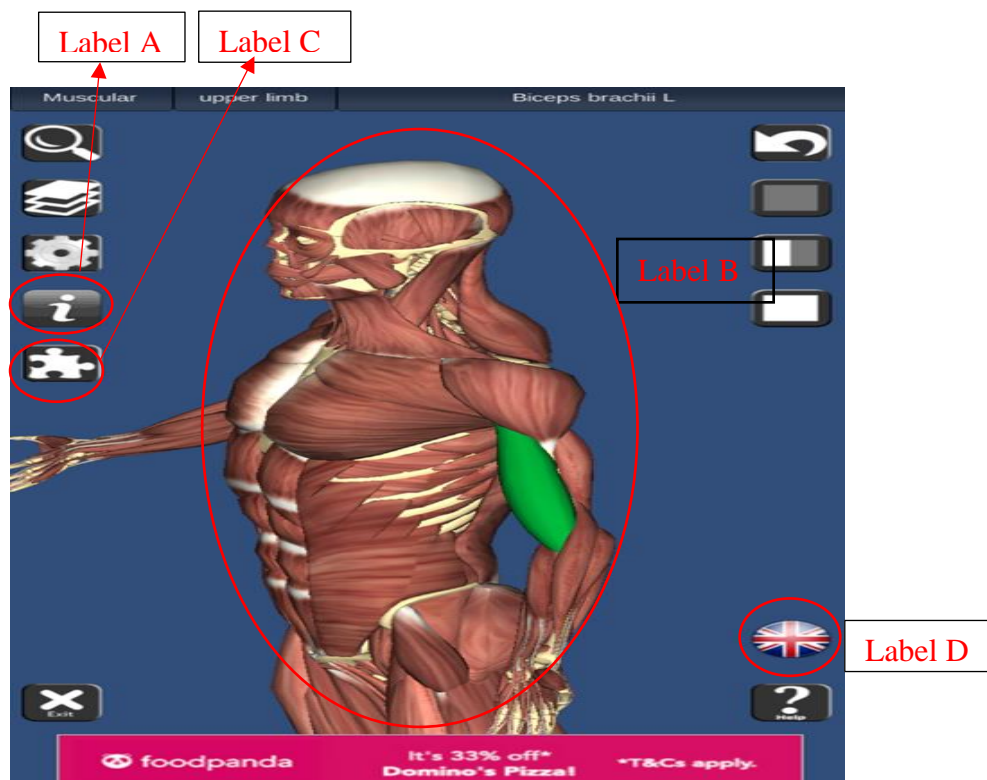
Figure 2.3: 3D Bones and Organs (Education Mobile, 2013).

3D Bones and Organs application is an interactive 3D application which provides user to learn the human bones and organ. It is a free application and it provides virtual learning for user to navigate and explore human body to reveal the anatomical structures. Label A shows that the information about the human body is based on the Wikipedia and anatomy textbook. It is useful for people who like anatomy and physiology learning.

Strengths

The strength of the application is to allow user to zoom in and out and rotate around the bones and organ of human body so that user can see the 3D Anatomy in label B. Furthermore,

it provides audio pronunciation for all bones name. Hence, user easy to get the information through virtual and audio learning. It contains the 3D information of skeleton, ligaments, muscles, respiratory system, circulation, nervous system, reproductive system, unary system and ear. Label C shows that it also provides 3D location quizzes to test the knowledge of user. User also can bookmark the important information. Label D shows that it can choose several languages such as French, Spanish and German when using the application.

Weaknesses

It is difficult to press the right answer on the model when doing the quiz because part of the model is too small. Moreover, this application cannot separate the model to small part in order to view clearly. Some information also not clearly provided for the part of the model. The advertisement cover at the bottom of the screen and it is difficult to navigate for the quiz.

2.4.4 Biology Academic
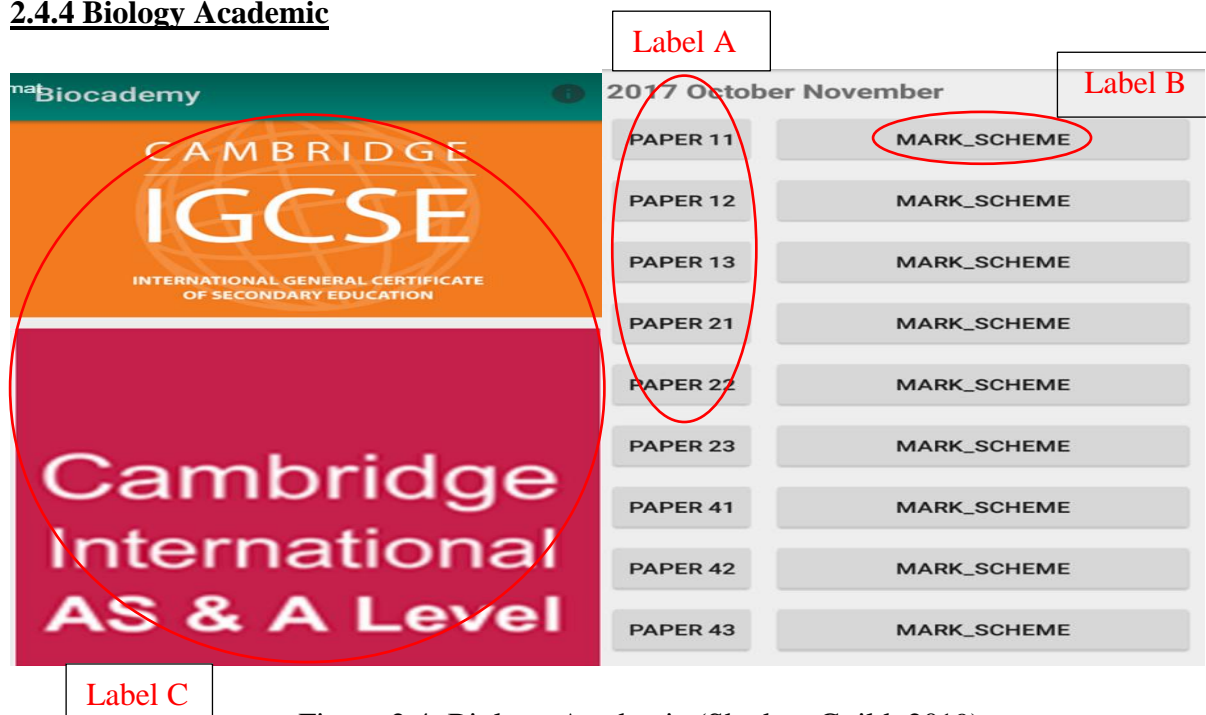
Figure 2.4: Biology Academic (Shadow Guild, 2019).

Biology Academic is an application which give a wide range of A Level and Olympiad Biology Revision Notes, latest past papers and mark schemes that can be used by student to prepare the IGCSE biology, A Level biology and International Biology Olympiad. It can increase the understanding and knowledge about the biology.

Strengths

This application allow user to choose the past papers they would like to do in label A. Mark schemes also provided for each question paper so that user can find it easily to check the answer which respective for each question paper in label B. The IGCSE and A Level biology notes contain a lot of topics for user to learn such as biological molecules, enzymes, homeostasis and the topics is well organised in label C. The diagram in the note is showed in colour and it can attract the user. User can use this application without internet connection. Lastly, this application is free of cost and no advertisement.

Weaknesses

The notes and past papers are not interactive because user cannot edit and fill in the answer in the question paper. Some user will be felt boring when doing the question paper. It also does not provide the video or audio learning to deliver information to the user. The font size of the notes is small and it will cause user need to zoom in to see clearer of the content. User need to download the question paper and mark scheme before using it offline.

2.4.5 Concepts of Biology Textbook, Test Bank
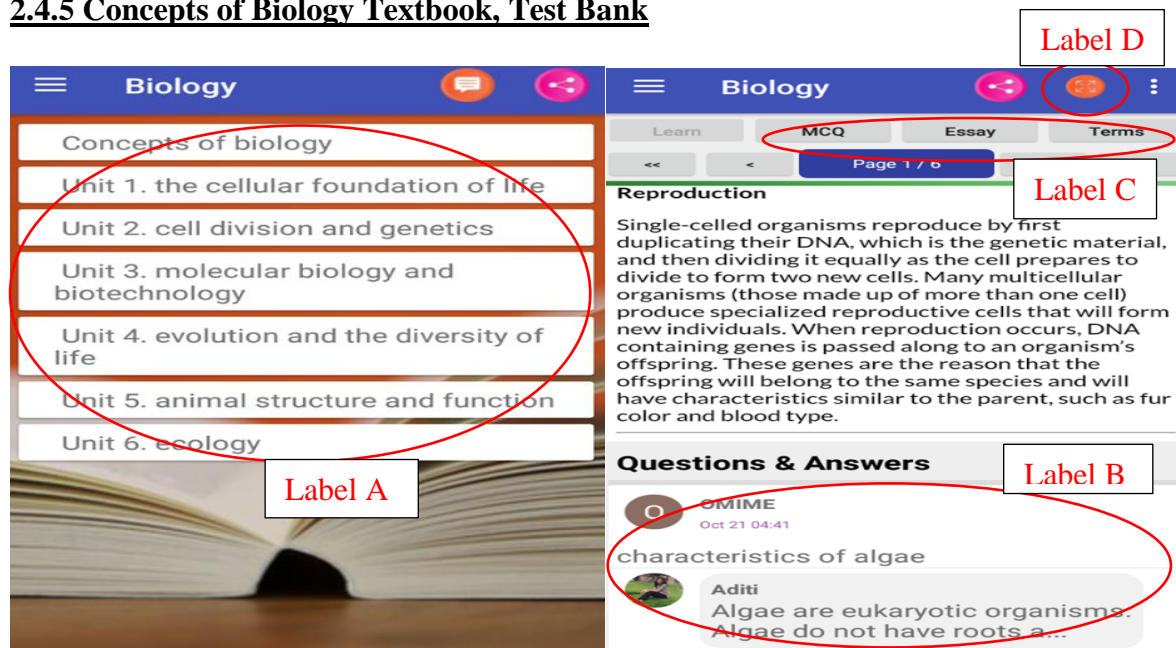
Figure 2.5: Concepts of Biology Textbook, Test Bank (QuizOver.com, 2017).

Concepts of Biology Textbook, Test Bank is an application that is designed to introduce the biology course and demonstrate the concept of Biology. This application covers the standard scope and major themes of biology. Hence, it can promote scientific literacy and increase the understanding of biology for the user.

Strengths

This application provides many topics and each topic has each own subtopic for user to read the information in label A. Moreover, it provides the discuss forum to user to comment in the bottom of the page in label B. So, user can discuss idea with other user and read other people's idea. Label C shows that it provides multiple choice questions, essay question flash cards and key-term flash cards to let user gain more knowledge. User also can zoom in and out of the page in label D.

Weaknesses

The weakness of this application is it does not provide audio, video and animation learning to let user learn it in an interesting and fun way. User also need to connect internet to join the discussion of forum. The forum discussion is occupied more than the space of content in the page and the paragraph of the context is not justified.

2.4.6 Mesh of Biology
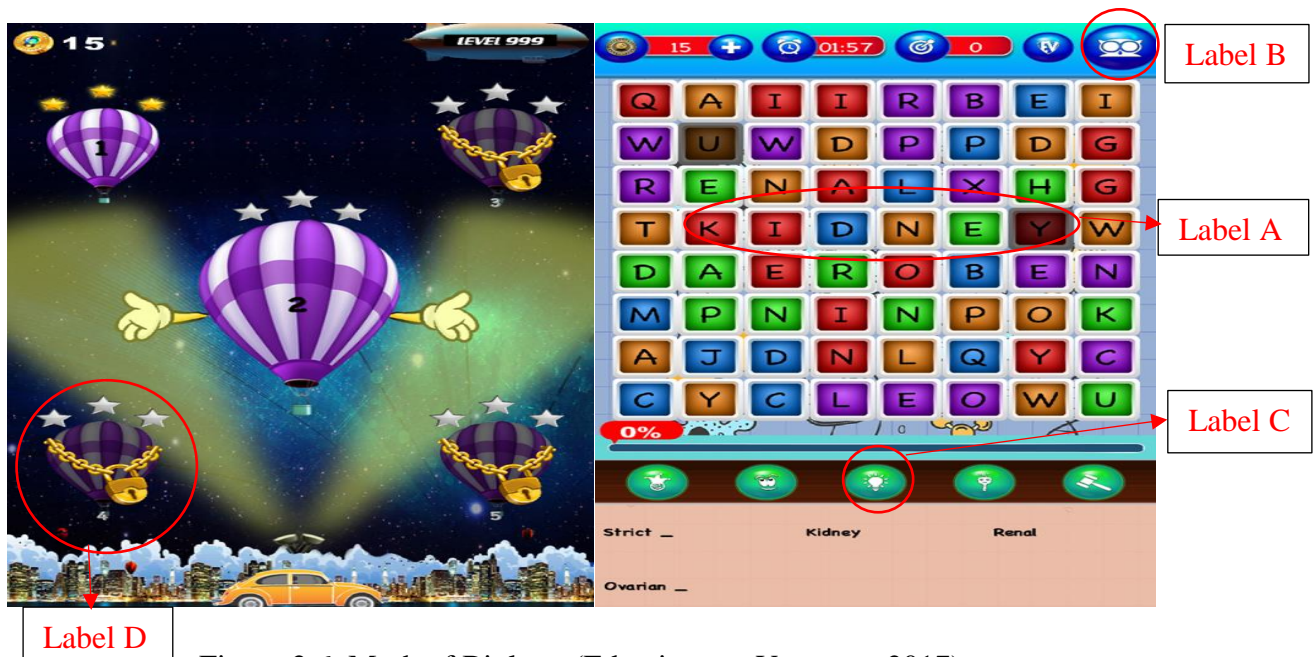
Figure 2.6: Mesh of Biology (Edutainment Ventures, 2017).

Mesh of Biology is an edutainment application made to teach the user to study the biology such as living organisms, cells, tissues and genetics. This application is a game that suitable for all age of people to play. User can learn biology in an interesting and fun way through this application.

Strengths

This application is interactive because it allows user to find and match the word of biology in label A. User can easy to learn and memorise the keywords of biology when they play the game. Some button also uses cartoon picture to convey the message in label B. Furthermore, label C shows that the hints are provided in the game to help user progress the level. This application also provides the meaning of word to increase the knowledge of user. User need to break the beginning level in order to get to the higher level in label D. Hence, it can increase the interest of user to challenge the new level of the game to gain more knowledge.

Weaknesses

The background sound of the application is too repetitive and it does not provide option to mute the audio sound. As a result, it will disturb the experience of the user. Moreover, user need to pay in order to remove the advertisements. If the user needs to skip the level to go to the higher level, they need to pay to unlock the higher level.

2.4.7 Biology – Lectures
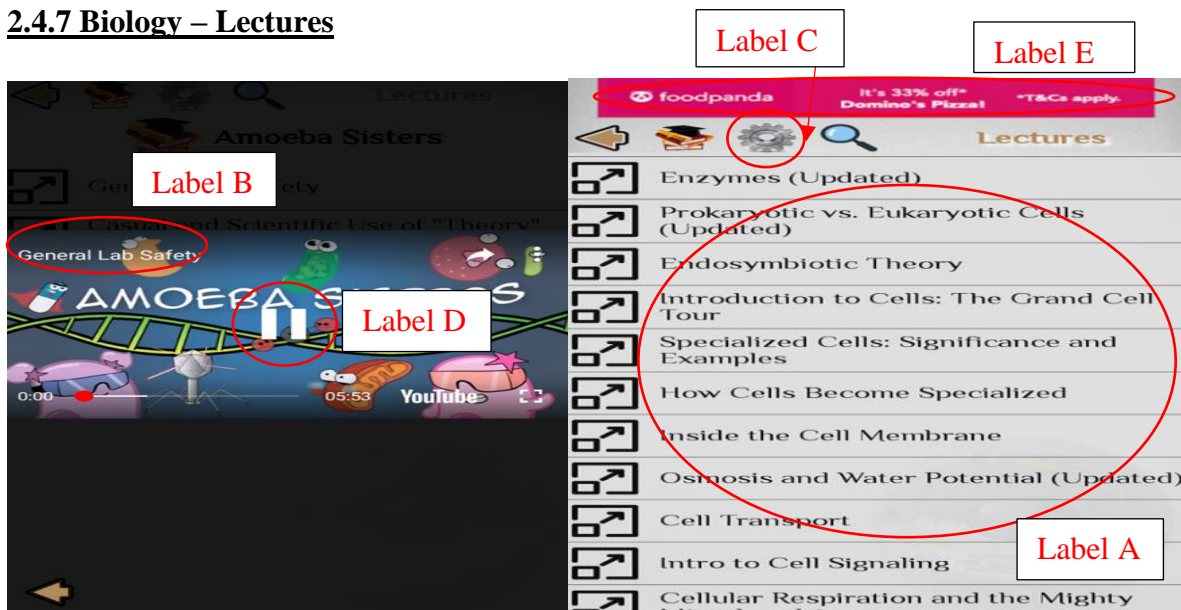
Figure 2.7: Biology – Lectures (duhnnae, 2018).

Biology-Lectures provides the biology lessons of university and college. User can learn it at home from this application. This application contains the lesson of university lectures, information of anatomy, cell biology, genetics, biology quotes, greatest biologists, book, history of biology and memes.

Strengths

This application provides video learning of biology to the user. User can choose the topic of what they want to learn in label A. When they click on the topic, it will show a video which is played from YouTube in label B. Moreover, label C shows that the video can be set to play in English or Spanish language in the setting. User also can control the video such as pausing the video which is showed in label D and increase the volume of sound. Apart from that, this application also provides text learning such as the history of biology and books of biology for user to read online. Last, user can save their favourite video in this application.

Weaknesses

The weakness of this application is it depends on internet connection to view the video and read the information of biology. It does not provide quiz to test the user. Label E also shows that the advertisement is always show up in this application.

2.4.8 Mammals by Tinybop
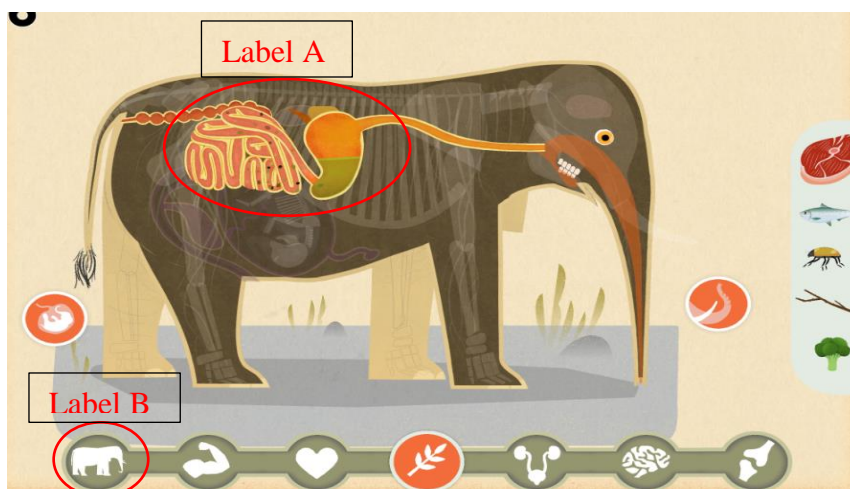
Figure 2.8: Mammals by Tinybop (Shaun Langevin, 2018).

Mammals by Tinybop is an edutainment courseware which allows user to explore the major body system of bat, tiger, kangaroo, elephant and sloth. It contains the inner and outer information of mammals such as the gestation of mammals, body and organ of mammals and their appearance. The handbook in this edutainment courseware provides instructional guidance to user to play it. User can make valuable observation and comparison of the mammals from this audiovisuals edutainment courseware.

Strengths

This edutainment courseware shows the body and organ of mammals in label A so that user more understanding about the structure of the animals. Tapping icons use graphic and picture to convey the message in label B. The sound of animal can be produced by tapping on the labels. The words are pointing to each part of the body to explain the meaning of the mammal. Hence, it can increase the understanding of the user and increase their interest to learn it. Moreover, it also provides discussion question to user to elevate learning. The information is clearly provided and it has explanation for each diagram. Lastly, it supports many languages and can be turn on and off.

Weaknesses

The number of mammals is less because it only contains 5 animals in this edutainment courseware. It will cause the information of mammals provided is limited because user can only gain the information of 5 mammals. It also does not have the information about the marine mammals.

2.4.9 Arloon Anatomy
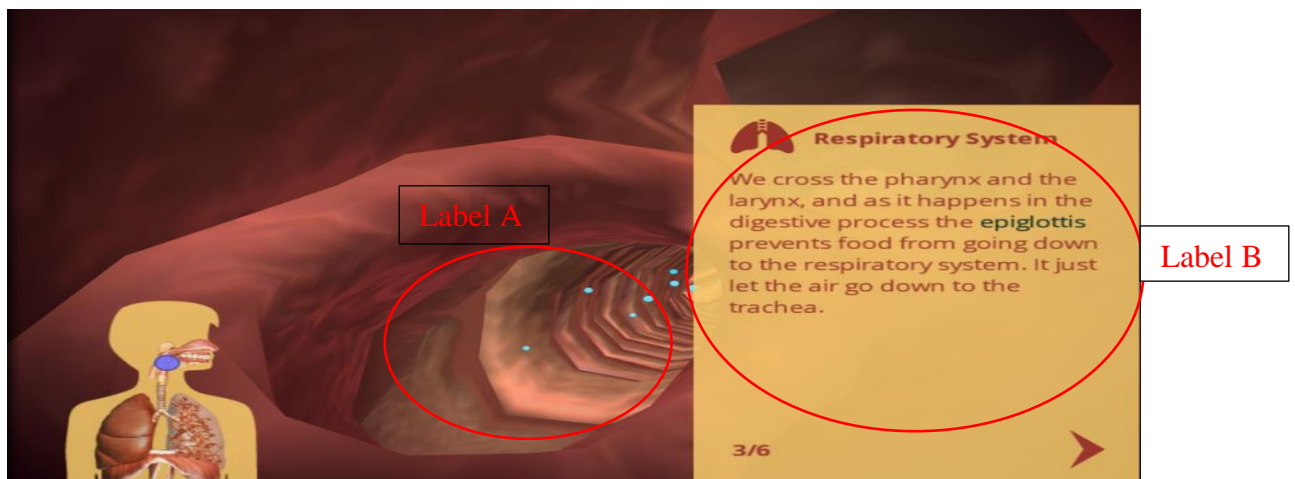
Figure 2.9: Arloon Anatomy (Emily Pohlonski, 2015).

Arloon Anatomy is a 3-D simulation edutainment courseware which allows user to familiar and understand the major organs of the human body systems. It is interactive because it allows user to engage in the topic and lesson. It can be used by teacher to teach and guide the student along the learning process. Through this edutainment courseware, user can learn the respiratory, circulatory, digestive, excretory, nervous, skeletal, muscular and reproductive system.

Strengths

User can manipulate and zoom in the 3-D images of the human body to learn detailed information about the structure and function of the human body that showed in label A. The informational slides are given to describe about the human body in label B. It also has included the augmented-reality feature to allow the 3-D images to match the user's human body. Hence, user can know the structure of the human body formed. Moreover, user can rotate and view the angle from all part of the organ. User also can adjust the time and the number of questions to complete the assessment exercises. Hence, it allows user to tailor the experience for their needs to complete the questions. English and Spanish language is available in this edutainment system.

Weaknesses

The image of internal organ produced by the augmented-reality feature that match the human body is not accurate when the person moves their body. It might get wrong information for the user when they see the image produced in this edutainment courseware. The 3-D image of the human body's organ is not very clear when the user zooms in the image.

2.5 Comparisons of similar multimedia applications

Table 2.1: Comparison of Multimedia Elements.

System / Application	Multimedia Elements					
	Text	Graphic	Video	Audio	Animation	
					2D	3D
Biology eBook & Quiz (Sana Edutech, 2016)	√	√	X	√	X	X
SPM Biology (Oxford Fajar, 2016)	√	√	X	X	X	X
3D Bones and Organs (Education Mobile, 2013)	√	X	X	√	X	√

Biology Academic (Shadow Guild, 2019)	√	√	X	X	X	X
Concepts of Biology Textbook, Test Bank (QuizOver.com, 2017)	√	√	X	X	X	X
Mesh of Biology (Edutainment Ventures, 2017)	√	√	X	√	√	X
Biology – Lectures (duhnnae, 2018)	√	√	√	X	X	X
Mammals by Tinybop (Shaun Langevin, 2018)	√	√	X	√	√	X
Arloon Anatomy (Emily Pohlonski, 2015)	√	√	X	X	X	√

Table 2.2: Comparison of User Interface Design.

System / Application	Interface Design				Learnability	Interactivity
	Font	Colour	Navigation	Creativity		
Biology eBook & Quiz (Sana Edutech, 2016)	3	4	4	3	4	4
SPM Biology	3	3	3	2	2	3

(Oxford Fajar, 2016)					
3D Bones and Organs (Education Mobile, 2013)	2	4	3	4	5	4
Biology Academic (Shadow Guild, 2019)	2	3	4	3	4	2
Concepts of Biology Textbook, Test Bank (QuizOver.com, 2017)	3	3	4	3	4	3
Mesh of Biology (Edutainment Ventures, 2017)	2	4	3	4	3	3
Biology – Lectures (duhnnae, 2018)	3	4	3	3	4	3
Mammals by Tinybop (Shaun	3	3	3	3	3	4

Langevin, 2018)						
Arloon Anatomy (Emily Pohlonski, 2015)	3	2	4	3	4	4

1-Bad 2-Poor 3-Average 4-Good 5-Excellent

2.6 Learning Approach (Learner-Centered Approach)

The learner-centered approach is defined as shifting the focus of instruction from the instructor to the learner and it offers the best experience for the learner because it has engaged them with the instructor, the content and other learners (Peak Performance Center, n.d.). The constant engagement can help the learner to develop a deeper understanding about the materials presented. The learner-centered approach acknowledges all the essential needs of the learners and ensure the learners get a personalized and convenient learning experience (Anand Timothy, 2015). It places the learner at the center of the learning. For example, learner can easily access the course content and it allows the interaction between the learner and the instructor.

Apart from that, the learner-centered approach can promote a different, deeper and better kind of learning for the learner (Kaleem S. Clarkson, n.d.). It facilitates the personalized learning because all learners do not have the same leaning needs. Some learner maybe already has some knowledge about the topic and some of them maybe entirely new to the concept. Hence, it is needed to provide the supplementary materials for the learner in the application to make the learning more effective. The learner-centered approach also can provide the knowledge and skills for the learner as well as increase their critical thinking in the process of leaning (NC State University, 2019). It can engage the participant in the learning process and encourages them to reflect on what and how they are learning it. For example, it helps the learner to learn how to think and make decisions, how to solve the problems and generate the ideas.

2.7 Users Requirements Gathering

2.7.1 Survey Questionnaire

Survey questionnaire is one of the important methods to collect data and information for the researcher. It can help the researcher to find the answers of the research problem, test the hypothesis and evaluate the outcomes (John Dudovskiy, 2019). The questionnaire is a written or printed form that consists of a formalized set of questions to collect the information from respondents (Business Jargons, n.d.). The survey questionnaire had been used by the author to collect the data about the Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach). The information that are needed to collect from the respondents is the user requirements and the improved features for the edutainment system (computer software). The paper questionnaire had been designed in closed-ended and open-ended questions and it had distributed to 45 persons to answer it. Moreover, the online questionnaire also had been distributed to 35 respondents to answer it. Hence, there are 80 persons participated in the survey questionnaire. The format of questions is simple and directed so that it can encourage people to participant in this questionnaire. The questionnaire method had been chosen because it is easier to analysis and the answer can be compared easily. The response of the questionnaire had been recorded and the statistical analysis had been performed. The information is collected in a standardised way and the problems about the investigate issues will be identified and improved through the questionnaire (Evidence Base, 2006). Hence, the collected data from the survey questionnaire will be analysed to make improvement for the edutainment system.

2.7.2 Data collection and analysis

1. Do human activities affect the ecosystem?
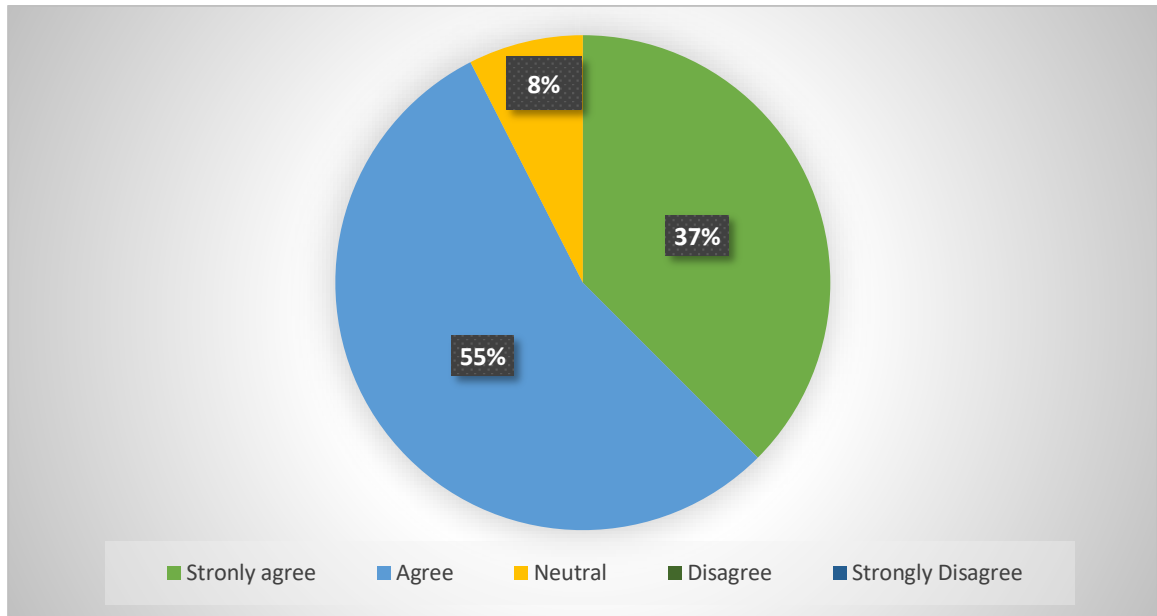
Figure 2.10: Pie chart of "Do human activities affect the ecosystem?".

The pie chart shows that the responses of the question from the total number of 80 respondents which is 45 respondents in the paper questionnaires and 35 respondents in the online questionnaires. Most of the respondents agreed that the human activities affect the ecosystem which is 55% in the pie chart. There are 22 respondents agreed that the human activities can affect the ecosystem in the paper questionnaires and 22 respondents agreed that the human activities can affect the ecosystem in the online questionnaires. The second highest responses are the answer of strongly agree which is 37% in the pie chart. There are 20 respondents strongly agreed that the human activities can affect the ecosystem from the paper questionnaires and there are 10 respondents strongly agreed that the human activities can affect the ecosystem from the online questionnaires. There are 8% respondent neutral agreed that the human activities affect the ecosystem in the pie chart where both of the number of respondents are equal from the paper questionnaires and the online questionnaires which both of it is 3 respondents. There is no response in the options of disagree and strongly disagree in the question.

2. How concerned are you about the endangered ecosystem?
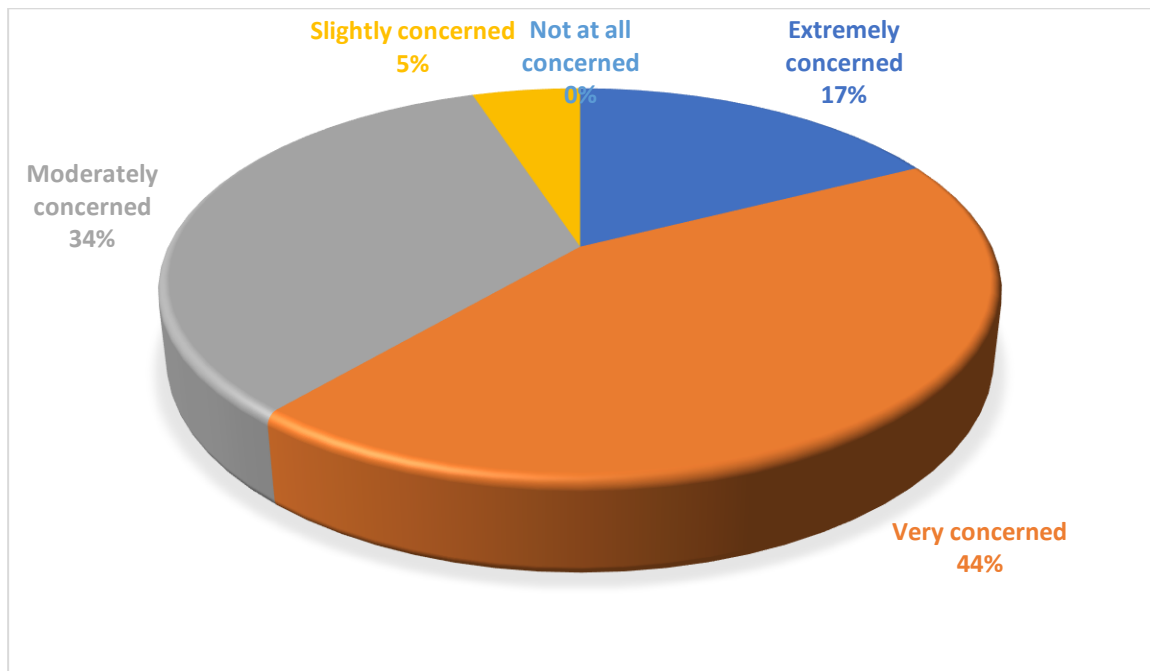
Figure 2.11: Pie chart of "How concerned are you about the endangered ecosystem?".

The pie chart shows that the responses of the question from the total number of 80 respondents which is 45 respondents in the paper questionnaires and 35 respondents in the online questionnaires. It shows that 17% respondents are extremely concerned about the endangered ecosystem and it can be seen in the paper questionnaires and online questionnaires which both of it is 7 respondents respectively. There are 44% of respondents are very concerned about the endangered ecosystem in the pie chart and it is the highest number of responses among the other options in the question. The evidences can be seen in the paper questionnaires and online questionnaires which both of it have 19 respondents and 16 respondents respectively. The pie chart also shows that the 34% of respondents are moderately concerned about the endangered ecosystem which is 18 respondents from the paper questionnaires and 8 respondents from the online questionnaires. However, only 5% of respondents are slightly concerned about the endangered ecosystem in the pie chart because it only has 1 respondent from the paper questionnaires and 4 respondents from the online questionnaires. There is no response in the option of not at all concerned about the endangered ecosystem in the question.

3.   Do you think the importance of the ecosystem should be educated to the students?
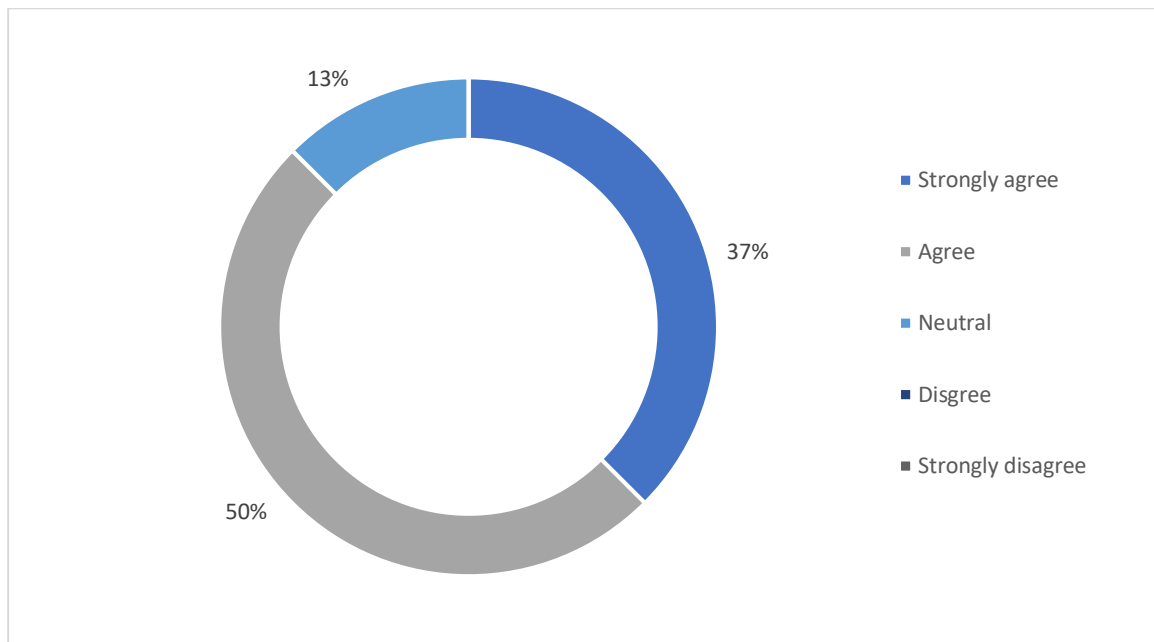
Figure 2.12: Pie chart of "Do you think the importance of the ecosystem should be educated to the students?".

The pie chart shows that the responses of the question from the total number of 80 respondents which is 45 respondents in the paper questionnaires and 35 respondents in the online questionnaires. Half of the respondents are agreed that the importance of the ecosystem should be educated to the students in the pie chart. There are 19 respondents from the paper questionnaires and 21 respondents from the online questionnaires are agreed that the importance of the ecosystem should be educated to the students. The pie chart also shows that 31% respondents strongly agreed that the importance of the ecosystem should be educated to the students. There are 22 respondents strongly agreed that the importance of the ecosystem should be educated to the students from the paper questionnaires and 21 respondents are strongly agree that the importance of the ecosystem should be educated to the students from the online questionnaires. The pie chart also shows that 13% respondents are neutral agreed to the question where it has 4 respondents from paper questionnaires and 6 respondents from online questionnaires neutral agreed to it. There is no response in the options of disgree and strongly disagree in the question.

4. Which do you think is the most important features that an edutainment system (computer software) should have? (Can tick more than one)
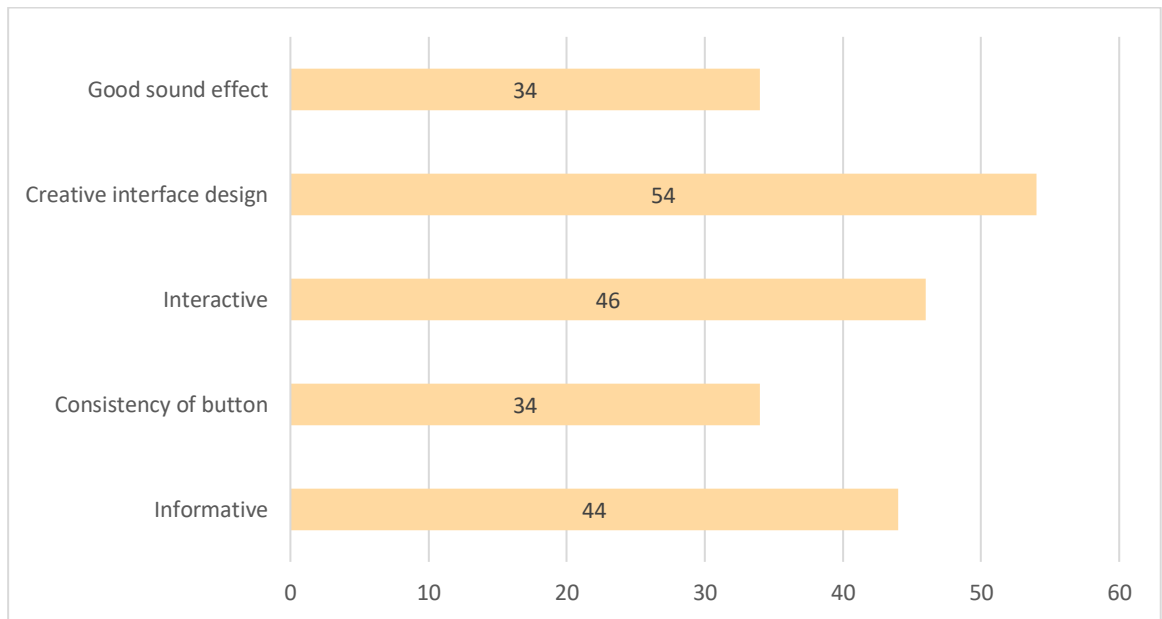
Figure 2.13: Bar chart of "Which do you think is the most important features that an edutainment system (computer software) should have?".

The bar chart shows that the responses of the question from the total number of 80 respondents which is 45 respondents in the paper questionnaires and 35 respondents in the online questionnaires. The creative interface design is the highest number of responses which is 54 respondents in the pie chart. There are 30 respondents from the paper questionnaires and 24 respondents from the online questionnaires who choose the features of creative interface design in the edutainment system. The second highest response is the interactive of an edutainment system which is 46 respondents in the bar chart. It shows that 26 and 20 respondents react to it from the paper questionnaires and online questionnaires respectively. Moreover, 44 respondents felt that the feature of informative also an important feature in an edutainment system. There are 26 respondents and 18 respondents who select the informative feature in the edutainment system from the paper questionnaires and the online questionnaires respectively. The good sound effect and the consistency of button have the same responses in the pie chart which is 34 respondents respectively. There are 30 respondents from the paper questionnaires and 38 respondents from the online questionnaires who react to both of this feature respectively.

5. Which module do you prefer the most if an edutainment system (computer software) consists of?
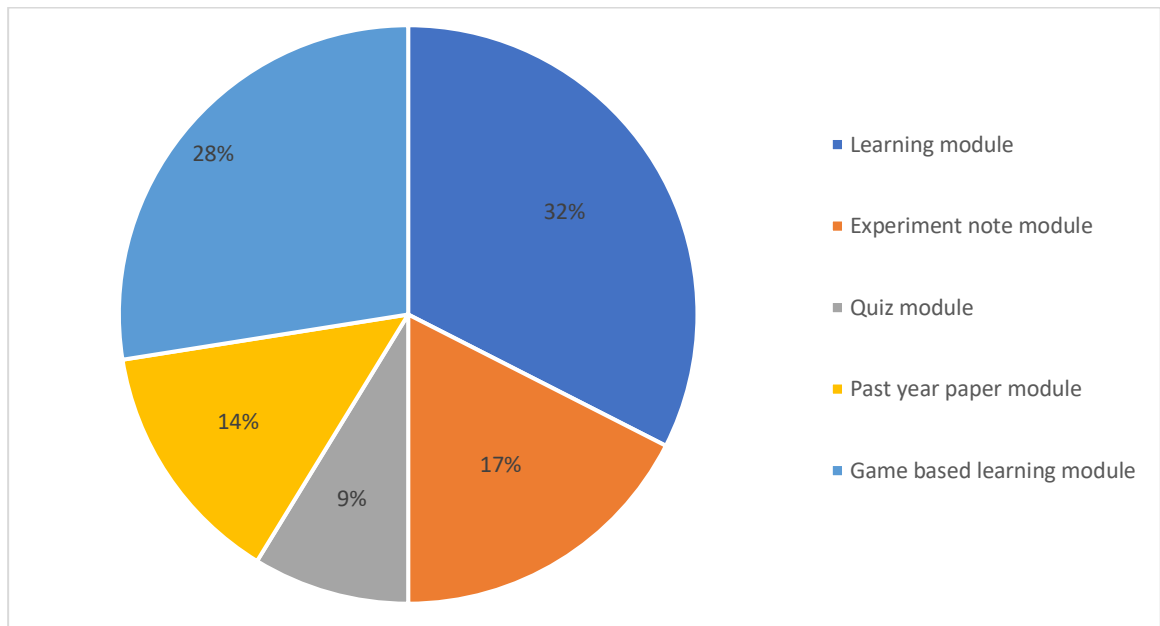
Figure 2.14: Pie chart of "Which module do you prefer the most if an edutainment system (computer software) consists of?".

The pie chart shows that the responses of the question from the total number of 80 respondents which is 45 respondents in the paper questionnaires and 35 respondents in the online questionnaires. Learning module is the highest response which is 32% in the pie chart. There are 14 respondents and 12 respondents prefer the learning module from the paper questionnaires and online questionnaires respectively. The game based learning module is the second higher responses in the pie chart which is 28%. There are 16 respondents from the paper questionnaires and 6 respondents from the online questionnaires prefer the game based learning module. The experiment note module is 17% and the past year paper is 14% in the pie chart. There are 8 respondents from the paper questionnaires and 6 respondents from the online questionnaires who like the experiment note module. On the other hand, there are 4 respondents from the paper questionnaires and 7 respondents from the online questionnaires who prefer the past year paper module. The quiz module is the lowest in the pie chart which is 9%. There are 3 respondents and 4 respondents who like the quiz module from the paper questionnaires and online questionnaires respectively.

6. Do you think the learning module of an edutainment system (computer software) should focus on what kind of information? (Can tick more than one)
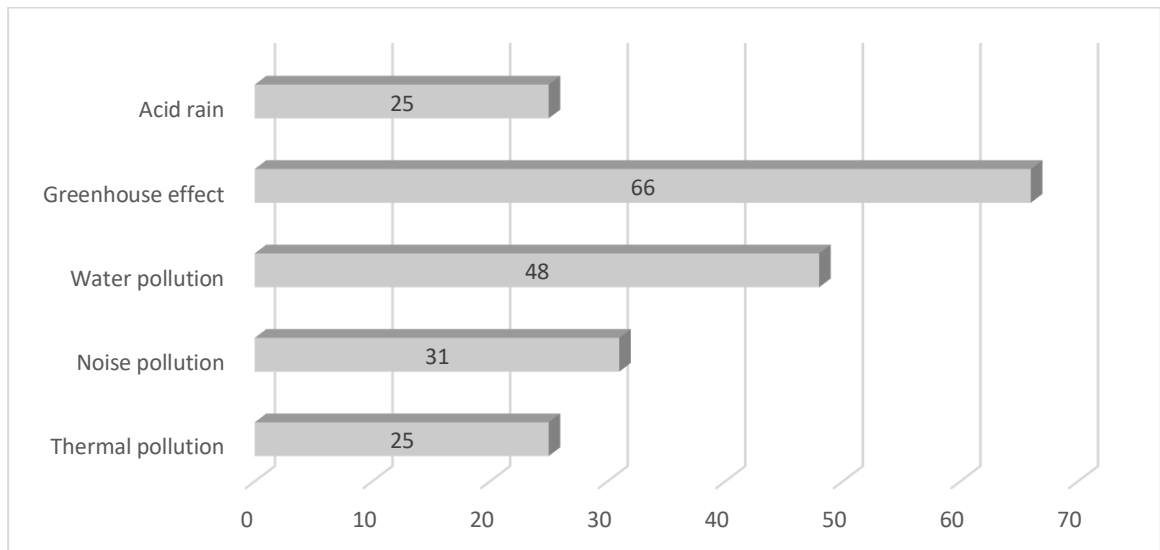
Figure 2.15: Bar chart of "Do you think the learning module of an edutainment system (computer software) should focus on what kind of information?".

The bar chart shows that the responses of the question from the total number of 80 respondents which is 45 respondents in the paper questionnaires and 35 respondents in the online questionnaires. Most of the respondents would like to know the information of greenhouse effect and it is the highest number of respondents in the pie chart which is 66 respondents. There are 42 respondents from the paper questionnaires and 24 respondents from the online questionnaires who choose the greenhouse effect. The pie chart also shows that 48 respondents who want to know the information of water pollution where the total number of respondents from the paper questionnaires is 29 and the total number of respondents from the online questionnaires is 19. There are 31 respondents who want to focus on the information of noise pollution. It can be proved by 16 respondents from the paper questionnaires and 15 respondents from the online questionnaires. The total number of respondents who want to know the information of acid rain and thermal pollution are 25 respondents respectively. There are 12 respondents from the paper questionnaires and 15 respondents from the online questionnaires who want to know the information of acid rain whereas there are 14 respondents from the paper questionnaires and 11 respondents from the online questionnaires who want to know the information of thermal pollution.

7. Do you think the learning module of the edutainment system (computer software) is an effective way of learning when compared to textbook?
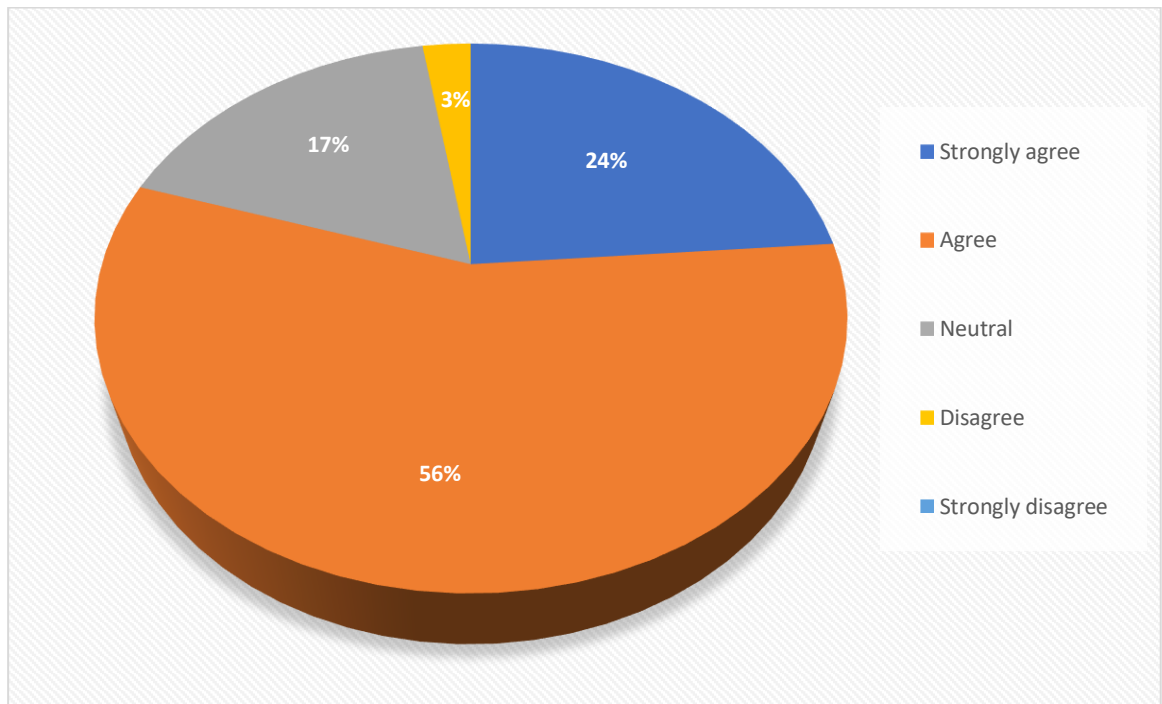
Figure 2.16: Pie chart of "Do you think the learning module of the edutainment system (computer software) is an effective way of learning when compared to textbook?".

The pie chart shows that the responses of the question from the total number of 80 respondents which is 45 respondents in the paper questionnaires and 35 respondents in the online questionnaires. There are 56% respondents in the pie chart agreed that the learning module of the edutainment system is an effective way of learning when compared to textbook. It can be seen by the 24 respondents from the paper questionnaires and 21 respondents from the online questionnaire who are agreed it. The pie chart also shows that there are 24% respondents who are strongly agreed to the question. It can be proved by the 13 respondents from the paper questionnaires and 6 respondents from the online questionnaires who are strongly agree to it. There are 17% responses in the pie chart where there have 8 respondents from the paper questionnaires and 6 respondents from the online questionnaires who are neutral to this question. However, there are 3% respondents in the pie chart who are disagreed to it. The online questionnaires have shown that 2 respondents disagree to it. There is no response in the option of strongly disagree in the question.

8. Do you think the learning module should provide video learning for the user?
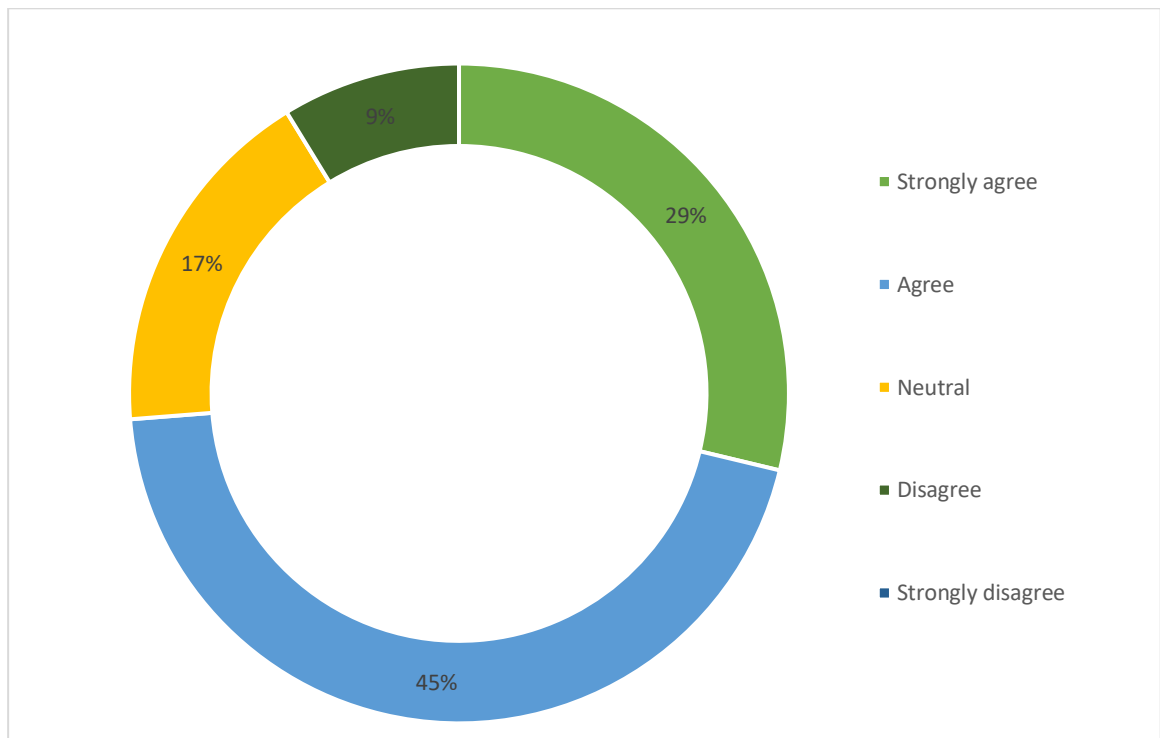
Figure 2.17: Pie chart of "Do you think the learning module should provide video learning for the user?".

The pie chart shows that the responses of the question from the total number of 80 respondents which is 45 respondents in the paper questionnaires and 35 respondents in the online questionnaires. Most of the respondents are strongly agreed that the learning module should be provided in the learning module which is 45% in the pie chart. There are 22 respondents from the paper questionnaires and 12 respondents from the online questionnaires agreed to it. On the other hand, there are 29% respondents strongly agreed it. It can be proved by the 19 respondents from the paper questionnaires and 4 respondents from the online questionnaires. However. there are 14.17% respondent neutral agreed to it where it can be seen from the 3 respondents in the paper questionnaires and 11 respondents in the online questionnaires. The pie also shows that there are only 9% respondents disagree it in the pie chart. It can be shown by 1 respondent from the paper questionnaires and 6 respondents from the online questionnaires. There is no response in the option of strongly disagree in the question.

9. Are the animation images that applied in the experiment note module can increase the interests of user to study it?
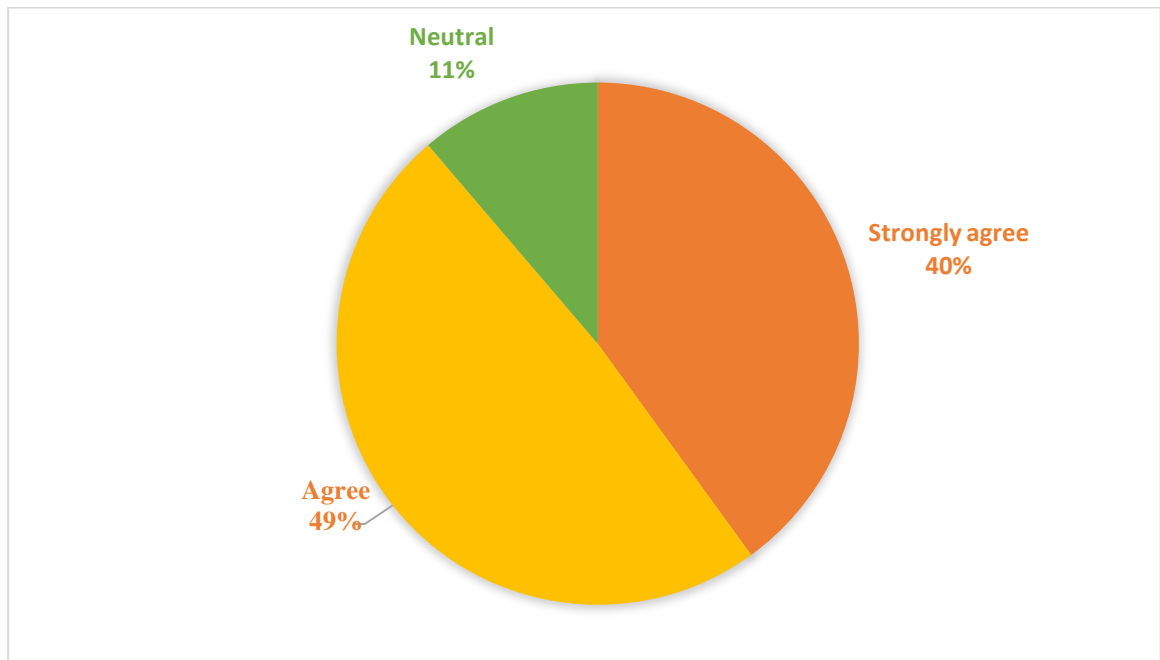
Figure 2.18: Pie chart of "Are the animation images that applied in the experiment note module can increase the interests of user to study it?".

The pie chart shows that the responses of the question from the total number of 80 respondents which is 45 respondents in the paper questionnaires and 35 respondents in the online questionnaires. Most of the respondents are agreed that the animation images that applied in the experiment note module can increase the interests of user to study it which is 49% in the pie chart. There are 20 respondents from the paper questionnaires and 19 respondents from the online questionnaires who are agreed to it. Moreover, there are 40% respondents in the pie chart are strongly agreed to the questions where it can be seen from the 21 respondents in the paper questionnaires and 11 respondents in the online questionnaires who are agreed to it. However, there are 11% respondents who are neutral agreed to the question. It can be shown by the 4 respondents from the paper questionnaires and 5 respondents from the online questionnaires who are neutral agreed to it. There is no response in the options of disagree and strongly disagree in the question.

10. The quiz module should provide explanation for each question?
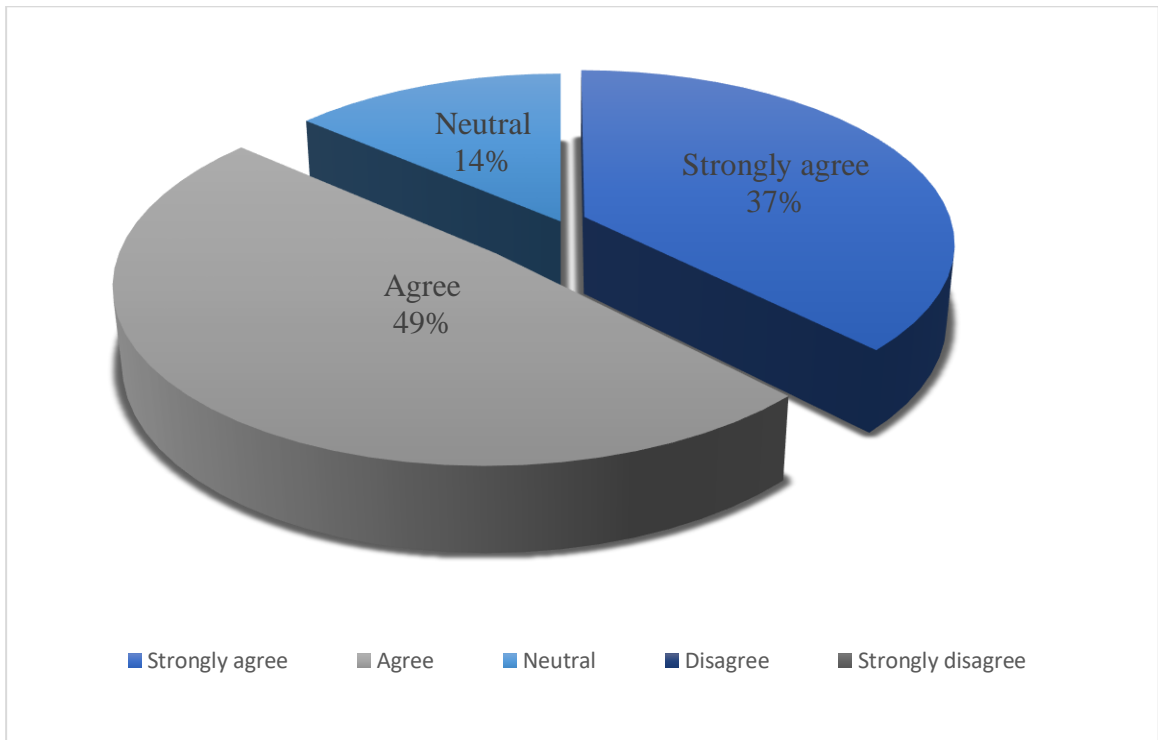
Figure 2.19: Pie chart of "The quiz module should provide explanation for each question?".

The pie chart shows that the responses of the question from the total number of 80 respondents which is 45 respondents in the paper questionnaires and 35 respondents in the online questionnaires. Almost half of the respondents are agreed to the quiz module should provide explanation for each question in the pie chart which is 49% in the pie chart. There are 21 respondents from the paper questionnaire and 18 respondents from the online questionnaires who are agreed to it. The pie chart also shows that there are 37% respondents are strongly agreed to the question. It can be proved by the 19 respondents from the paper questionnaires and 11 respondents from the online questionnaires who are strongly agreed to it. On the other hand, there are 14% respondents in the pie chart who are neutral agreed that the quiz module should provide explanation for each question where it can be seen from the 5 respondents from the paper questionnaires and 6 respondents from the online questionnaires who are neutral agreed to it. There is no response in the options of disagree and strongly disagree in the question.

11. The past year paper module should include the marking scheme?
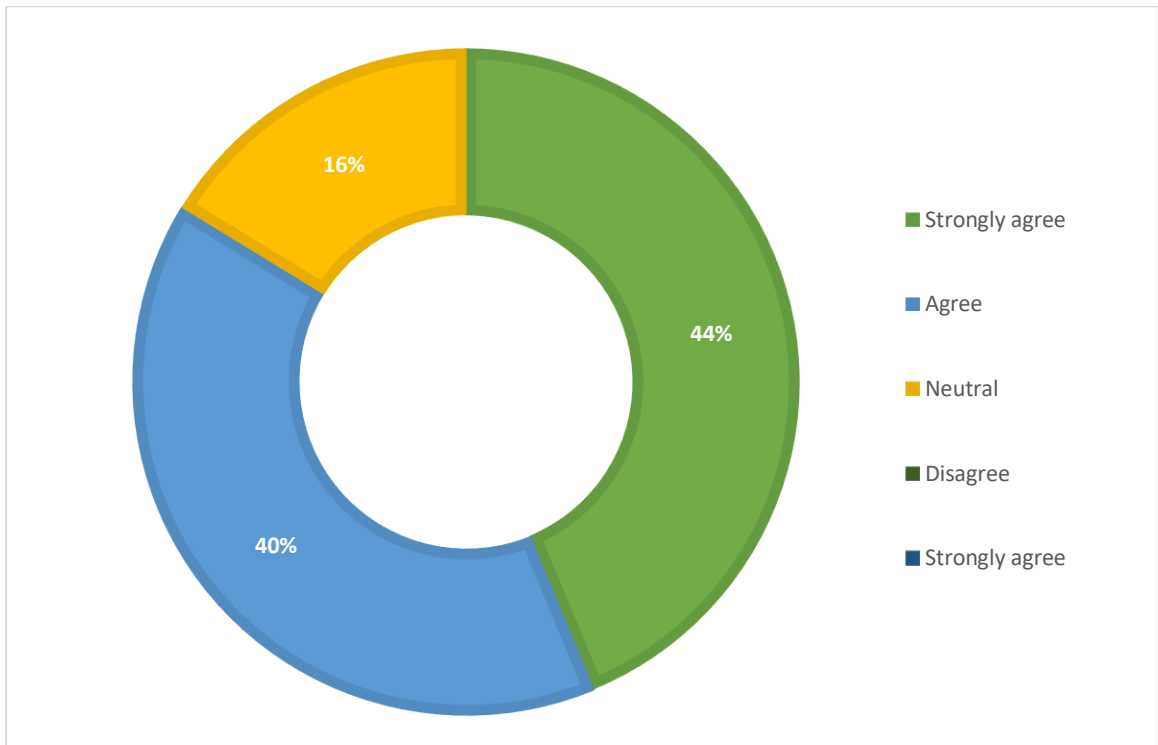
Figure 2.20: Pie chart of "The past year paper module should include the marking scheme?".

The pie chart shows that the responses of the question from the total number of 80 respondents which is 45 respondents in the paper questionnaires and 35 respondents in the online questionnaires. The pie chart shows that 44% respondents are strongly agreed to the marking scheme should be included in the past year paper module. There are 21 respondents from the paper questionnaires and 14 respondents from the online questionnaire who are strongly agreed about it. On the other hand, there are 40% respondents who are agreed to it. It can be proved by the 17 respondents from the paper questionnaires and 15 respondents from the online questionnaires. However, there are 16% respondents in the pie chart who are neutral agreed that the marking scheme should be included in the past year paper module. It can be proved by the 6 respondents in both of the paper questionnaires and online questionnaires respectively. There is no response in the options of disagree and strongly disagree in the question.

12. The game based module can motivate students to learn the ecosystem?
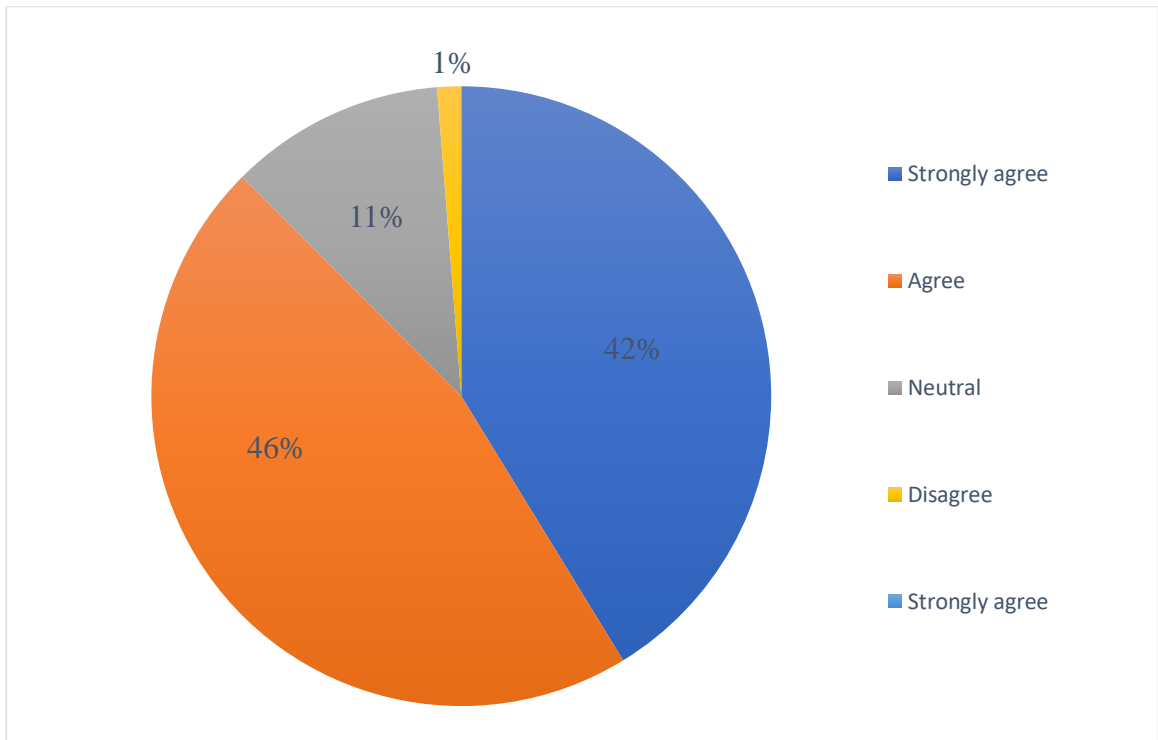
Figure 2.21: Pie chart of "The game based module can motivate students to learn the ecosystem?".

The pie chart shows that the responses of the question from the total number of 80 respondents which is 45 respondents in the paper questionnaires and 35 respondents in the online questionnaires. Most of the respondents are agreed that the game based module can motivate students to learn the ecosystem and it occupies 46% in the pie chart. There are 22 respondents from the paper questionnaire and 15 respondents from the online questionnaires who are agreed to it. The pie chart also shows that 42% respondents are strongly agreed to it and it can be proved from the paper questionnaires and online questionnaires which have 22 respondents and 11 respondents respectively. On the other hand, there are 11% respondents who are neutral agreed to it in the pie chart where it can be seen from the paper questionnaires and online questionnaires and both of it has 1 respondent and 8 respondents respectively. There is only 1 person who is disagreed from the online questionnaire and there is no response in the option of strongly disagree from the survey.

13. Can you accept an edutainment system (computer software) without game based module?
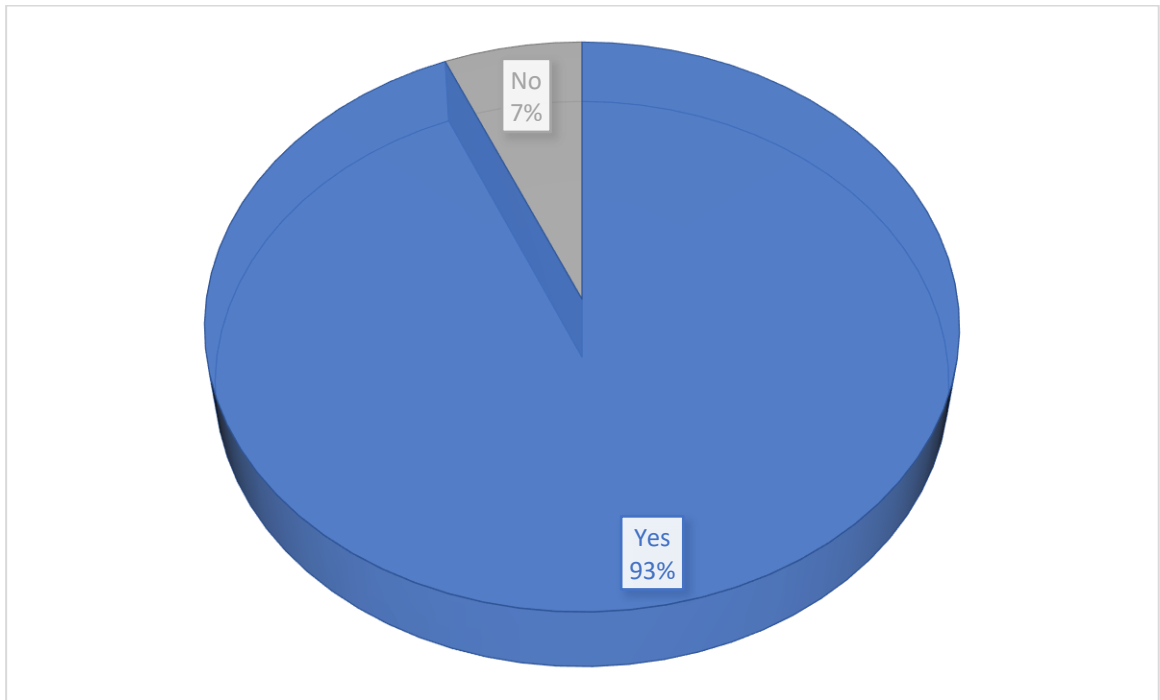
Figure 2.22: Pie chart of "Can you accept an edutainment system (computer software) without game based module?".

The pie chart shows that the responses of the question from the total number of 80 respondents which is 45 respondents in the paper questionnaires and 35 respondents in the online questionnaires. The pie chart shows that the number of respondents who can accept the edutainment system (computer software) without game based module is more than the number of respondents who cannot accept it. The paper questionnaires show that there are 25 respondents can accept the edutainment system (computer software) without game based module and 20 respondents cannot accept the edutainment system (computer software) without game based module. On the other hand, the online questionnaires show that there are 21 respondents can accept the edutainment system (computer software) without game based module and 14 respondents cannot accept the edutainment system (computer software) without game based module.

14. The paper 1, paper 2 and paper 3 should be categorized in the past year module?
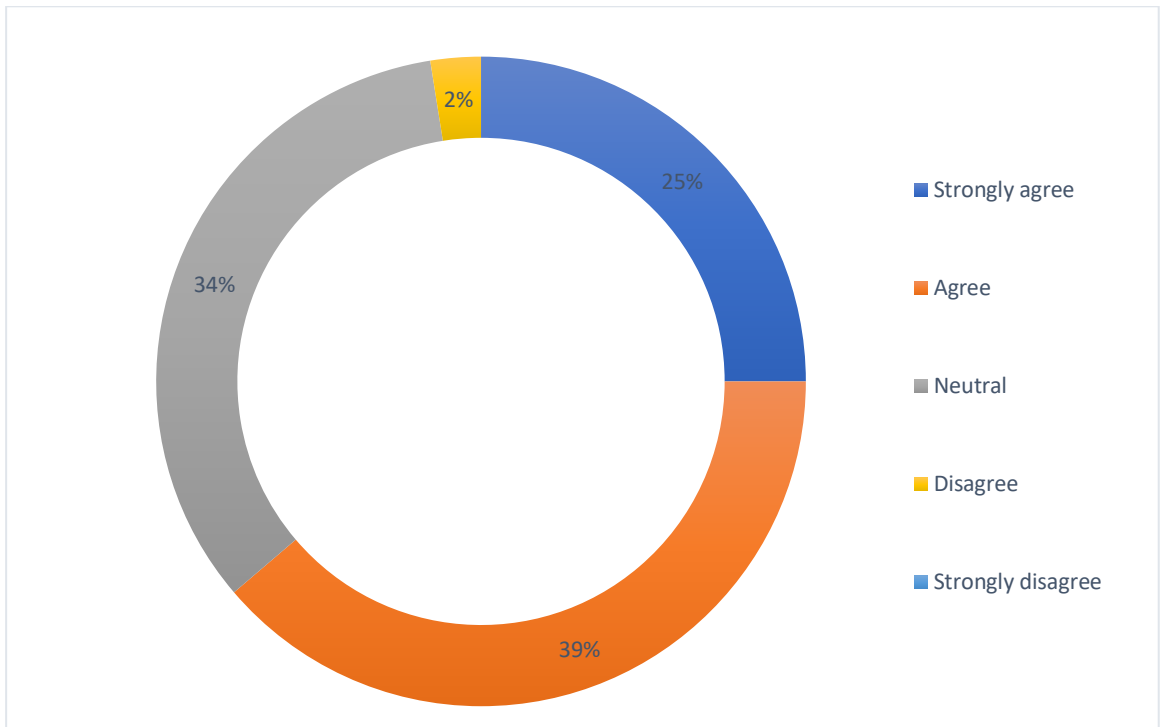
Figure 2.23: Pie chart of "The paper 1, paper 2 and paper 3 should be categorized in the past year module?".

The pie chart shows that the responses of the question from the total number of 80 respondents which is 45 respondents in the paper questionnaires and 35 respondents in the online questionnaires. The pie chart shows that 39% respondents who are agreed that the paper 1, paper 2 and paper 3 should be categorized in the past year module and 34% respondents who are neutral agreed to it. There are 14 respondents from the paper questionnaires and 17 respondents from the online questionnaires are agreed that the paper 1, paper 2 and paper 3 should be categorized in the past year module. On the other hand, there are 16 respondents from the paper questionnaires and 11 respondents from online questionnaires who are neutral agreed to it. Moreover, the pie chart shows that 25% respondents are strongly agreed to it where it can be seen from the paper questionnaires and online questionnaires who have 13 and 7 respondents respectively. However, there are 2% in the pie chart who are disagree to it and it can be seen from the 2 respondents in the paper questionnaires. There is no response in the option of strongly disagree of the question.

15. If there any additional information that you would like to provide for the new edutainment system (computer software)?

Table 2.3: Reponses of "If there any additional information that you would like to provide for the new edutainment system (computer software)?".

1. Provide online link to the relative information for user	2. Some information can link to website.
3. Keep the quiz, past year paper's question simple and short or clear.	4. Add simulations, Augmented Reality simulations.
5. Add in forum discussion features to enable users help each other to resolve their academic problems.	6. Fit in features that will help students to discuss their opinions.
7. Community learning group / COP	8. Design in colorful
9. Add in animation and images to attract the user.	10. The information need to be clearly.
11. The game should be fun and interesting.	12. Show the steps of the experiment to the user.
13. Problem solving function.	14. Offline functionality.
15. Provide guidelines for the user.	16. A progress bar.
17. Encourage user to plant more trees.	18. Students should not addict to computer video games while using computer software to help in their education.
19. Everything must be provided after analysis.	

Through the analysis of the survey, there are some respondents provide the information about the new edutainment system (computer software). Firstly, the edutainment system (computer software) can provide the online link to link to the relative information of the website. Moreover, the questions of the quiz module and the past year paper module should be simple, shortly and clearly. Furthermore, the Augmented Reality (AR) can be added into the edutainment system (computer software). In addition, the edutainment system can provide the discussion forum or the community learning group to enable the users to resolve

their academic problems. Apart from that, the edutainment system can be designed in colourful and added some animation images to attract the user. Then, the information of the edutainment system should be clearly and the game based learning module should be fun and interesting. The experiment note module should show the steps of the experiment for the user. Besides, the edutainment system (computer software) need to have problem solving function and offline functionality. Lastly, the edutainment system can provide the guidelines and progress bar for the user.

2.7.3 Discussions

In overall, the questions above are responded positively from most of the respondents. The first question and the second question show that the major respondents are agreed that the human activities will affect the ecosystem and they are very concerned about the endangered ecosystem. Hence, half of them are agreed that the importance of the ecosystem should be educated to the students in question 3. Question 4 shows that the creative interface design, interactive and informative are the top 3 of the important features that an edutainment system should have. The question 5 shows that the learning module is the most popular module among the others and most of the respondents are prefer it. Next, the respondents from the question 6 think that the edutainment system should focus more on greenhouse effect in the learning module. Besides, more than half of the respondents are agreed that the learning module of the edutainment system is an effective way of learning when compared to textbook in question 7. Furthermore, question 8 shows that most of the respondents are agreed that the learning module should provide video learning for the user but a minor respondent is disagreed to it. Question 9 and question 10 shows that almost half of the respondents are agreed to both of the questions. Question 11 shows that most of the respondents are strongly agreed that the past year paper module should include the marking scheme. Question 12 shows that almost half of the respondents agreed that the game based module can motivate students to learn the ecosystem. However, most of them can accept an edutainment system without game based module in question 13. The respondents also agreed that the paper 1, paper 2 and paper 3 should be categorized in the past year module in question 14. The last question is a structure question and it had received a lot of useful reply from the respondents in order to improve the edutainment system.

CHAPTER 3 Methodology and System Design

3.1 Overview

The chapter 3 is about the methodology and the system design for this project. This chapter consists of system requirements, ADDIE model, system flow diagram, storyboard design and project planning. At first, this chapter will shows the system requirements. The system requirements is the configuration of the system so that the hardware and software application can run smoothly. The system requirements are divided into 2 parts which are software requirements and hardware requirements. The software requirements show the type of softwares in text, graphics, audio, video and animation and the descriptions had provided for each of the softwares. On the other hand, the hardware requirements show the type of hardwares and the specifications. The ADDIE model is showed after the system requirements in chapter 3. The ADDIE model is the methodology used in this multimedia project. It consists of 5 phases which are analysis, design, development, implementation and evaluation phase. The explanations had been provided in each phase of ADDIE model. Next, the system flow diagram and the storyboarding design of Computer Aided Instruction (CAI) for Biology Curriculum (Leaner Centered Approach) are showed in chapter 3. The system flow diagram shows the relationships between each of the components in the edutainment system. Furthermore, the storyboarding design shows the instructions, flowchart as well as the illustrations of each module in the edutainment system. Lastly, the Gantt chart of project 1 and project 2 are showed in chapter 3. It will show the work done and the planning of tasks in each period.

3.2 System Requirements

3.2.1 Software Requirements

Table 3.1: Text.

Type of software	Description
Windows Notepad	It is used to edit plaintext files such as cut, copy and paste as well as data transformation.

Type of software	Description
Emacs	It is used to edit the text such as undo, redo and text formatting.

Table 3.2: Graphics.

Type of software	Description
IconAuthor	It is an icon-based authoring tool which allows user to structure the flow of a program.
Adobe Photoshop	It is an image editor to edit and enhancing images.
Fotografix	It is an image editor to crop and change colour depth of the images.
Adobe Illustrator	It is a drawing program to allow user to compose and edit vector graphics.

Table 3.3: Audio.

Type of software	Description
Adobe Audition	It is a waveform editor to edit audio such as record audio and store it as digital audio.
Sound Forge	It can manipulate the digital audio such as mix multiple sound sources and tracks.
Wavelab	It can converse between different audio file formats and between different sound quality levels.
Goldwave	It can apply simple or advances effects of audio and it can filter the audio

Table 3.4: Video.

Type of software	Description
Adobe Premiere	It is used to edit the video sequences in a computer such as splitting and transition.
Video Studio	It can add the title, special effect and background sound into the video
Windows Movie Maker	It can edit the video such as crop the video.

Table 3.5: Animation.

Type of software	Description
Ulead GIF Animator	It can be used for create GIF animation.
Synfig Studio	It can used to edit and modify the 2D animation.
Daz3D	It can used to create unique and complex 3D animation.

Table 3.6: Authoring Tools.

Type of software	Description
Macromedia Authorware	It is a multimedia development tools used to create interactive cross-platform multimedia presentations, animations and internet applications.
Adobe Director	It is a program used to create multimedia applications.

Adobe Flash	It is a multimedia software platform used to produce animations, desktop applications and mobile applications.

3.2.2 Hardware Requirements

Table 3.7: Hardware.

Type of Hardware	Specification
Processor	Intel ® Core™ i5-6200U CPU @ 2.3GHz 2.40GHz
Physical Memory (RAM)	4GB
Hard Disk Drive	1000GB
Display & Graphics	NVIDIA® GeForce® 940MX with 2 GB Dedicated VRAM
Expansion Ports	Two USB 2.0/3.0
Audio	Speaker
Communication devices	Wireless
System	x64-based processor

3.3 ADDIE model

Figure 3.1: ADDIE Model (Branson, Rayner, Cox, Furman, King, Hannum, 1975).

The methodology for this multimedia project is ADDIE model. The ADDIE model is a generic process which consists of 5 phases that are used by the instructional designers and training developers (Richard Culatta, 2019). The 5 phases of this ADDIE model are analysis, design, development, implementation and evaluation phases. It provides a flexible and dynamic guideline to build an effective training and support performance tools for instructional designers and training developers. The ADDIE Model also represents an iterative and reflect process (Eoghan Quigley, 2019). The results of formative evaluation of each phase may lead the instructional designer back to any previous phase and the end product of one phase is the starting product of the next phase. Each of the steps in the ADDIE model will has an outcome that feeds to the subsequent steps.

3.3.1 Analysis

The first phase of the ADDIE model is analysis. Analysis phase is the foundation for all other phases of the instructional design. It is also called the "Goal-Setting Stage" and the focus of the designer in this analysis phases is on the target audience (Serhat Kurt, 2017). During this phase, the unrealistic requirements, constraints, cause of problems and the possible solutions will be identified. Moreover, some specific research techniques such as needs

analysis, job analysis and task analysis are used in this analysis phase. The output of this phase has included the instructional goals and a list of tasks to be instructed. These outputs will be the inputs for the design phase. The analysis phase serves as a major and important role in the quality assurance process because it defines the project's needs and the ways to achieve success of the project (Lonnie Harmon, n.d.). Hence, it is better not to skip the analysis phase in order to avoid the mistaken assumptions in the project.

During the analysis phase, the research is conducted by the author to analyse the edutainment system and benchmarking it with other similar systems. The related information of the existing systems such as the functionalities, features, strengths and weaknesses are found through the internet. Then, the author has performed a comparison tables to compare the feature of the existing system such as the multimedia elements and the user interface design of the existing systems. Through this method, the problem statement has been identified. After that, the author identifies the solutions and expected innovation in order to solve the problems. The new and creative idea is created for this project in order to solve the problems of the existing systems. Moreover, the goals and objectives of the project is identified and established. The development tools that used to develop the edutainment courseware is analysed and identified. Lastly, the author performs the Gantt chart for FYP1 and FYP2 to analyse and estimate the length of time that need to be developed the edutainment courseware.

3.3.2 Design

The second phase of the ADDIE model is design. The design phase is driven by the output of the analysis phase in order to produce a model or blueprint to develop the instruction (Donald Clark, 2015). It will outline how to reach the instructional goals determined during the analysis phase and expand the instructional foundation. Hence, the design phase needs to be specific and systematic in developing and evaluating the planned strategies in order to achieve the project's goals. The related data and contents will be found during this design phase (James D. Newman, 2017). For instance, the design phase may include the detailed storyboards and prototypes, conducting a learning analysis, writing objectives and test items, selecting a delivery system, and sequencing the instruction. It is also an important step to describe the process involved in the system. The output of the design phase will be the inputs for the develop phase.

In the design phase, the author will sketch the storyboard to provide the general idea about the edutainment courseware. The layout of the user interface in the storyboard will be designed to show the look like of the user interface in the edutainment courseware. The storyboard design also will include the detailed descriptions and flow diagram in order to deliver the important information about the edutainment courseware. Moreover, the author will collect the important and required data about this project. Firstly, the sample data about the edutainment courseware will be collected by using the questionnaire survey. The questionnaire will be in closed-ended questions which consists of multiple-choice questions and "Yes/No" questions to let people to answer. The author will be distributed to at least 30 people to fill in the questionnaire. The response results from the respondents about the edutainment courseware will be recorded and summarized.

3.3.3 Development

The third phase of ADDIE model is development. The development phase depends largely upon the design phase. Instructional designers should know the required tools and the appropriate skills and talents to create the system in the development phase (Duane Shoemaker, 2014). During this phase, it will develop the instruction by using the media and the supporting documentation. It can include hardware and software to develop the system. The tool that is used in the development phase is vary and it may require the specific training to learn how to use it. The development phase also needs a lot of testing on the system (Aris Apostolopoulos, 2018). This is because it can check the error and content of the system during the process of development. In short, the purpose of the development phase is to generate the lesson plans and lesson materials.

During the development phase, the author will choose to use the authoring tools to develop the system such as the Adobe Director and Adobe Animate. It is because Adobe Director can support various audio, video and images format and Adobe Animate can be used to design vector graphic and bitmapped animation. The user interface of the system will start to design by using the authoring tool such as adding the graphics, choosing the colours and decide the type of fonts to be used on the interface of the system. The user interface will be designed nicely to provide the interactivity, consistency and good navigation for the user. The author will create and make the materials of multimedia elements such as text, graphics, audio

and animation to import and combine them into the courseware. The modules are developed according to the storyboard that are designed in the design phase.

3.3.4 Implementation

The fourth phase of ADDIE model is implementation. During this implementation phase, the materials that are created during the development phase will be introduced to the target audience and the learning process begins (Michael Treser, 2015). The designers will combine and assemble the designed content and integrate them into a system in order to deliver it to the learners. The instruction can be delivered in classroom-based, lab-based, or computer-based. Organizing the learning environment for learning suitability is important in the implementation phase (Morrison, Roas, & Kemp, 2007). The procedure for training the facilitators should be conducted in order to deliver and transferred the information of the instruction to the target audience effectively and efficiently. In short, implementation phase can increase the student's understanding about the materials, support them to achieve the objectives and ensure the student can transfer the knowledge from the instructional setting to the job.

In the implementation phase, the author will deliver the system to the target audience. The necessary preparation will be conducted before the implementation session start such as reviewing and testing the system as well as master the information of edutainment courseware to present it to the target audience. The author will invite the target audiences to test it. At first, the author will introduce and explain the overall functionalities and features of the edutainment courseware such as the menu button and the back button to the learners. After that, the target audiences will try to use the system in order to understand it. The author will assist and teaches the target audiences about the edutainment courseware in the process of implementation phase. Moreover, the author will provide solution to them if they meet some problems when using the edutainment courseware. The author will pay attention to the feedbacks that are received from the target audience and record it down.

3.3.5 Evaluation

The last phase of ADDIE model is evaluation. This phase measures the effectiveness and efficiency of the instruction. It is also defined as the evaluation studies to collect the data

from the target audiences in order to verify the effectiveness of instructional (Denise Yates, 2014). This phase can be occurred throughout the entire instructional design process which is within the phases, between the phases and after the implementation phase. This phase can be broken down into two parts which are formative and summative (Brown University, 2019). Formative evaluation is assessing the initial and ongoing project activities and it is to improve the instruction before the final version is implemented. On the other hand, summative evaluation occurs after the final version of instruction is implemented and it can assess the overall effectiveness of the instruction. The evaluation phase is to meet the goals and enhance the project.

During the evaluation phase, the author will test the application by using questionnaire survey. The author will prepare the questionnaire about the edutainment courseware. After that, the author will find 40 respondents and make an appointment with them to test the application. On the testing day, the 40 respondents will be invited to test the application and the questionnaire will be distributed to them. The respondents will fill in the questionnaire after testing the application. The feedback and response from the respondents will be recorded and analysed. After that, the application will be evaluated to further enhance and improve it in order to deliver an efficiency and effectiveness of application to the target audience.
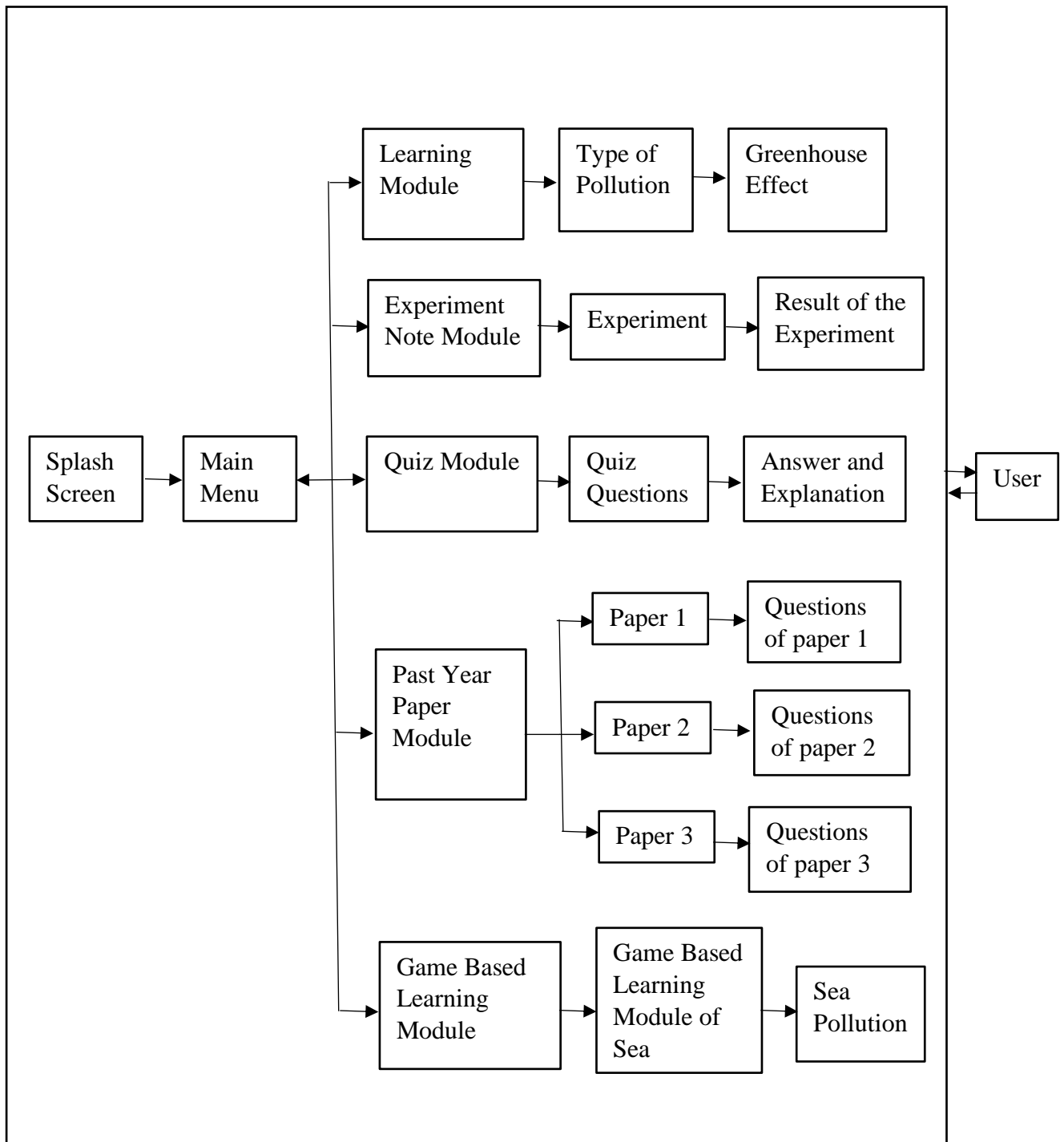
3.4 System Flow Diagram

Figure 3.2: System flow diagram of Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach).

3.5 Storyboarding Design

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Main Menu

Storyboard No: 1

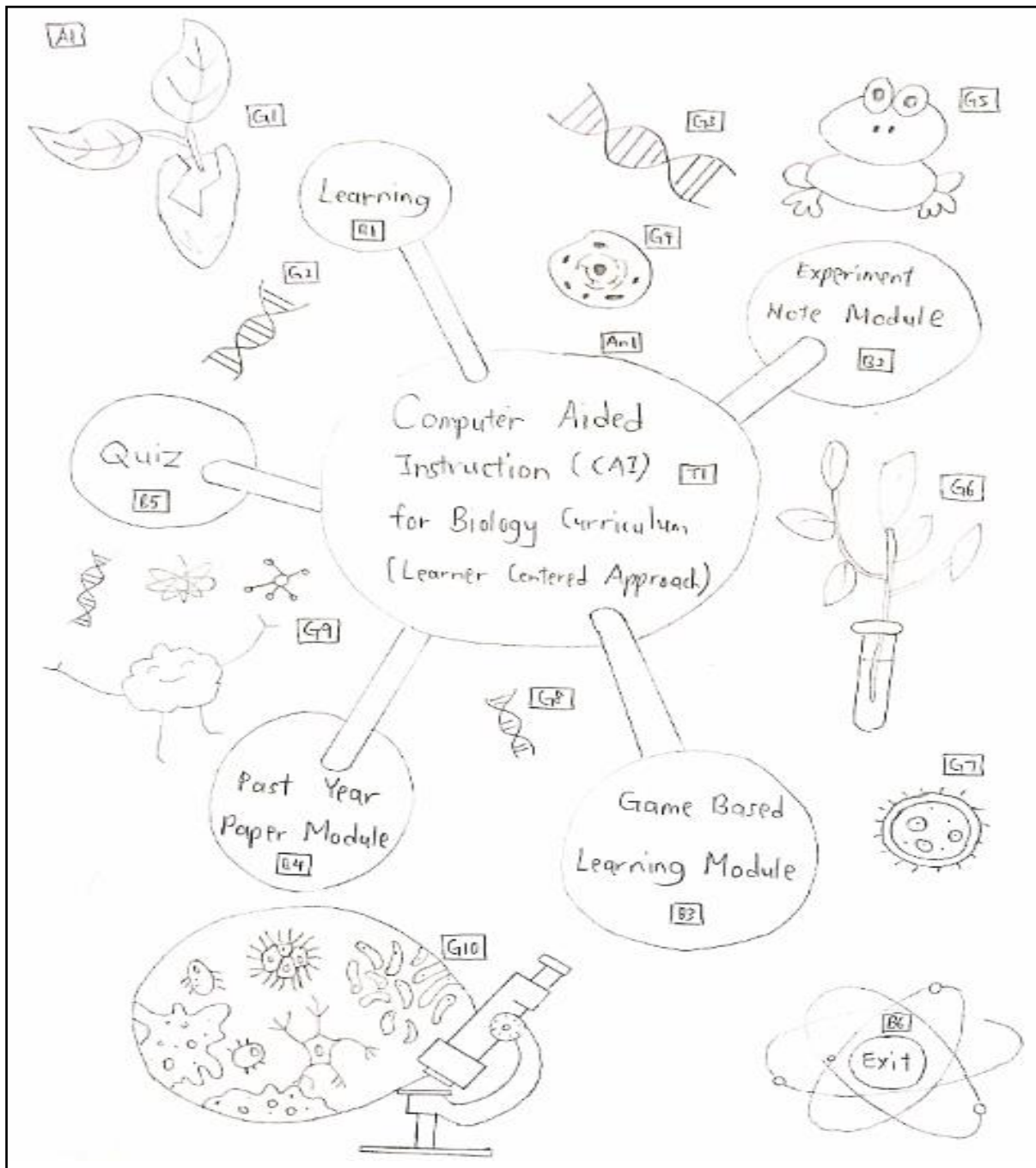T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)
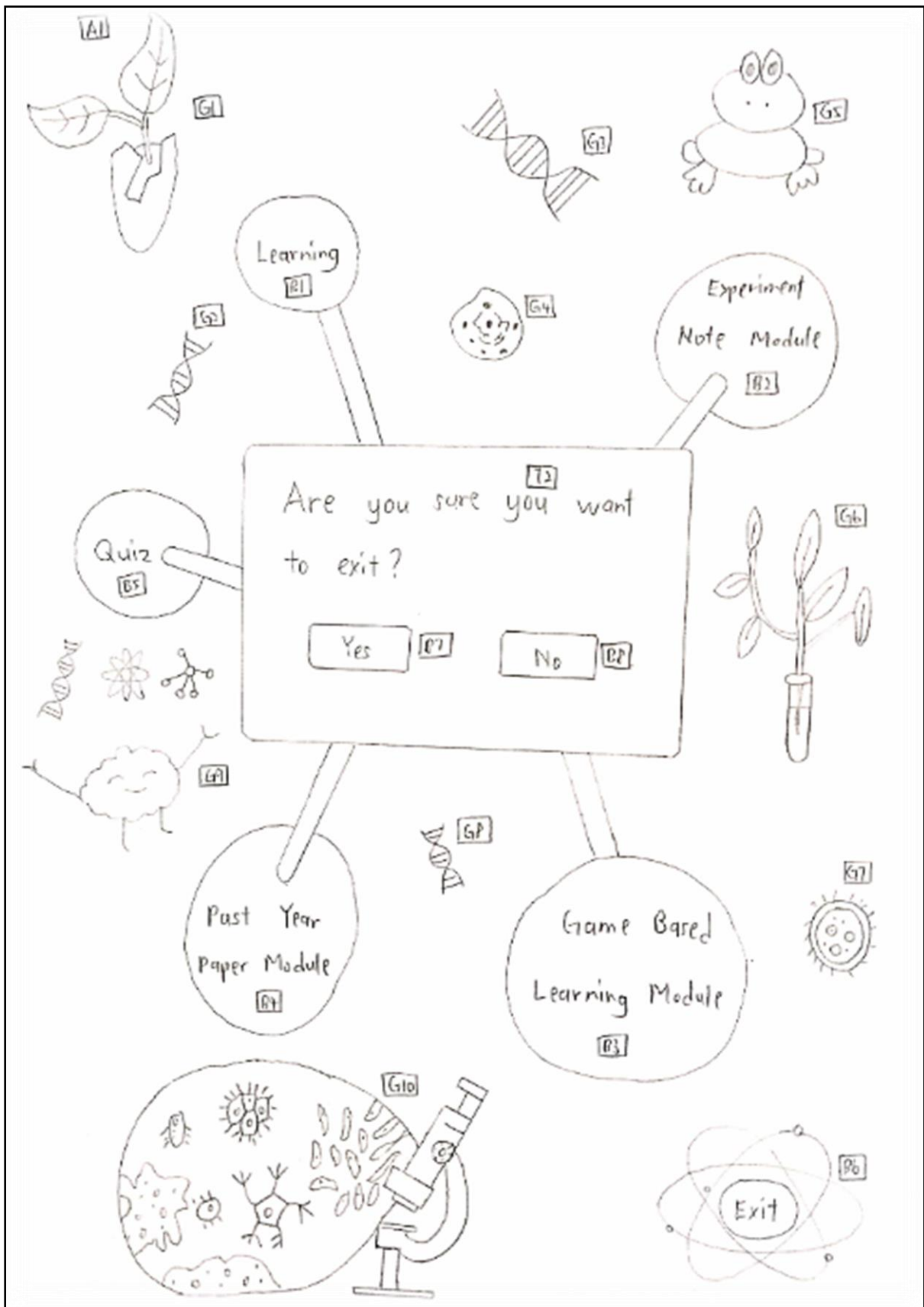

Figure 3.3: Storyboard of main menu.

Figure 3.4: Storyboard of main menu.

Table 3.8: Instructions and flowchart of main menu.

Instructions	Flowchart
B1, B2, B3, B4, B5, B6, A1, An1, T1, G1, G2, G3, G4, G5, G6, G7, G8, G9, G10 will first appear on the screen. -B1 is a button element which will link to the learning module. -B2 is a button element which will link to the experiment note module. -B3 is a button element which will link to the game based learning module. -B4 is a button element which will link to the past year paper module. -B5 is a button element which will link to the quiz module. -B6 is a button element which exit function. -B7 is a button element to exit the system. -B8 is a button element which returns back to the main menu when user click on it. -A1 is an audio element that plays as background music in the main menu. -An1 is a text element which displays the title of the module. -T1 is a text element which displays the title of the module. -G1, G2, G3, G4, G5, G6, G7, G8, G9, G10 are graphic elements which show the graphic images. T2 is a text element which shows "Are you sure you want to exit?"	Start Display B1, B2, B3, B4, B5, B6, A1, An1, T1, G1, G2, G3, G4, G5, G6, G7, G8, G9, G10 Click on the button → No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Learning Module

Storyboard No: 2

T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)

Figure 3.5: Storyboard of learning module.

Table 3.9: Instructions and flowchart of learning module.

Instructions	Flowchart
B9, B10, B11, T3, T4, An2, G11, G12, G13, G14, G15, G16, A2 will first appear on the screen. -B9 is a button element which will link to another page to start the lesson. -B10 is a button element to let user switch on or off the sound. -B11 is a button element which will link to the main menu of the system. -T3, T4 are text elements which show the title of the lesson. -An2 is an animation element which shows the animation image. -G11, G12, G13, G14, G15, G16 are graphic elements which show the graphic images. -A2 is an audio element that plays as the background music of learning module.	Start Display B9, B10, B11, T3, T4, An2, G11, G12, G13, G14, G15, G16, A2 Click on the button — No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Learning Module

Storyboard No: 3

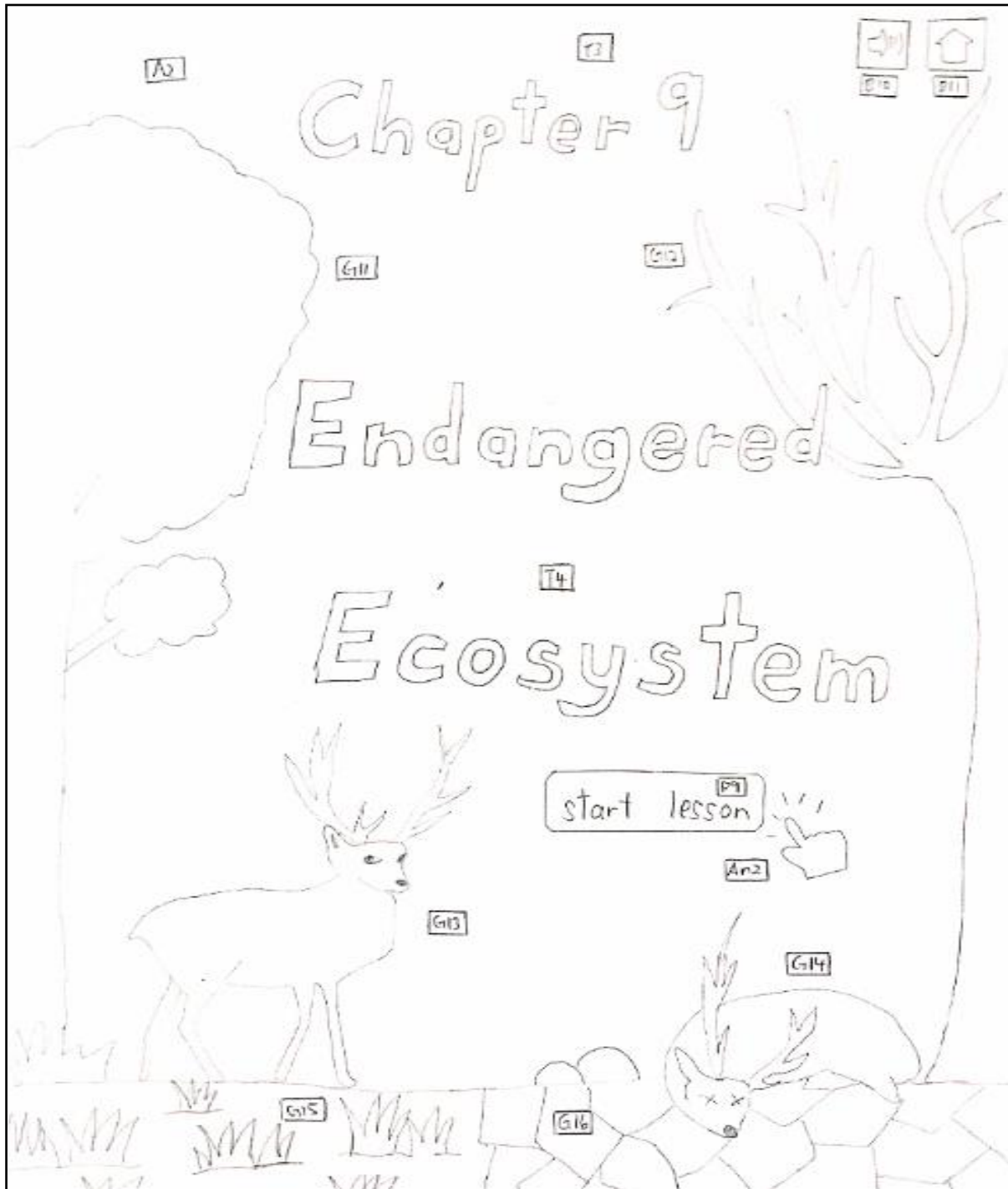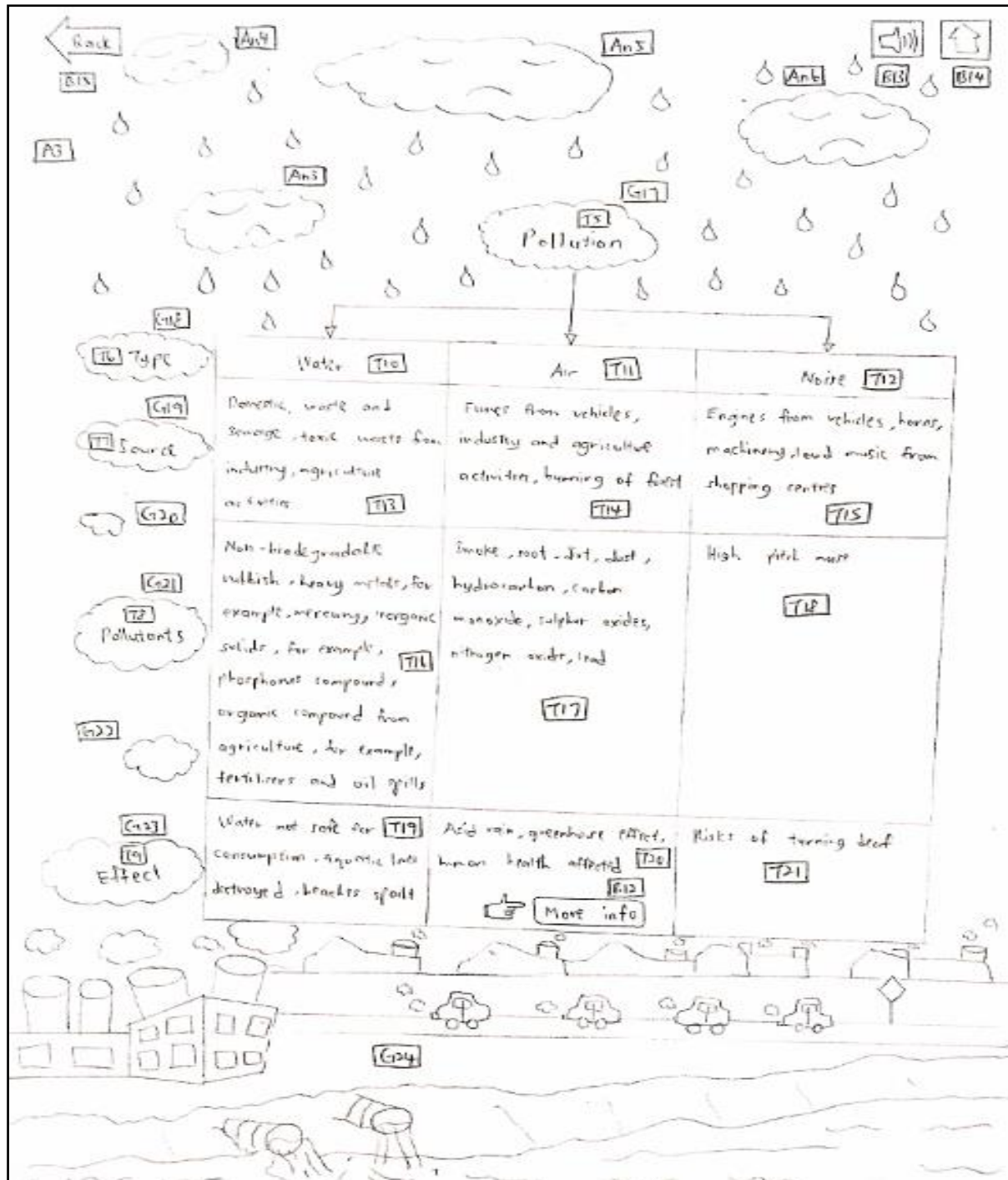T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)

Figure 3.6: Storyboard of learning module.

Table 3.10: Instructions and flowchart of learning module.

Instructions	Flowchart
B12, B13, B14, B15, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15, T16, T17, T18, T19, T20, T21, G18, G19, G20, G21, G22, G23, G24, An3, An4, An5, An6, A3 will first appear on the screen. -B12 is a button element which will link to another page to show more information. -B13 is a button element to let user switch on or off the sound. -B14 is a button element which will link to the main menu of the system. -B15 is a button element represent as a back button to back to the previous page. -T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15, T16, T17, T18, T19, T20, T21 are text elements which show the information of the lesson. -G17, G18, G19, G20, G21, G22, G23, G24 are graphic elements which show the graphic images. - An3, An4, An5, An6 are animation elements which show the animation images. -A3 is an audio element that plays as the background music of learning module.	Start Display B12, B13, B14, B15, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15, T16, T17, T18, T19, T20, T21, G18, G19, G20, G21, G22, G23, G24, An3, An4, An5, An6, A3 Click on the button — No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Learning Module

Storyboard No: 4

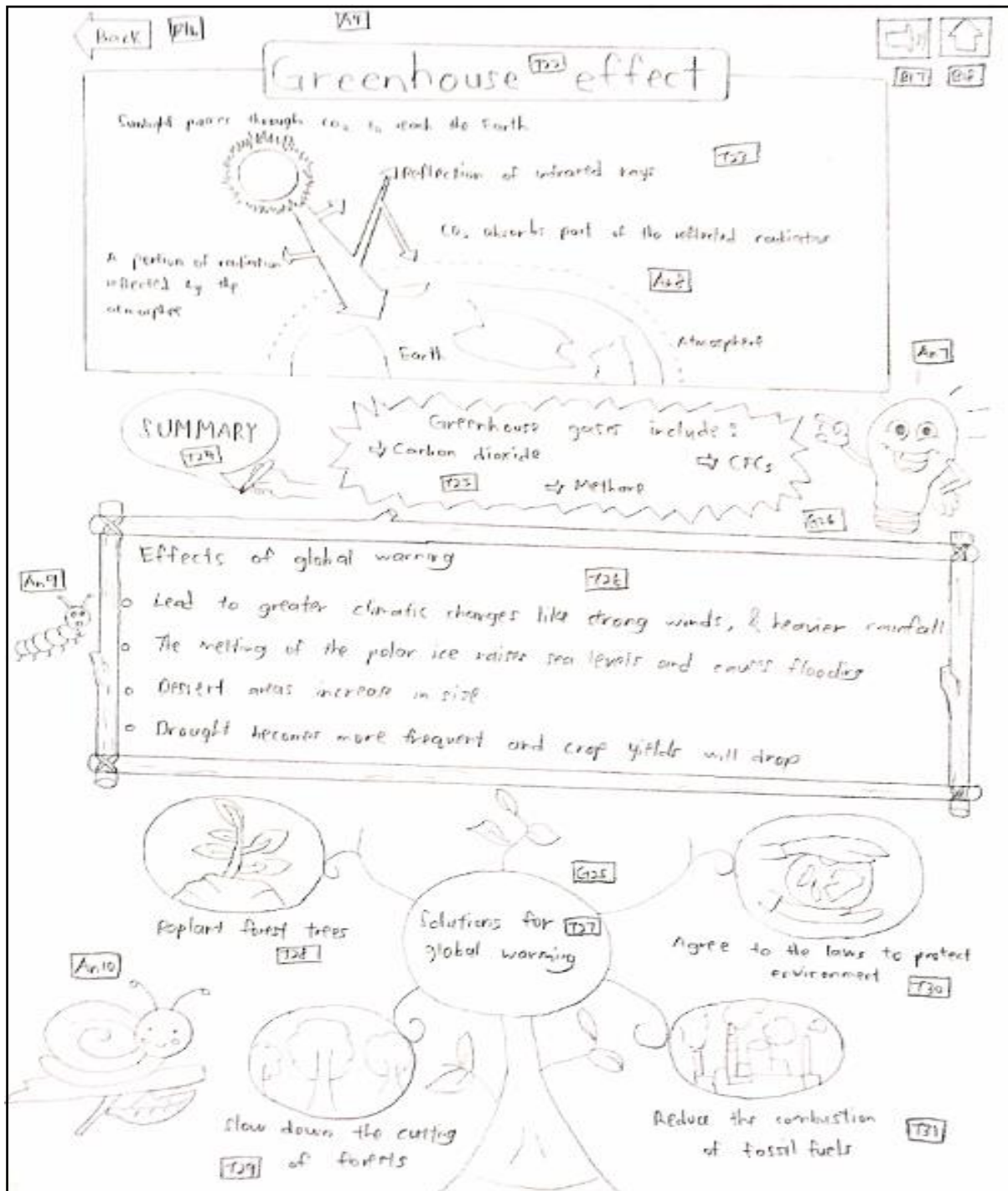T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)

Figure 3.7: Storyboard of learning module.

Table 3.11: Instructions and flowchart of learning module.

Instructions	Flowchart
B16, B17, B18, T22, T23, T24, T25, T26, T27, T28, T29, T30, T31, G25, G26, An7, An8, An9, An10, A4 will first appear on the screen. -B16 is a button element represent as a back button to back to the previous page. -B17 is a button element to let user switch on or off the sound. -B18 is a button element which will link to the main menu of the system. -T22, T23, T24, T25, T26, T27, T28, T29, T30 are text elements which show the information of the lesson. -G25, G26 are graphic elements which show the graphic images. -An7, An8, An9, An10 are animation elements which show the animation images. -A4 is an audio element that plays as the background music of learning module.	Start Display B16, B17, B18, T22, T23, T24, T25, T26, T27, T28, T29, T30, T31, G25, G26, An7, An8, An9, An10, A4 Click on the button — No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Experiment Note Module

Storyboard No: 5

T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)

Figure 3.8: Storyboard of experiment note module.

Table 3.12: Instructions and flowchart of experiment note module.

Instructions	Flowchart
B19, B20, B21, T32, T33, T34, T35, T36, T37, T38, T39, T40, T41, G27, G28, G29, G30, G31, G32, G33, G34, G35, G36, G37, G38, An11, An12, An13, An14, A5 will first appear on the screen. -B19 is a button element which will link to another page to show the experiment's result. -B20 is a button element to let user switch on or off the sound. -B21 is a button element which will link to the main menu of the system. -T32, T33, T34, T35, T36, T37, T38, T39, T40, T41 are text elements which show the information of the experiment. -G27, G28, G29, G30, G31, G32, G33, G34, G35, G36, G37, G38 are graphic elements which show the graphic images. -An11, An12, An13, An14 are animation elements which show the animation images. -A5 is an audio element that plays as the background music of experiment note module.	Start Display B19, B20, B21, T32, T33, T34, T35, T36, T37, T38, T39, T40, T41, G27, G28, G29, G30, G31, G32, G33, G34, G35, G36, G37, G38, An11, An12, An13, An14, A5 Click on the button — No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Experiment Note Module

Storyboard No: 6

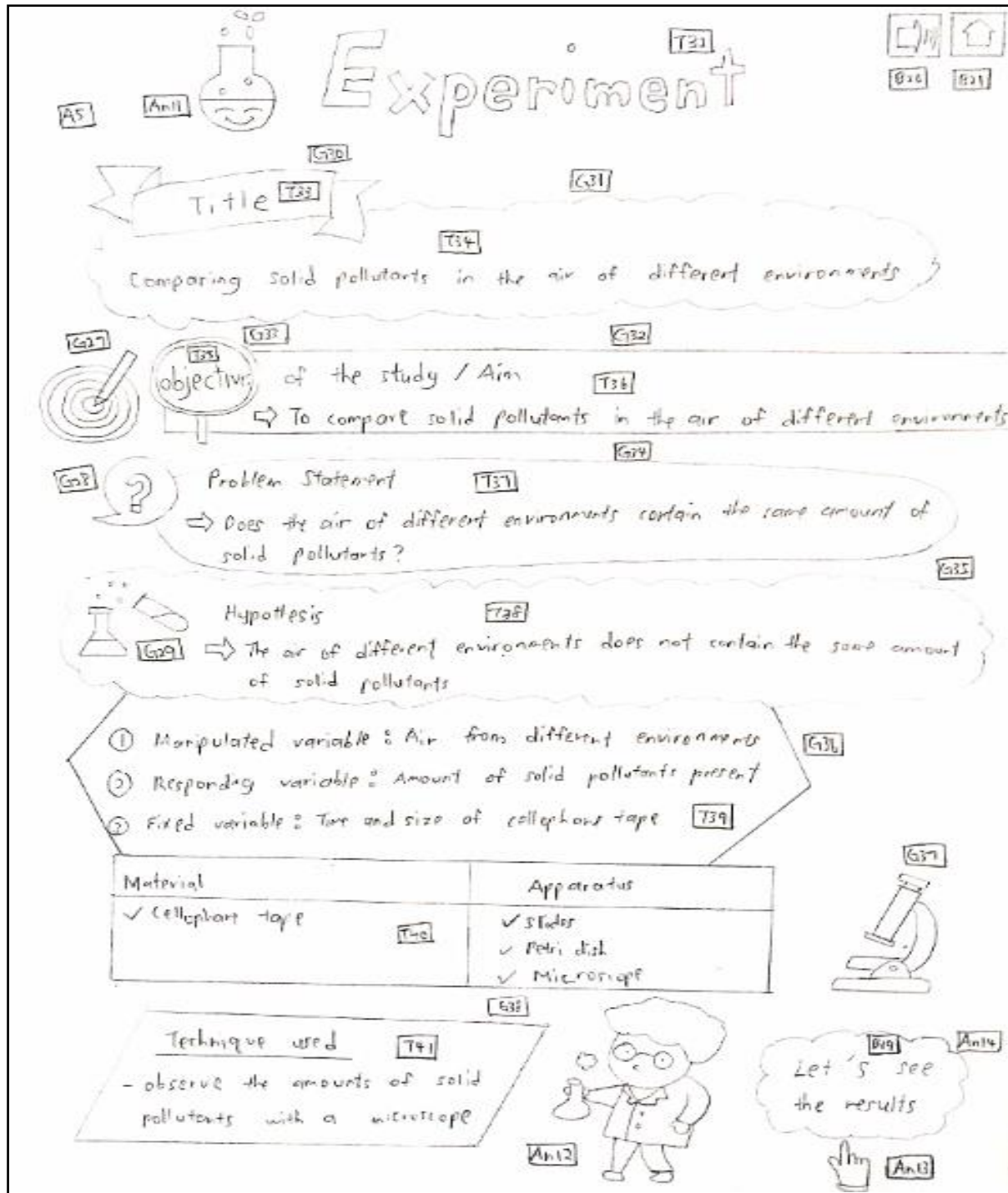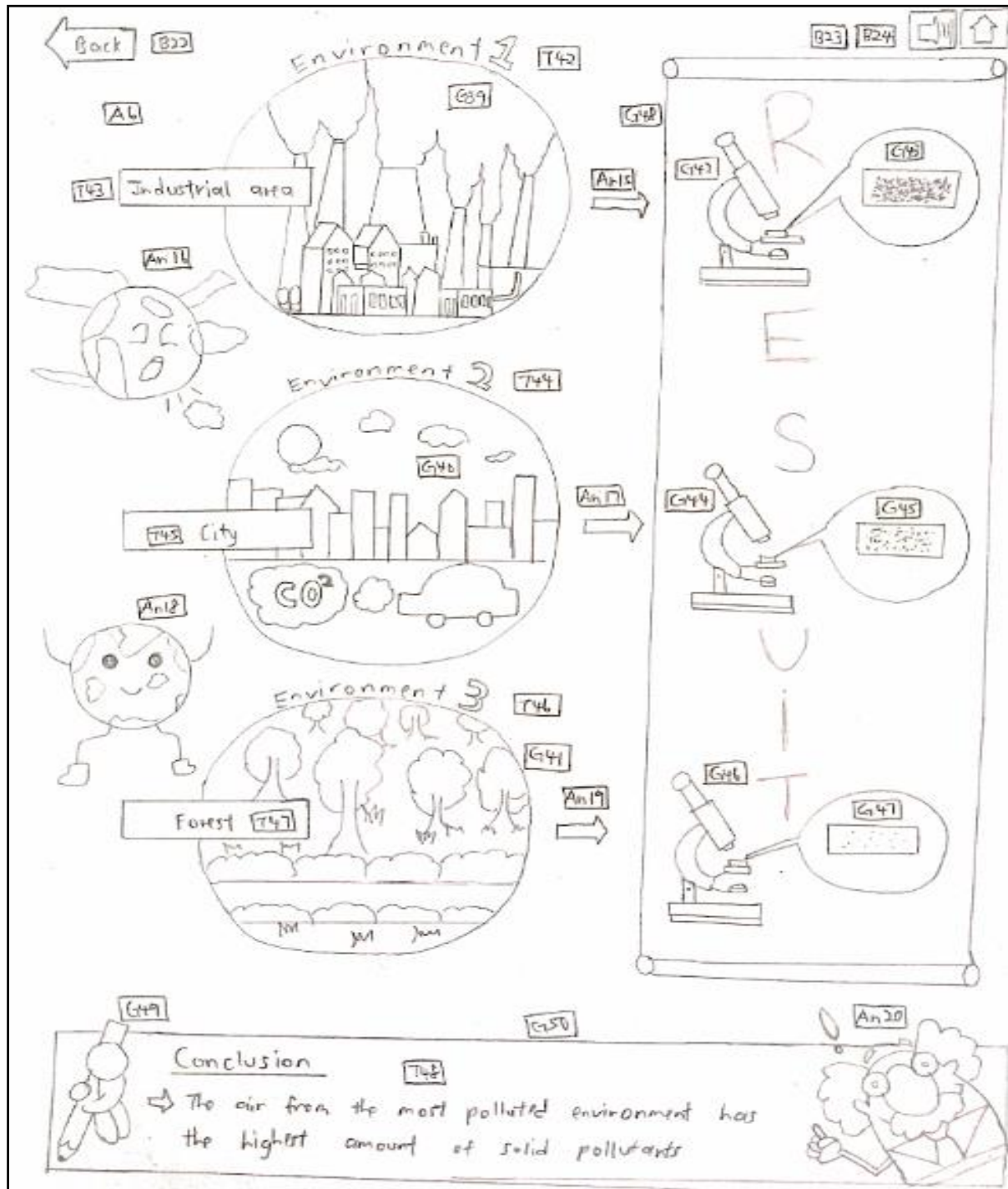T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)

Figure 3.9: Storyboard of experiment note module.

Table 3.13: Instructions and flowchart of experiment note module.

Instructions	Flowchart
B22, B23, B24, T42, T43, T44, T45, T46, T47, T48, G39, G40, G41, G42, G43, G44, G45, G46, G47, G48, G49, G50, An15, An16, An17, An18, An19, An20, A6 will first appear on the screen. -B22 is a button element represent as a back button to back to the previous page. -B23 is a button element to let user switch on or off the sound. -B24 is a button element which will link to the main menu of the system. -T42, T43, T44, T45, T46, T47, T48 are text elements which show the information of the experiment. -G39, G40, G41, G42, G43, G44, G45, G46, G47, G48, G49, G50 are graphic elements which show the graphic images. -An15, An16, An17, An18, An19, An20 are animation elements which show the animation images. -A6 is an audio element that plays as the background music of experiment note module.	Start Display B22, B23, B24, T42, T43, T44, T45, T46, T47, T48, G39, G40, G41, G42, G43, G44, G45, G46, G47, G48, G49, G50, An15, An16, An17, An18, An19, An20, A6 Click on the button — No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Quiz Module

Storyboard No: 7

T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)
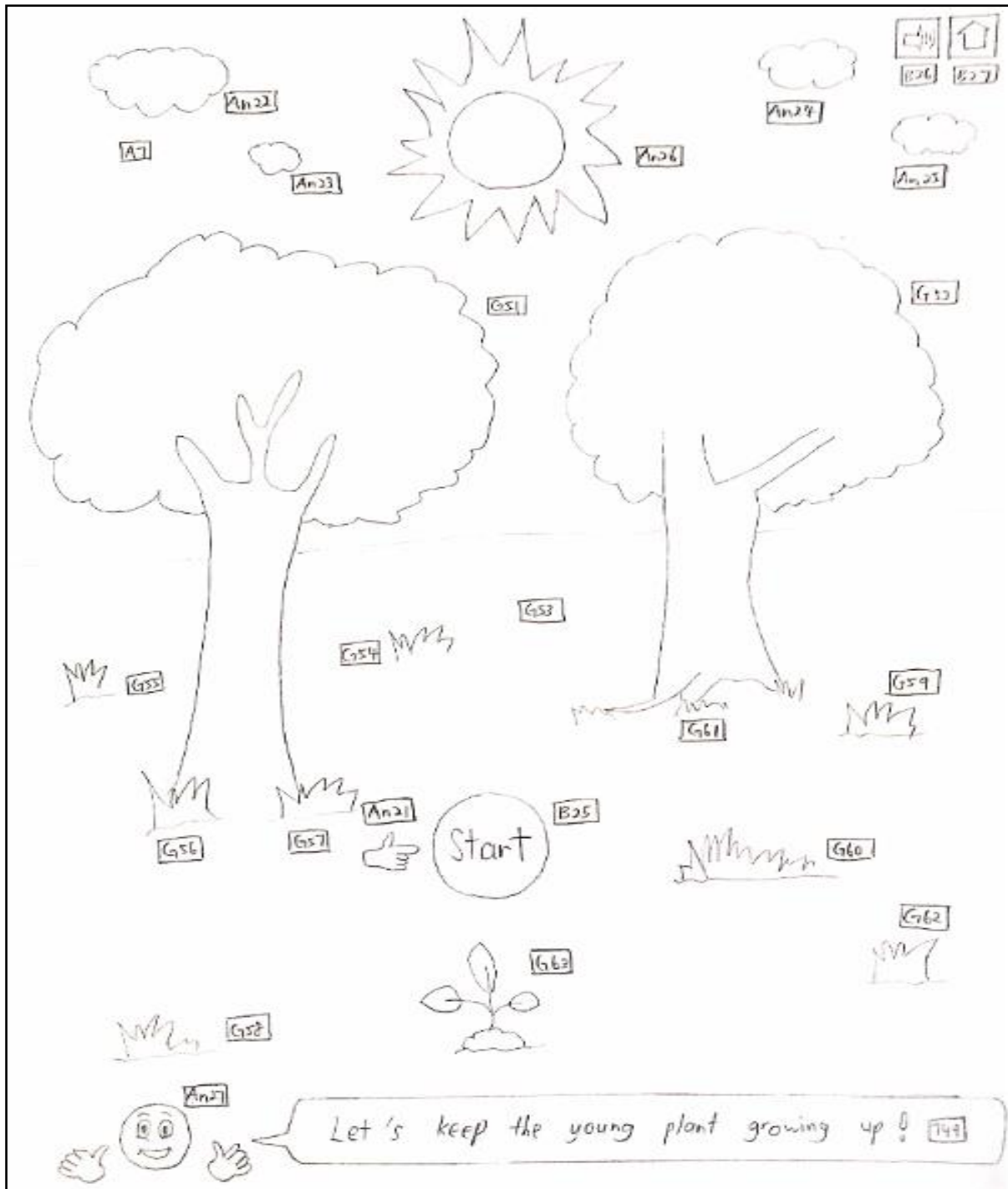
Figure 3.10: Storyboard of quiz module.

Table 3.14: Instructions and flowchart of quiz module.

Instructions	Flowchart
B25, B26, B27, T49, G51, G52, G53, G54, G55, G56, G57, G58, G59, G60, G61, G62, G63, An21, An22, An23, An24, An25, An26, An27, A7 will first appear on the screen. -B25 is a button element which will link to another page to start the quiz. -B26 is a button element to let user switch on or off the sound. -B27 is a button element which will link to the main menu of the system. -T49 is a text element which show "Let's keep the young plant growing up!" -G51, G52, G53, G54, G55, G56, G57, G58, G59, G60, G61, G62, G63 are graphic elements which show the graphic images. -An21, An22, An23, An24, An25, An26, An27 are animation elements which show the animation images. -A7 is an audio element that plays as the background music of the quiz module.	**Start** Display B25, B26, B27, T49, G51, G52, G53, G54, G55, G56, G57, G58, G59, G60, G61, G62, G63, An21, An22, An23, An24, An25, An26, An27, A7 Click on the button → No Yes Show the topic frame that user **End**

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Quiz Module

Storyboard No: 8

T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)
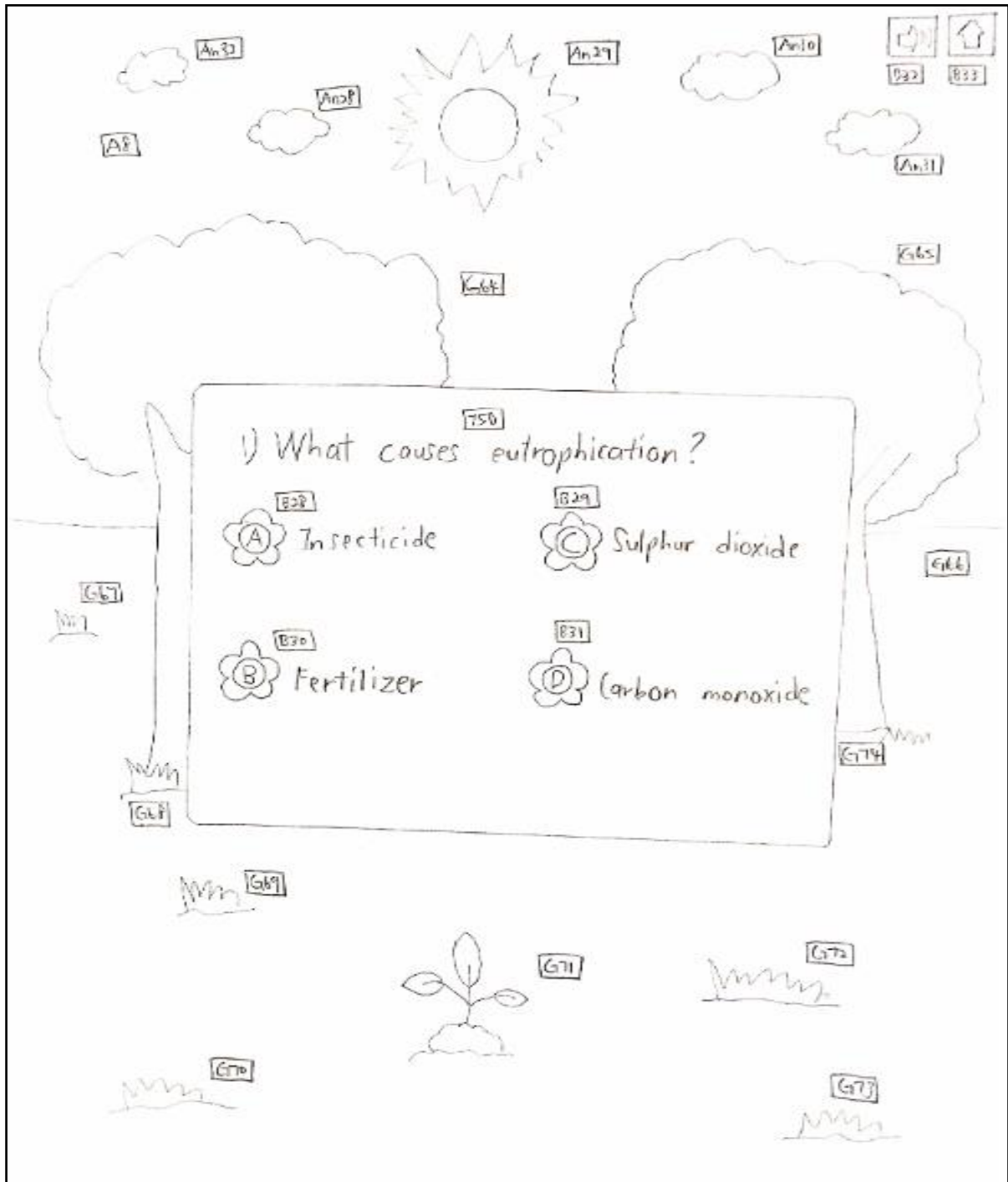
Figure 3.11: Storyboard of quiz module.

Table 3.15: Instructions and flowchart of quiz module.

Instructions	Flowchart
B28, B29, B30, B31, B32, B33, T50, G64, G65, G66, G67, G68, G69, G70, G71, G72, G73, G74, An28, An29, An30, An31, An32, A8 will first appear on the screen. -B28, B29, B30, B31 are button elements to allow user to pick and answer the quiz. -B32 is a button element to let user switch on or off the sound. -B33 is a button element which will link to the main menu of the system. -T50 is a text element represent the question of the quiz. -G64, G65, G66, G67, G68, G69, G70, G71, G72, G73, G74 are graphic elements which show the graphic images. -An28, An29, An30, An31, An32 are animation elements which show the animation images. -A8 is an audio element that plays as the background music of the quiz module.	Start Display B28, B29, B30, B31, B32, B33, T50, G64, G65, G66, G67, G68, G69, G70, G71, G72, G73, G74, An28, An29, An30, An31, An32, A8 Click on the button — No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Quiz Module

Storyboard No: 9

T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)
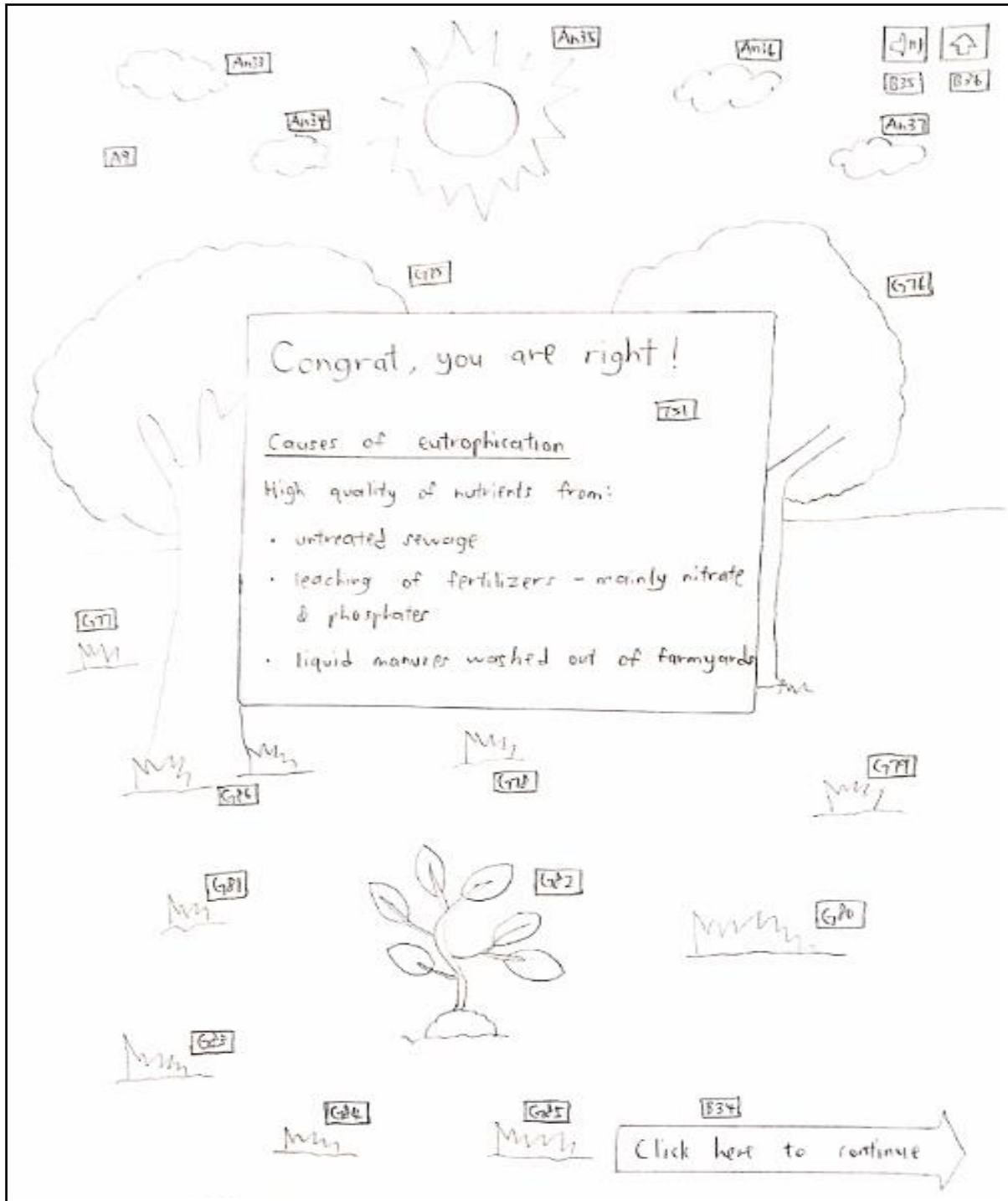
Figure 3.12: Storyboard of quiz module.

Table 3.16: Instructions and flowchart of quiz module.

Instructions	Flowchart
B34, B35, B36, T51, G75, G76, G77, G78, G79, G80, G81, G82, G83, G84, G85, G86, An33, An34, An35, An36, An37, A9 will first appear on the screen. -B34 is a button element which will link to another page to continue the quiz. -B35 is a button element to let user switch on or off the sound. -B36 is a button element which will link to the main menu of the system. -T51 is a text element which shows the explanation of the question. -G75, G76, G77, G78, G79, G80, G81, G82, G83, G84, G85, G86 are graphic elements which show the graphic images. -An33, An34, An35, An36, An37 are animation elements which show the animation images. -A9 is an audio element that plays as the background music of the quiz module.	Start Display B34, B35, B36, T51, G75, G76, G77, G78, G79, G80, G81, G82, G83, G84, G85, G86, An33, An34, An35, An36, An37, A9 No Click on the button Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Quiz Module

Storyboard No: 10

T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)
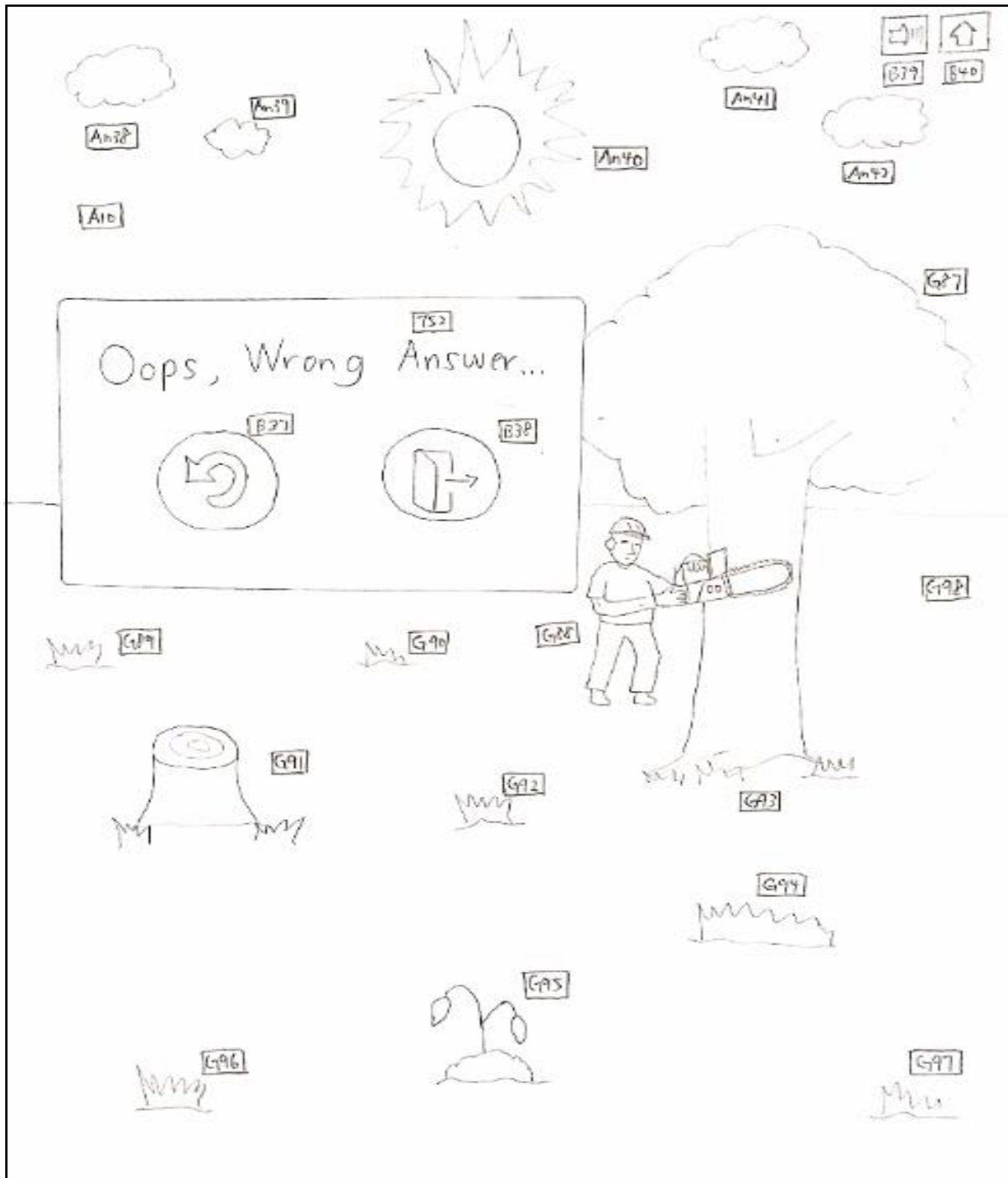
Figure 3.13: Storyboard of quiz module.

Table 3.17: Instructions and flowchart of quiz module.

Instructions	Flowchart
B37, B38, B39, B40, T52, G87, G88, G89, G90, G91, G92, G93, G94, G95, G96, G97, G98, An38, An39, An40, An41, An42, A10 will first appear on the screen. -B37 is a button element which will link to previous question of the quiz. -B38 is a button element which will link to the homepage of the quiz. -B39 is a button element to let user switch on or off the sound. -B40 is a button element which will link to the main menu of the system. -T52 is a text element which shows "Oops, Wrong Answer…" -G87, G88, G89, G90, G91, G92, G93, G94, G95, G96, G97, G98 are graphic elements which show the graphic images. -An38, An39, An40, An41, An42 are animation elements which show the animation images. -A10 is an audio element that plays as the background music of the quiz module.	Start Display B37, B38, B39, B40, T52, G87, G88, G89, G90, G91, G92, G93, G94, G95, G96, G97, G98, An38, An39, An40, An41, An42, A10 Click on the button — No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Quiz Module

Storyboard No: 11

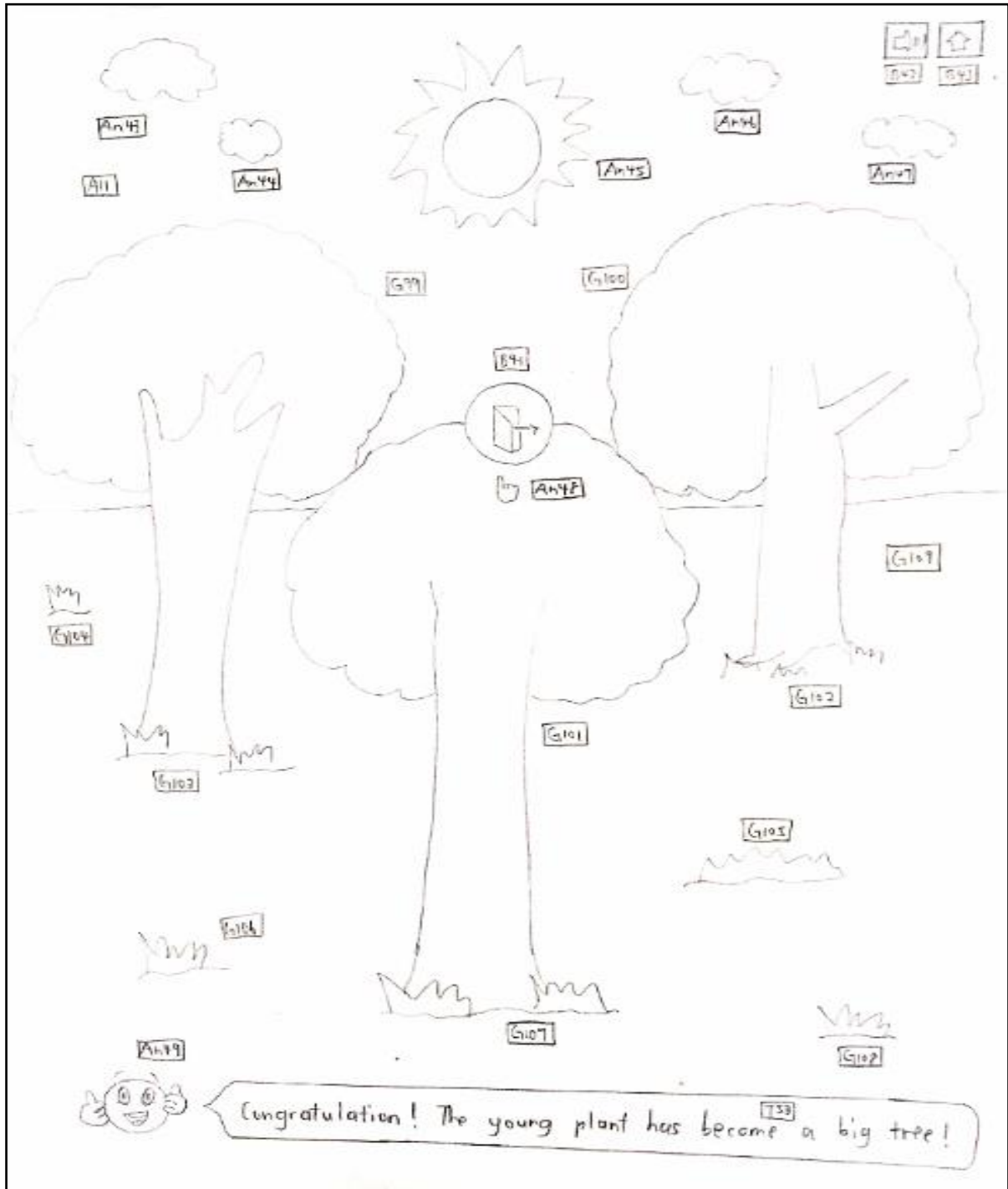T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)

Figure 3.14: Storyboard of quiz module.

Table 3.18: Instructions and flowchart of quiz module.

Instructions	Flowchart
B41, B42, B43, T53, G99, G100, G101, G102, G103, G104, G105, G106, G107, G108, G109, An43, An44, An45, An46, An47, An48, An49, A11 will first appear on the screen. -B41 is a button element which will link to the homepage of the quiz. -B42 is a button element to let user switch on or off the sound. -B43 is a button element which will link to the main menu of the system. -T53 is a text element which shows "Congratulation! The young plant has become a big tree!" - G99, G100, G101, G102, G103, G104, G105, G106, G107, G108, G109 are graphic elements which show the graphic images. -An43, An44, An45, An46, An47, An48, An49 are animation elements which show the animation images. -A11 is an audio element that plays as the background music of the quiz module.	Start Display B41, B42, B43, T53, G99, G100, G101, G102, G103, G104, G105, G106, G107, G108, G109, An43, An44, An45, An46, An47, An48, An49, A11 Click on the button — No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Past Year Paper Module

Storyboard No: 12

T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)

Figure 3.15: Storyboard of past year paper module.

Table 3.19: Instructions and flowchart of past year paper module.

Instructions	Flowchart
B44, B45, B46, B47, B48, G110, An50, An51, An52, An53, An54, An55, A12 will first appear on the screen. -B44 is a button element which will link to another page of paper1. -B45 is a button element which will link to another page of paper2. -B46 is a button element which will link to another page of paper3. -B47 is a button element to let user switch on or off the sound. -B48 is a button element which will link to the main menu of the system. -G110 is a graphic element which show the graphic images. -An50, An51, An52, An53, An54, An55 are animation elements which show the animation images. -A12 is an audio element that plays as the background music of the past year paper module.	Start Display B44, B45, B46, B47, B48, G110, An50, An51, An52, An53, An54, An55, A12 Click on the button → No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Past Year Paper Module

Storyboard No: 13

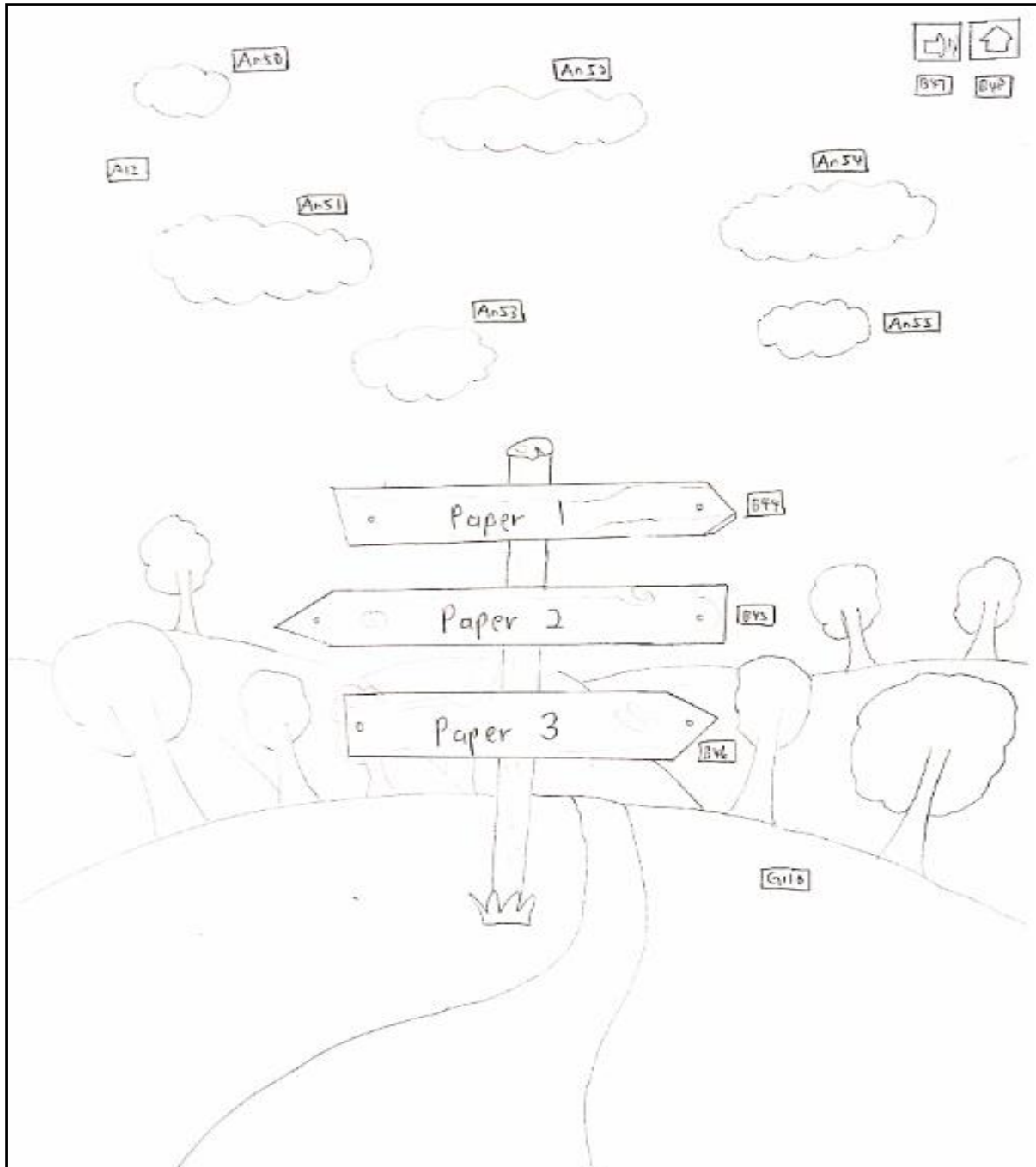T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)

Figure 3.16: Storyboard of past year paper module.

Table 3.20: Instructions and flowchart of past year paper module.

Instructions	Flowchart
B49, B50, B51, B52, B53, B54, T54, G111, G112, G113, An56, An57, An58, A13 will first appear on the screen. -B49, B50, B51, B52 are button element to allow user to pick and answer the question. -B53 is a button element to let user switch on or off the sound. -B54 is a button element which will link to the main menu of the system. -T54 is a text element represents as the question of paper1. -G111. G112, G113 are graphic elements which show the graphic images. -An56, An57, An58 are animation elements which show the animation images. -A13 is an audio element that plays as the background music of the paper 1.	Start Display B49, B50, B51, B52, B53, B54, T54, G111, G112, G113, An56, An57, An58, A13 Click on the button — No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Past Year Paper Module

Storyboard No: 14

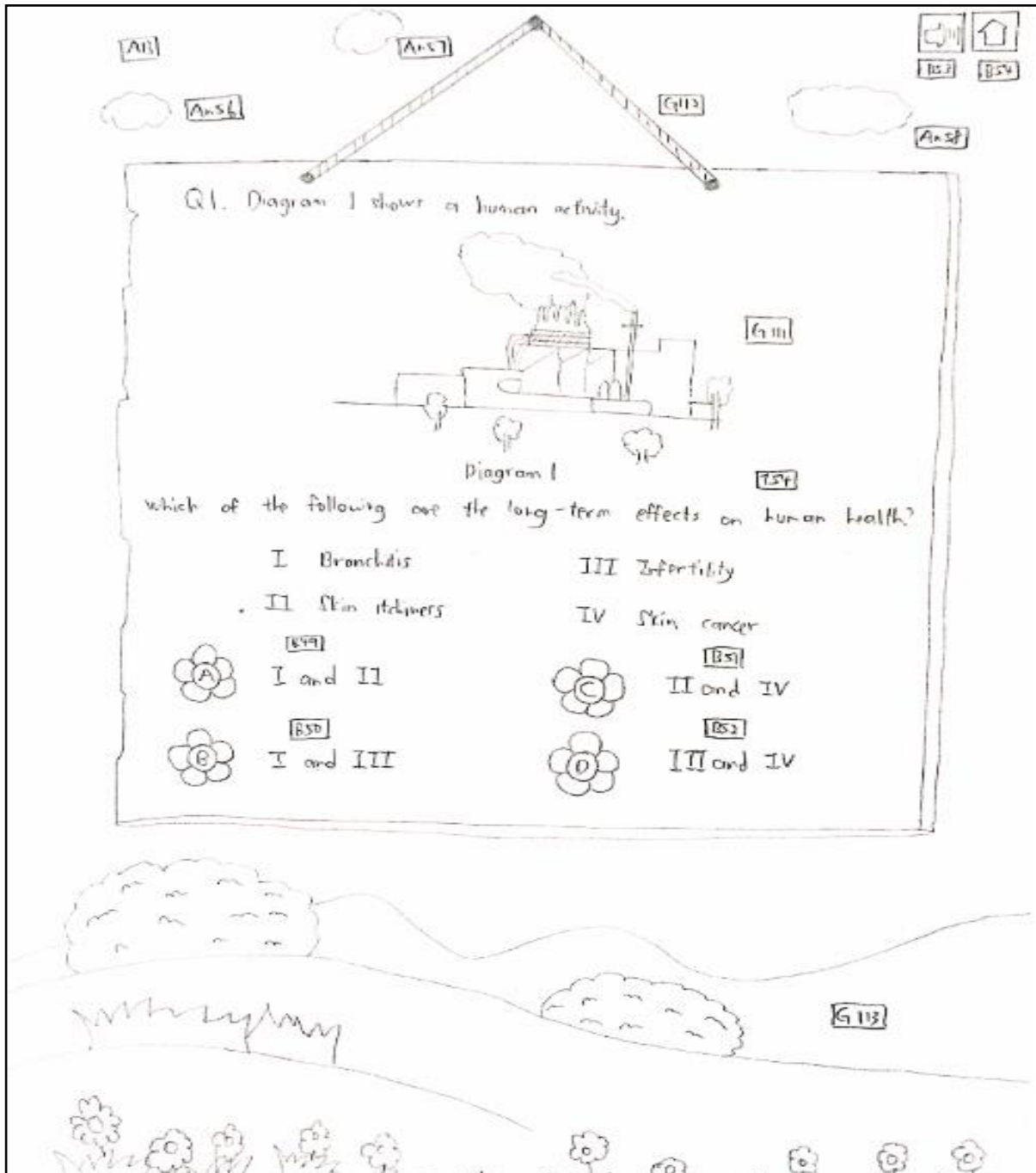T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)

Figure 3.17: Storyboard of past year paper module.

Table 3.21: Instructions and flowchart of past year paper module.

Instructions	Flowchart
B55, B56, B57, T55, G114, G115, An59, An60, An61, A14 will first appear on the screen. -B55 is a button element which will link to the next question of the paper 1. -B56 is a button element to let user switch on or off the sound. -B57 is a button element which will link to the main menu of the system. -T55 is a text element which shows the explanation of the question. -G114. G115 are graphic elements which show the graphic images. -An59, An60, An61 are animation elements which show the animation images. -A14 is an audio element that plays as the background music of the paper 1.	Start Display B55, B56, B57, T55, G114, G115, An59, An60, An61, A14 No Click on the button Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Past Year Paper Module

Storyboard No: 15

T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)
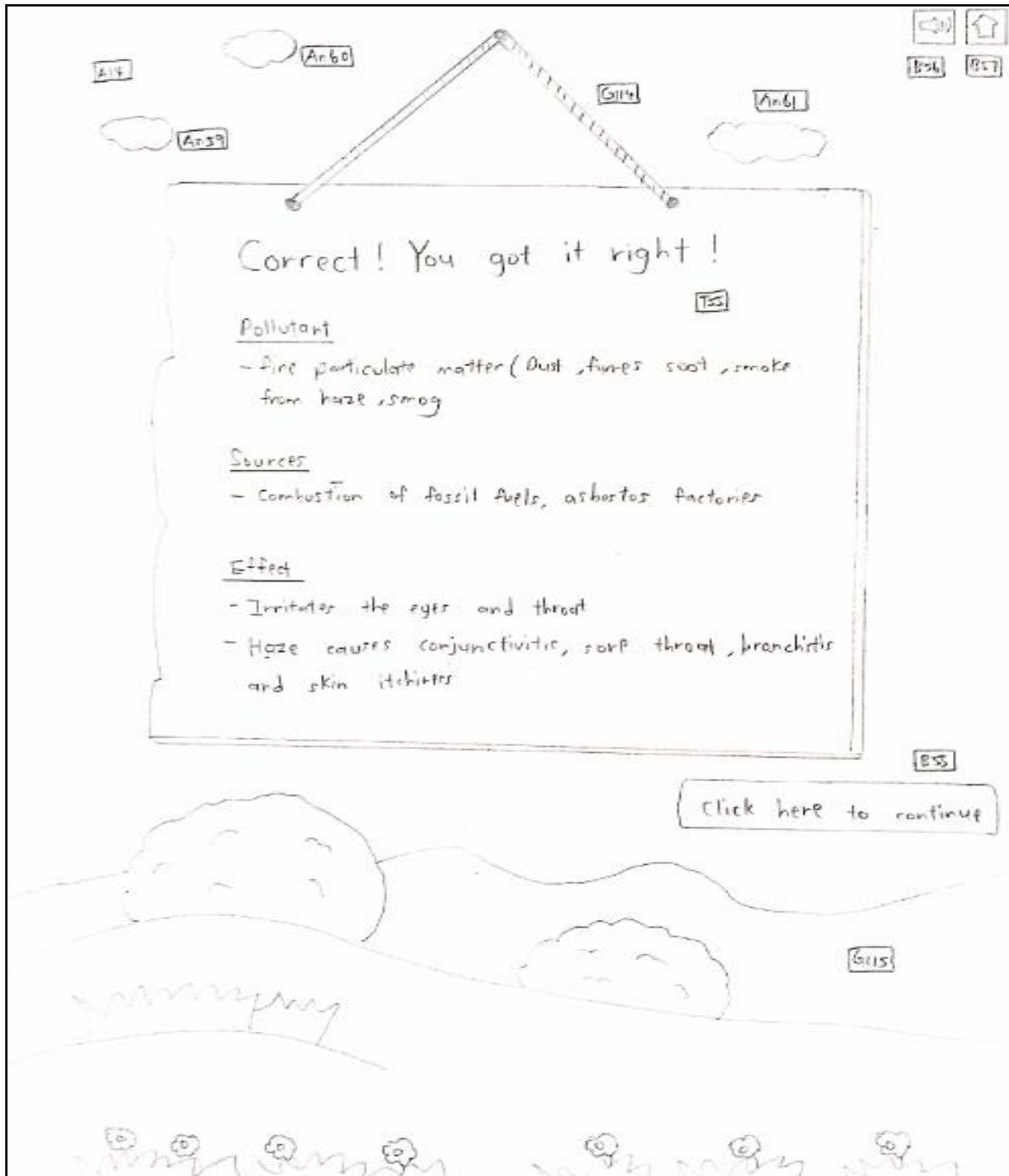

Figure 3.18: Storyboard of past year paper module.

Table 3.22: Instructions and flowchart of past year paper module.

Instructions	Flowchart
B58, B59, B60, T56, G116, G117, An62, An63, An64, A15 will first appear on the screen. -B58 is a button element which will link to the next question of the paper 1. -B59 is a button element to let user switch on or off the sound. -B60 is a button element which will link to the main menu of the system. -T56 is a text element which shows the explanation of the question. -G116. G117 are graphic elements which show the graphic images. -An62, An63, An64 are animation elements which show the animation images. -A15 is an audio element that plays as the background music of the paper 1.	Start Display B58, B59, B60, T56, G116, G117, An62, An63, An64, A15 Click on the button — No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Past Year Paper Module

Storyboard No: 16

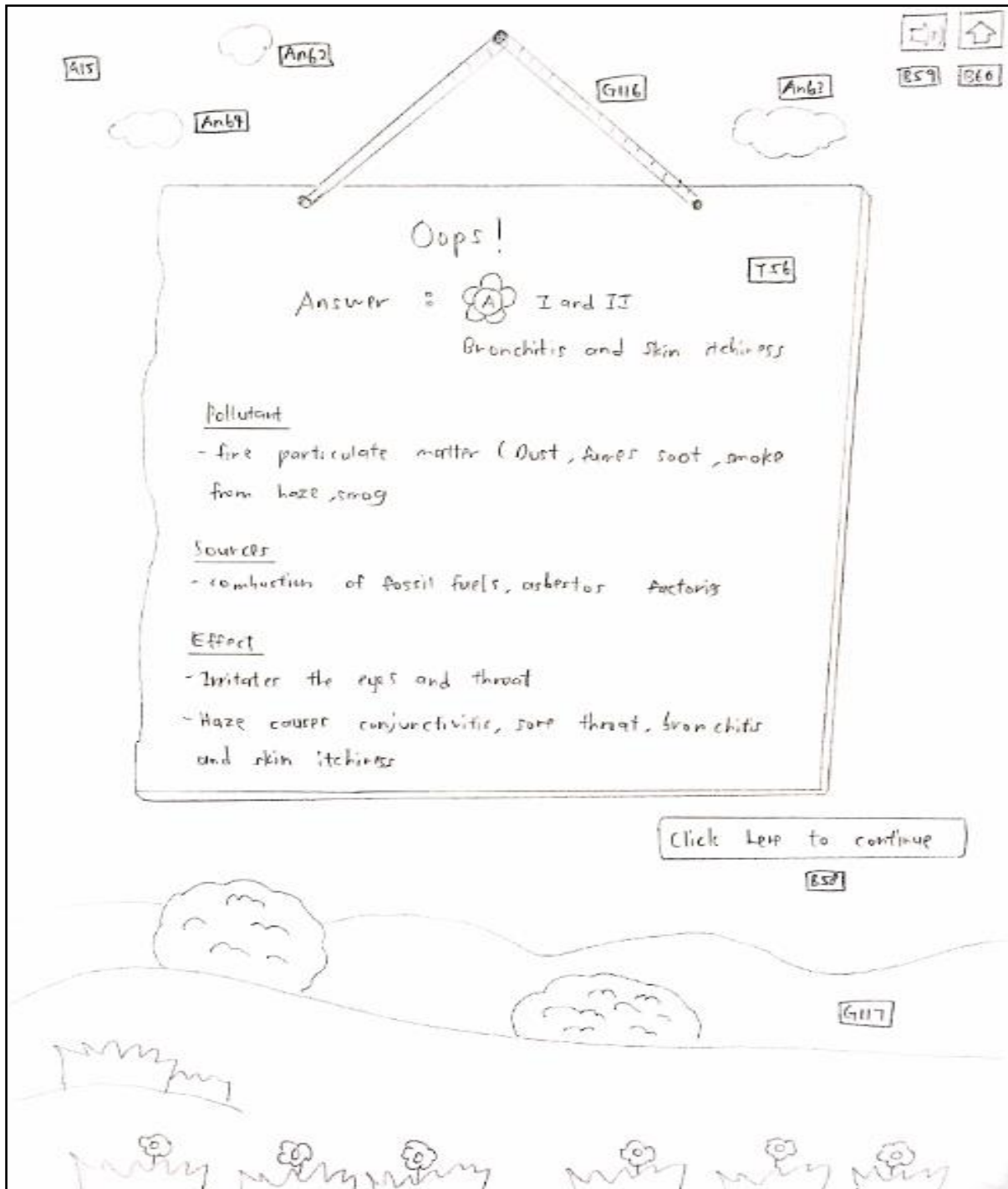T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)

Figure 3.19: Storyboard of past year paper module.

Table 3.23: Instructions and flowchart of past year paper module.

Instructions	Flowchart
B61, B62, B63, B64, T57, T58, G119, G120, G121, An65, An66, A16 will first appear on the screen. -B61 is a button element which will link to another page of the question. -B62 is a button element to let user switch on or off the sound. -B63 is a button element which will link to the main menu of the system. -B64 is a button element represent as a back button to back to the previous page. -T57 is a text element which shows "Paper2". -G118. G119, G120, G121 are graphic elements which show the graphic images. -An65, An66 are animation elements which show the animation images. -A16 is an audio element that plays as the background music of the paper 2.	Start Display B61, B62, B63, B64, T57, T58, G119, G120, G121, An65, An66, A16 Click on the button — No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Past Year Paper Module

Storyboard No: 17

T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)

Figure 3.20: Storyboard of past year paper module.

Table 3.24: Instructions and flowchart of past year paper module.

Instructions	Flowchart
B65, B66, B67, B68, T59, G122, G123, An67, An68, An69, An70, A17 will first appear on the screen. -B65 is a button element which will link to another page to check the answers of paper2. -B66 is a button element to let user switch on or off the sound. -B67 is a button element which will link to the main menu of the system. -B68 is a button element represent as a back button to back to the previous page. -T59 is a text element which shows the question of paper 2. -G122, G123 are graphic elements which show the graphic images. -An67, An68, An69, An70 are animation elements which show the animation images. -A17 is an audio element that plays as the background music of the paper 2.	Start Display B65, B66, B67, B68, T59, G122, G123, An67, An68, An69, An70, A17 Click on the button — No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Past Year Paper Module

Storyboard No: 18

T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)

Figure 3.21: Storyboard of past year paper module.

Table 3.25: Instructions and flowchart of past year paper module.

Instructions	Flowchart
B69, B70, B71, T60, T61, G124, An71, A18 will first appear on the screen. -B69 is a button element represent as a back button to back to the previous page. -B70 is a button element to let user switch on or off the sound. -B71 is a button element which will link to the main menu of the system. -T60 is a text element which shows "Answer". -G124 is a graphic element which show the graphic images. -An71 is an animation element which show the animation image. -A18 is an audio element that plays as the background music of the paper 2.	Start Display B69, B70, B71, T60, T61, G124, An71, A18 Click on the button — No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Past Year Paper Module

Storyboard No: 19

T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)

Figure 3.22: Storyboard of past year paper module.

Table 3.26: Instructions and flowchart of past year paper module.

Instructions	Flowchart
B72, B73, B74, B75, T62, T63, G125, G126, G127, G128, An72, An73, An74, A19 will first appear on the screen. -B72 is a button element represent as a back button to back to the previous page. -B73 is a button element to let user switch on or off the sound. -B74 is a button element which will link to the main menu of the system. -B75 is a button element which will link to another page to check the answer of paper3. -T62 is a text element which shows "Paper 3". -T63 is a text element which shows the questions of paper 3. -G125, G126, G127, G128 are graphic element which show the graphic images. -An72, An73, An74 are animation element which show the animation image. -A19 is an audio element that plays as the background music of the paper 3.	Start Display B72, B73, B74, B75, T62, T63, G125, G126, G127, G128, An72, An73, An74, A19 Click on the button — No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Past Year Paper Module

Storyboard No: 20

T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)

Figure 3.23: Storyboard of past year paper module.

Table 3.27: Instructions and flowchart of past year paper module.

Instructions	Flowchart
B76, B77, B78, T65, G129, G130, A20 will first appear on the screen. -B76 is a button element represent as a back button to back to the previous page. -B77 is a button element to let user switch on or off the sound. -B78 is a button element which will link to the main menu of the system. -T64 is a text element which shows "Answer". -T65 is a text element which shows the questions of paper 3. -G129, G130 are graphic elements which show the graphic images. -A20 is an audio element that plays as the background music of the paper 3.	Start Display B76, B77, B78, T65, G129, G130, Click on the button → No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Game Based Learning Module

Storyboard No: 21

T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)
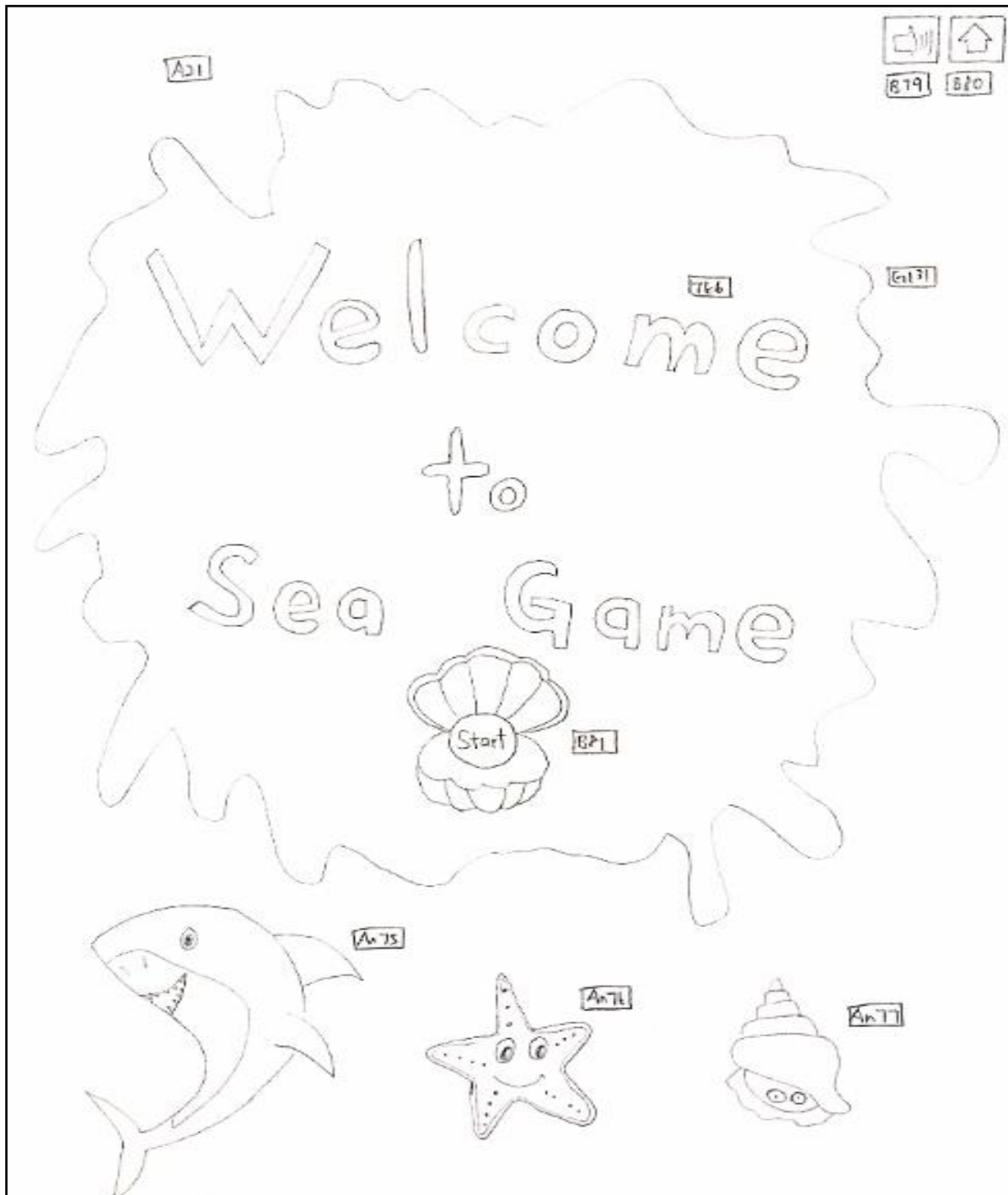
Figure 3.24: Storyboard of game based learning module.

Table 3.28: Instructions and flowchart of game based learning module.

Instructions	Flowchart
B79, B80, B81, T66, G131, An75, An76, An77, A21 will first appear on the screen. -B79 is a button element to let user switch on or off the sound. -B80 is a button element which will link to the main menu of the system. -B81 is a button element which will link to another page to start the game. -T66 is a text element which shows "Welcome to Sea Game". -G131 is a graphic element which shows the graphic image. -An75, An76, An77 are animation elements which show the animation images. -A21 is an audio element that plays as the background music of the game.	**Start** Display B79, B80, B81, T66, G131, An75, An76, An77, A21 Click on the button — No Yes Show the topic frame that user **End**

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Game Based Learning Module

Storyboard No: 22

T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)
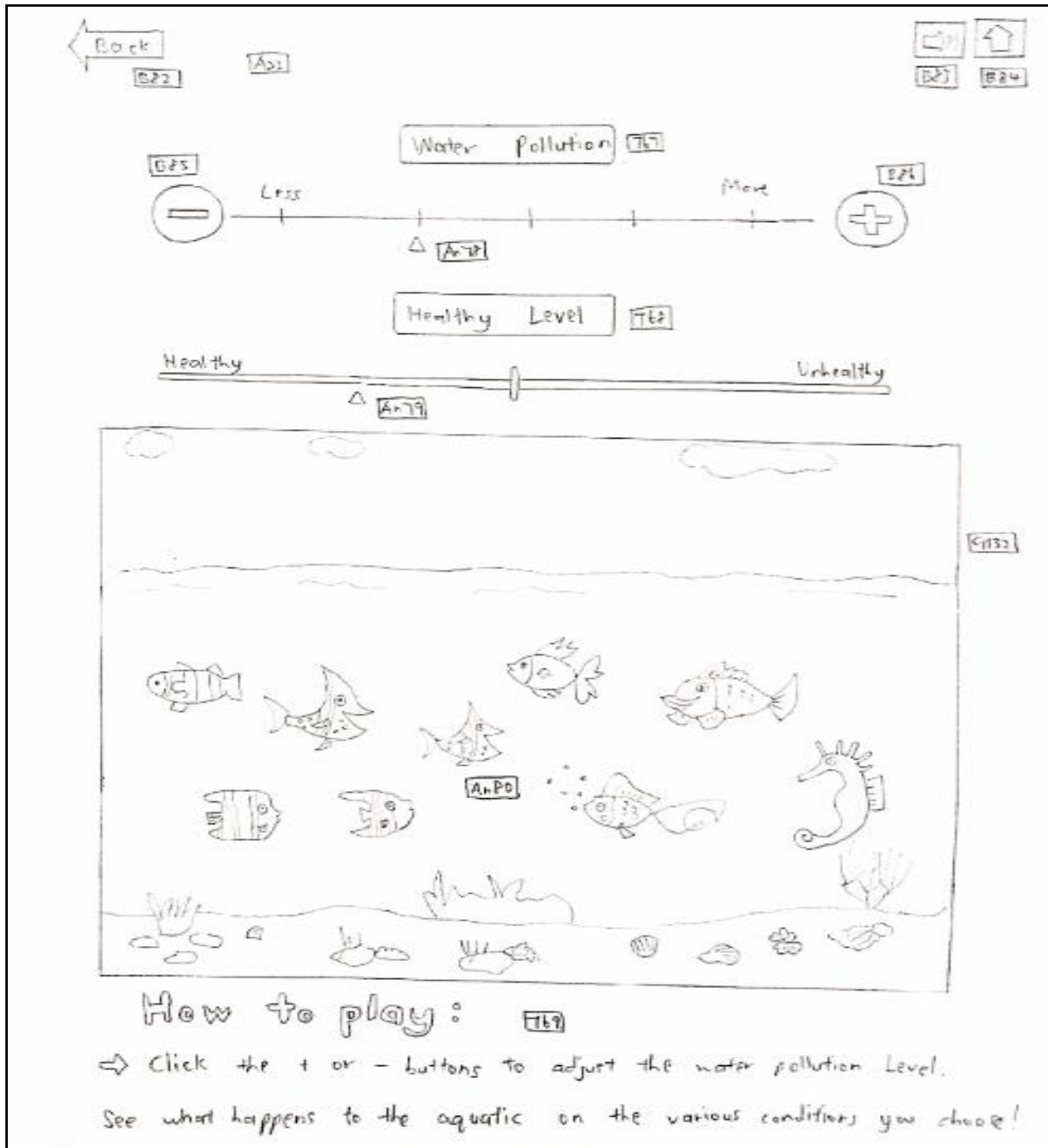
Figure 3.25: Storyboard of game based learning module.

Table 3.29: Instructions and flowchart of game based learning module.

Instructions	Flowchart
B82, B83, B84, B85, B86, T67, T68, T69, G132, An78, An79, An80, A22 will first appear on the screen. -B82 is a button element represent as a back button to back to the previous page. -B83 is a button element to let user switch on or off the sound. -B84 is a button element which will link to the main menu of the system. -B85 is a button element to decrease the water pollution. -B86 is a button element to increase the water pollution. -T67 is a text element which shows "Water Pollution". -T68 is a text element which shows "Healthy Level". -T69 is a text element which shows the instruction of the game. -G132 is a graphic element which shows the graphic image. -An78, An79, An80 are animation elements which show the animation images. -A22 is an audio element that plays as the background music of the game.	Start Display B82, B83, B84, B85, B86, T67, T68, T69, G132, An78, An79, An80, A22 Click on the button — No Yes Show the topic frame that user End

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Topic: Game Based Learning Module

Storyboard No: 23

T(Text), G(Graphic), A(Audio), V(Video), An (Animation), B(Button)
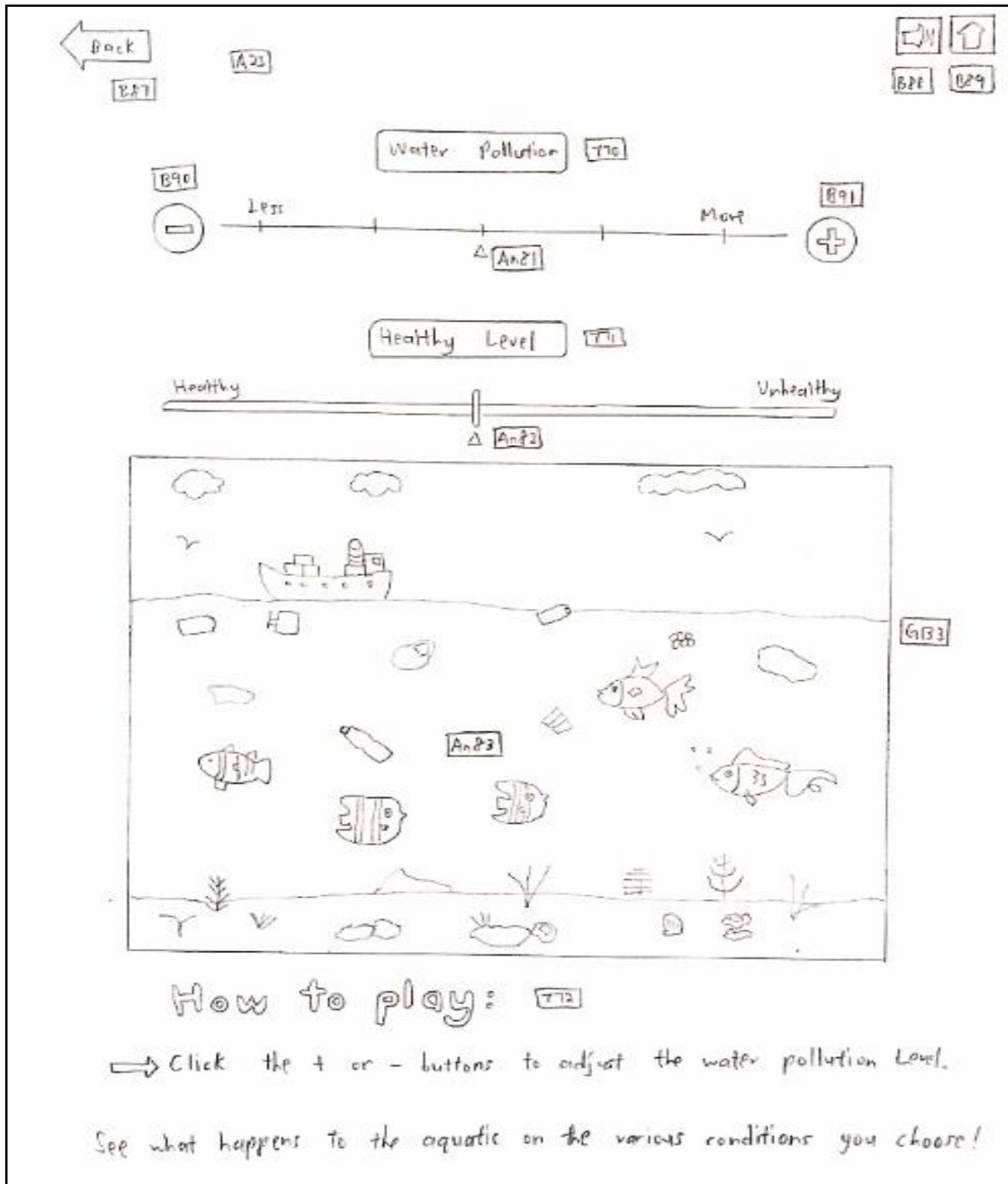
Figure 3.26: Storyboard of game based learning module.

Table 3.30: Instructions and flowchart of game based learning module.

Instructions	Flowchart
B87, B88, B89, B85, B90, B91, T70, T71, T72, G133, An81, An82, An83, A23 will first appear on the screen. -B87 is a button element represent as a back button to back to the previous page. -B88 is a button element to let user switch on or off the sound. -B89 is a button element which will link to the main menu of the system. -B90 is a button element to decrease the water pollution. -B91 is a button element to increase the water pollution. -T70 is a text element which shows "Water Pollution". -T71 is a text element which shows "Healthy Level". -T72 is a text element which shows the instruction of the game. -G133 is a graphic element which shows the graphic image. -An81, An82, An83 are animation elements which show the animation images. -A23 is an audio element that plays as the background music of the game.	Start Display B87, B88, B89, B85, B90, B91, T70, T71, T72, G133, An81, An82, An83, A23 Click on the button — No Yes Show the topic frame that user End

3.6 Project Planning

3.6.1 Project 1

Year	2020													
Month	January			February				March				April		
Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Date / Task	13 - 19	20-26	27-31	1-9	10-16	17-23	24-29	1-8	9-15	16-22	23-31	1-5	6-12	13-19
Planning	■													
Meeting with supervisor	■													
Discuss project idea	■													
Finalise the project title	■													
Analysis		■	■	■										
Identify problem statement		■												
Identify solutions		■												
Identify expected innovation		■												
Identify objective			■											
Identify project scope			■											
Identify target audience			■											
Perform literature review				■										
Identify learning approach				■										

Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Identify development tool					■											
Design						■	■	■	■							
Design system flow diagram						■										
Sketch storyboard						■										
Design system flow chart						■										
Collect data from survey questionnaire							■									
Analysis data collection							■									
Discuss the data collection							■									
Design main menu								■								
Development									■	■	■	■	■	■	■	■
Develop first module									■	■	■	■	■			
Develop second module														■	■	■
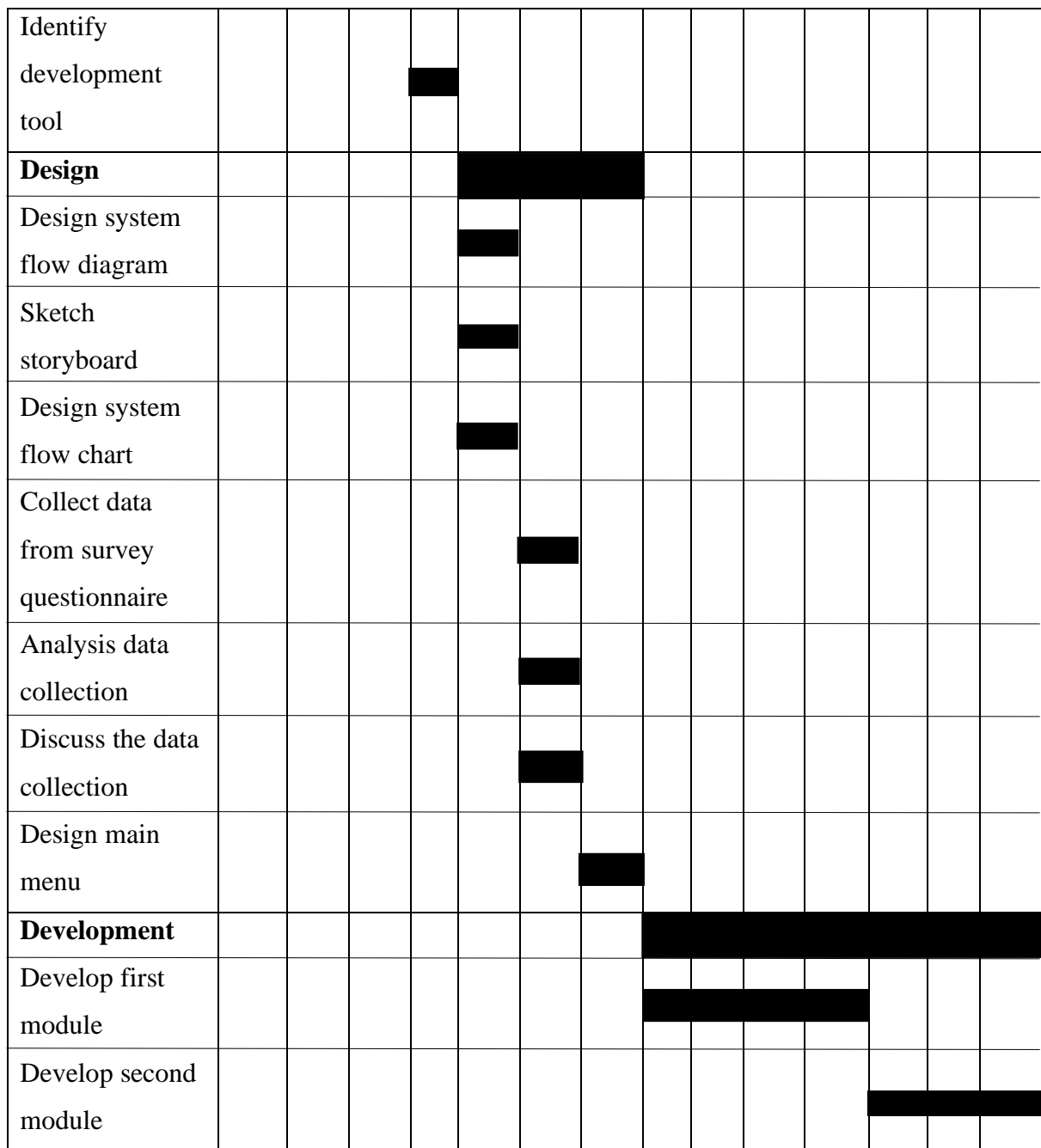
Figure 3.27: Gantt chart of FYP 1.

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Year	2020													
Month	May	June				July					August			
Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Date \ Task	25-31	1-7	8-14	15-21	22-30	1-5	6-12	13-19	20-26	27-31	1-9	10-16	17-23	24-30
Development	█	█	█	█	█	█	█	█	█	█				
Develop third module	█	█												
Develop forth module			█	█	█									
Develop fifth module						█	█							
Integrate module									█					
Implementation										█	█	█		
Test the project outcome										█				
Invite the target audience											█			
Deliver to target audience												█		
Evaluation													█	█
Deliver to others for testing													█	
Receive feedbacks													█	
Modify the system if need														█
Make improvement														█

Figure 3.28: Gantt chart of FYP 2

Chapter 4 Development

4.1 Overview

The overview of the chapter 4 is the development process of multimedia edutainment which include the pre-authoring process, authoring process and post-authoring process. The pre-authoring process include the process of creating and editing text of all module by using the test editing website, process of creating and editing graphics by using background remover tool and snipping tool, process of creating and editing animations by using cel animation and path animation, process of editing audio by using Doc and MP3 converter and process of editing video in macromedia director. The authoring process include the main menu design, learning module design, experiment note module design, past year paper module design and game module design. The post-authoring process is publishing in Director after finishing all the design of movie in Macromedia Director. The main menu, learning module, experiment note module, quiz module, past year paper module and game module is integrated and published into a multimedia courseware. Hence, user can view the overall output of the edutainment system. The multimedia edutainment also gone through the implementation and evaluation stage so that it can be launched and tested by the user to enhance the quality of the system.

4.2 Development Process

The development process of multimedia edutainment includes the development process which are the pre-authoring process, authoring process and post-authoring process. Pre-authoring process include the process of creating and editing text, process of creating and editing graphics, process of creating and editing animations, process of editing audio and process of editing video. The authoring process include the main menu design, learning module design, experiment note module design, past year paper module design and game module design. The post-authoring process is publishing in Director after finishing all the design of movie in Macromedia Director. The movie of main menu, learning module, experiment note module, quiz module, past year paper module and game module is integrated and published so that user can see the output of the multimedia edutainment. Then, the multimedia edutainment is implemented and evaluated so that it can deliver and tested by the user. The testing result will be improved to produce a good quality system.

4.2.1 Pre-authoring Process

4.2.1.1 Process of creating and editing text
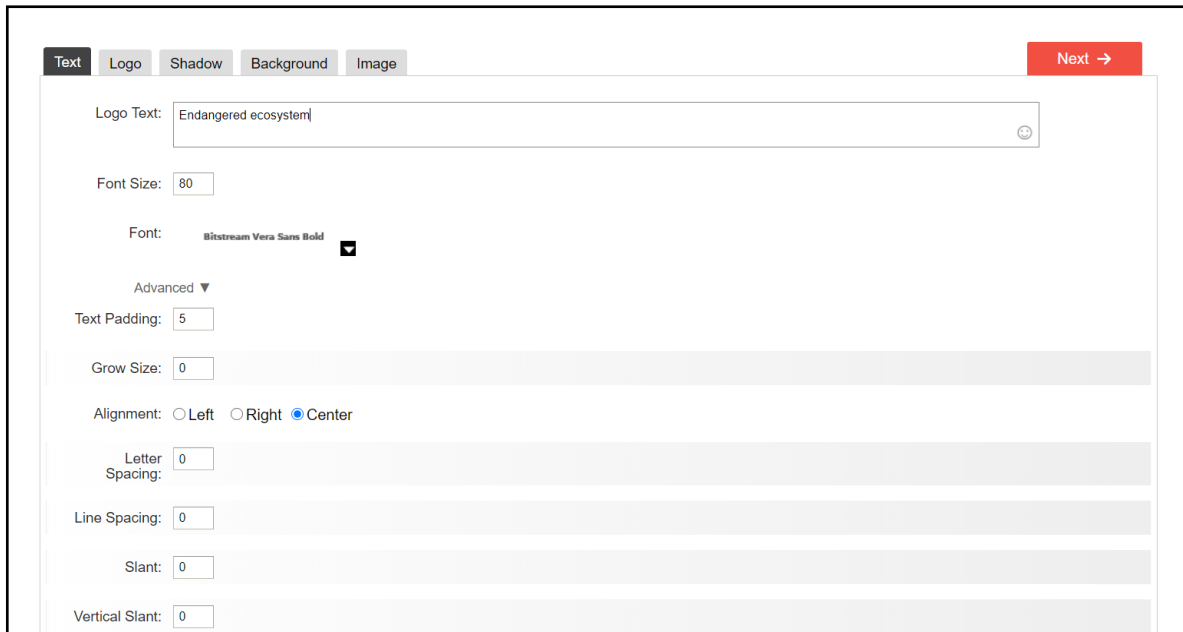
Figure 4.1 Editing text of Flamingtext website

The process of creating and editing text is edited by using the online editing text website which called famingtext. Every word is type in the editing text website and convert it into a non-flat and coloured word so that it looks like computer fonts in the multimedia courseware. The text of this multimedia courseware is using sans-serif to display the words in the main menu and each module. The colour of the text is chosen to used so that it is not contrast with the background colour. Most of the text's colour are black colour, blue colour and white colour in the multimedia courseware. The main menu is using the 3D text for the title and the button is using white colour text so that the text is easier to see when it put on the blue button. The size and the position of the text is adjusted nicely on the interface of the main menu and each module.

4.2.1.2 Process of creating and editing graphics

Figure 4.2 Background remover

The graphics of the multimedia courseware are edited by using the background remover tool which can remove the background of the graphics. The graphic is searching from the internet and it put into the background remover to remove the background. After remove the background, the graphic is downloaded and snip by using the snipping tool. Some of the graphics are using rectangular mode snipping and some of the graphics are using free-form mode snipping. The snipping images is saved and imported to the multimedia courseware. It is also need to adjust the size and position of the graphics on the interface of the stage. Most of the graphics are 3D such as the 3D button and 3D images so that it can increase the visualization of the images.

4.2.1.3 Process of creating and editing animations
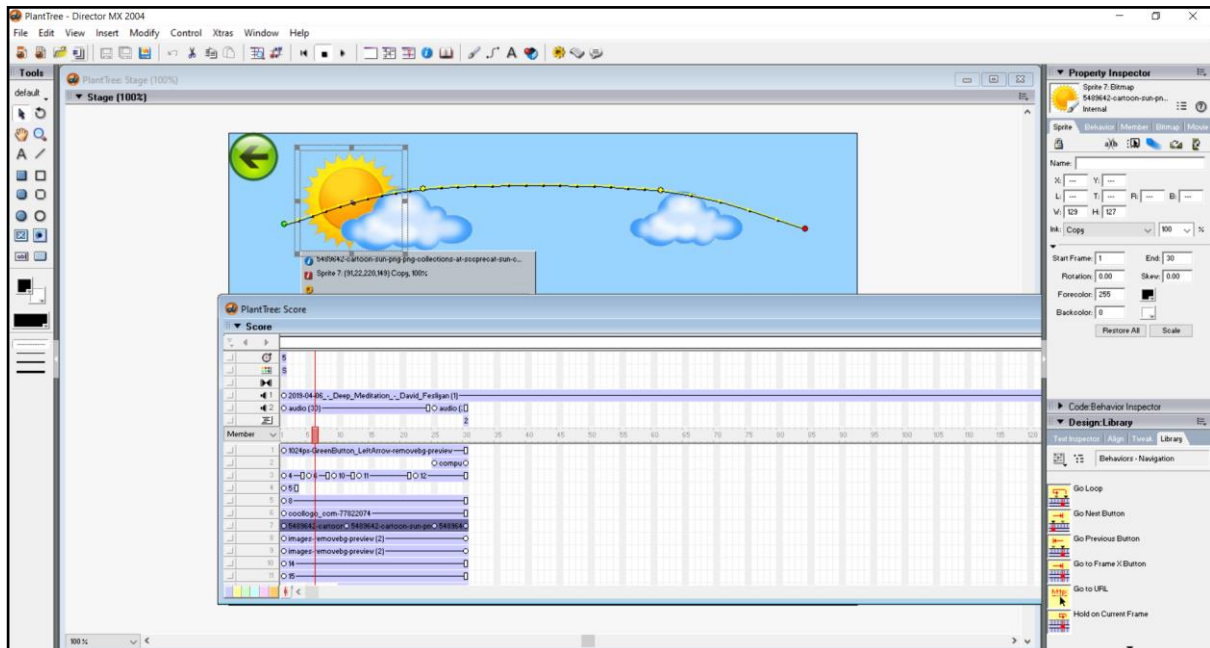
Figure 4.3 path animation editing from the sprite

The animations in the multimedia courseware is created and edited by using the cel animation which put the two different images on the sprite and adjust the position of it in the multimedia courseware. For example, the animated sun that used in the learning module, experiment note module, quiz module and past year paper module are put by adjust the position of two different images of sun in the sprite. When the macromedia director plays, it will show the sun is moving. Besides, the path animation also used by dragging the images and it will show the images is moving. For example, the fish in the sea game is drag in the stage so that it will show the fishes is moving when the user play on it.

4.2.1.4 Process of editing audio
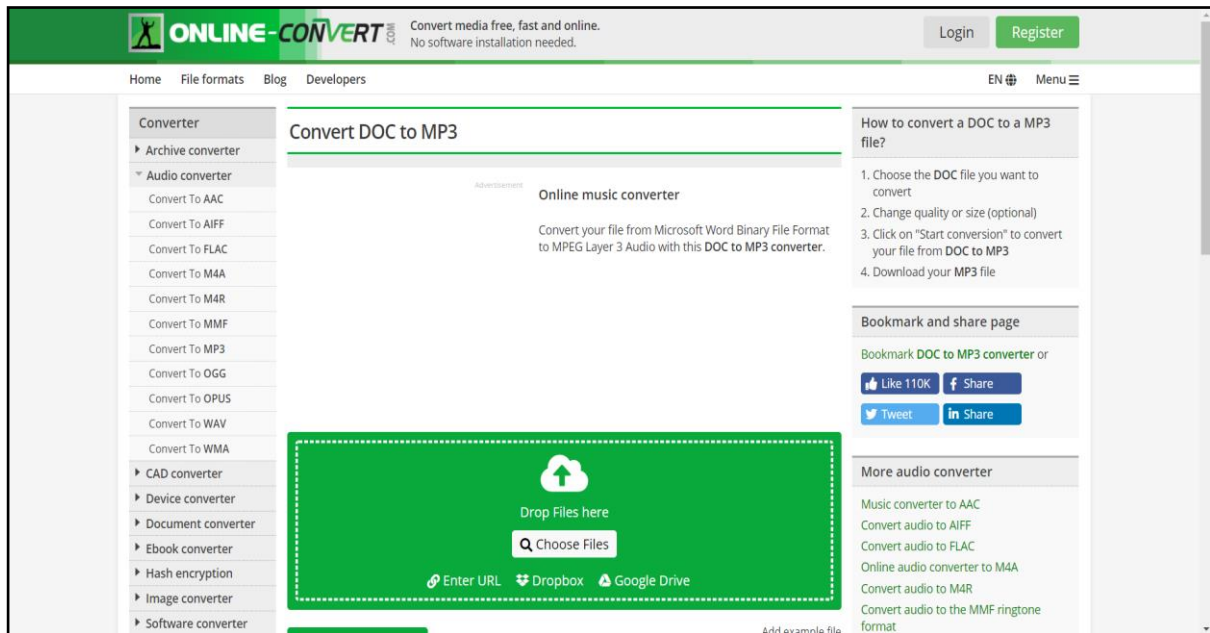
Figure 4.4 DOC to MP3 converter

The process of editing audio is using the online DOC to MP3 converter website. The sound of the explanation is converting by using DOC to MP3 converter website. First, write the text in the Microsoft Word and save. After that, upload to the DOC to MP3 converter website and it will start conversing the text to sound. After completed, download the mp3 and import into the macromedia director. Then adjust to the position of the sound that would like to put. For the audio of background music, the audio of it is searching and download from the Royalty free peaceful and relaxing background music website. The music is download and import into the macromedia director. Then, the audio of music is import into the macromedia director and adjusted in the sprite.

4.2.1.5 Process of editing video
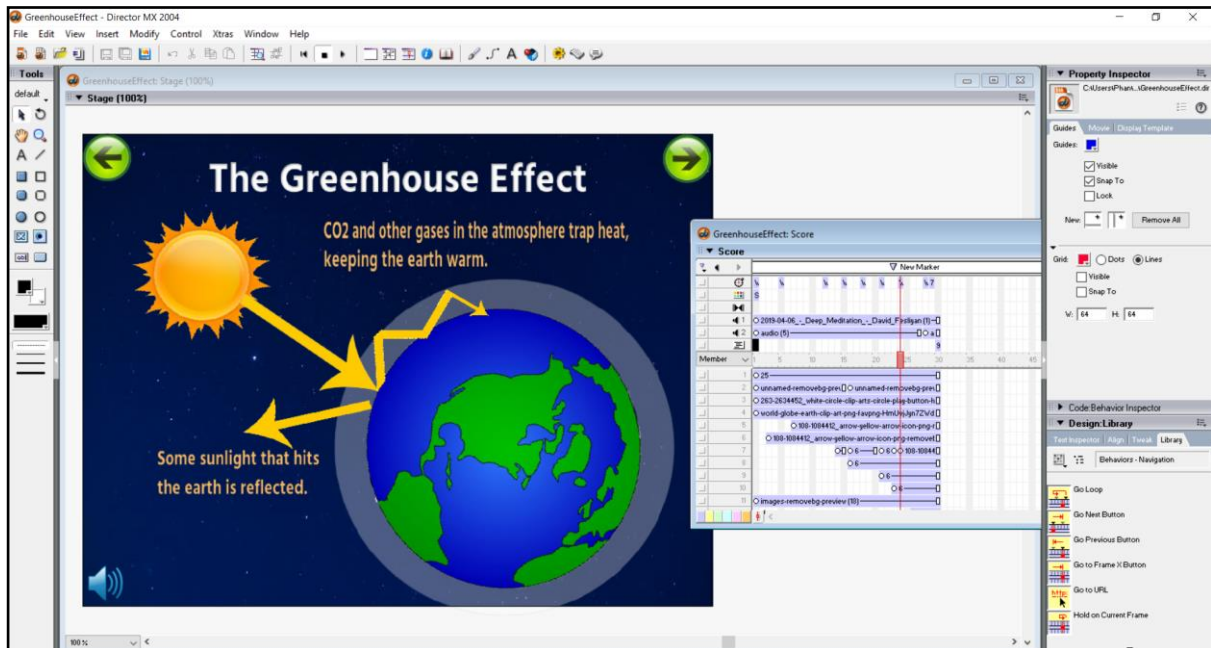
Figure 4.5 Video editing from the sprite

The process of editing video is using the images that put in the sprite and adjust the position of it in the Macromedia Director. For example, the process of greenhouse effect in the learning module is created by putting the images of the earth, sun, arrow and son on. After that, adjust the position of the images and text in the sprite so that when it plays, it will show like a video for the process of greenhouse effect. The audio of the explanation as well as the background music is put in the sound sprite to explain the process of the greenhouse effect to the user. Hence, when user play on it, it will look like he is watching a video.

4.2.2 Authoring Process

4.2.2.1 Main menu design
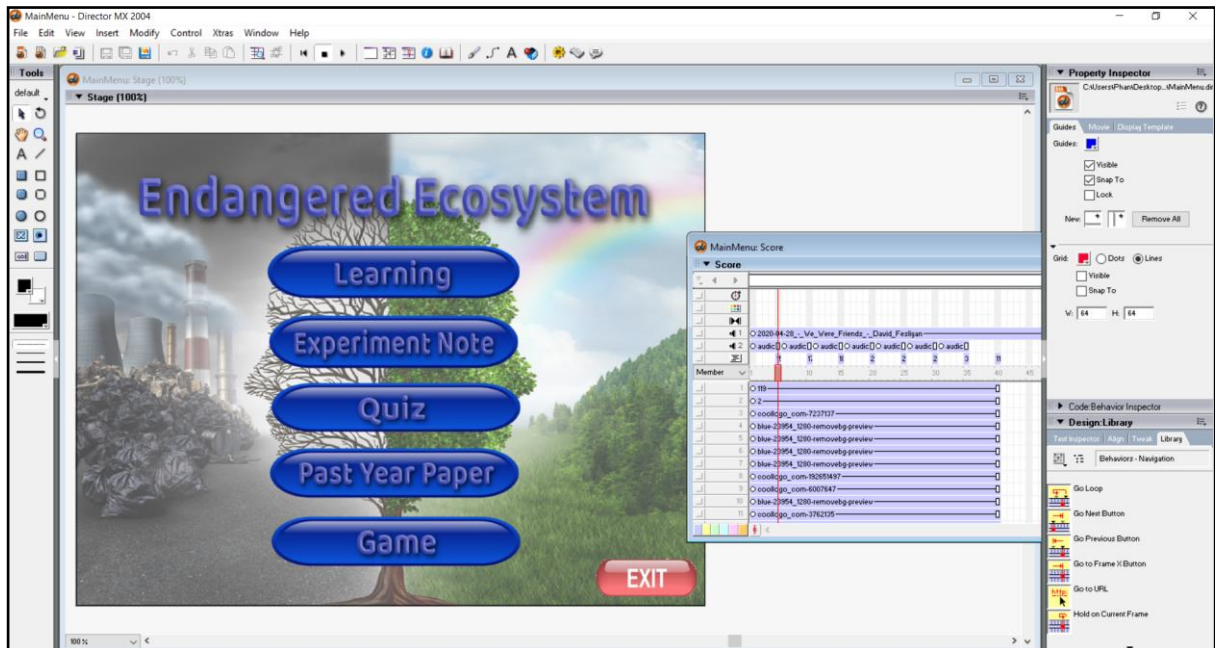
Figure 4.6 Screenshot of main menu design

The title of the multimedia courseware is put on the top of the main menu which is endangered ecosystem. The main menu is designed by the five buttons in the middle of main menu and one button in the bottom right for the user to click. The first button is the learning button which will direct user to the learning module. The second button is the experiment note button which will direct user to the experiment note module. Next, the third button is the quiz button which will direct user to the quiz module. The fourth button is the past year paper module which will direct user to the past year paper module. The fifth button is the game button which will direct user to the game module. The last button is the exit button for the user to exit the multimedia courseware when they click on it.

4.2.2.2 Learning module design
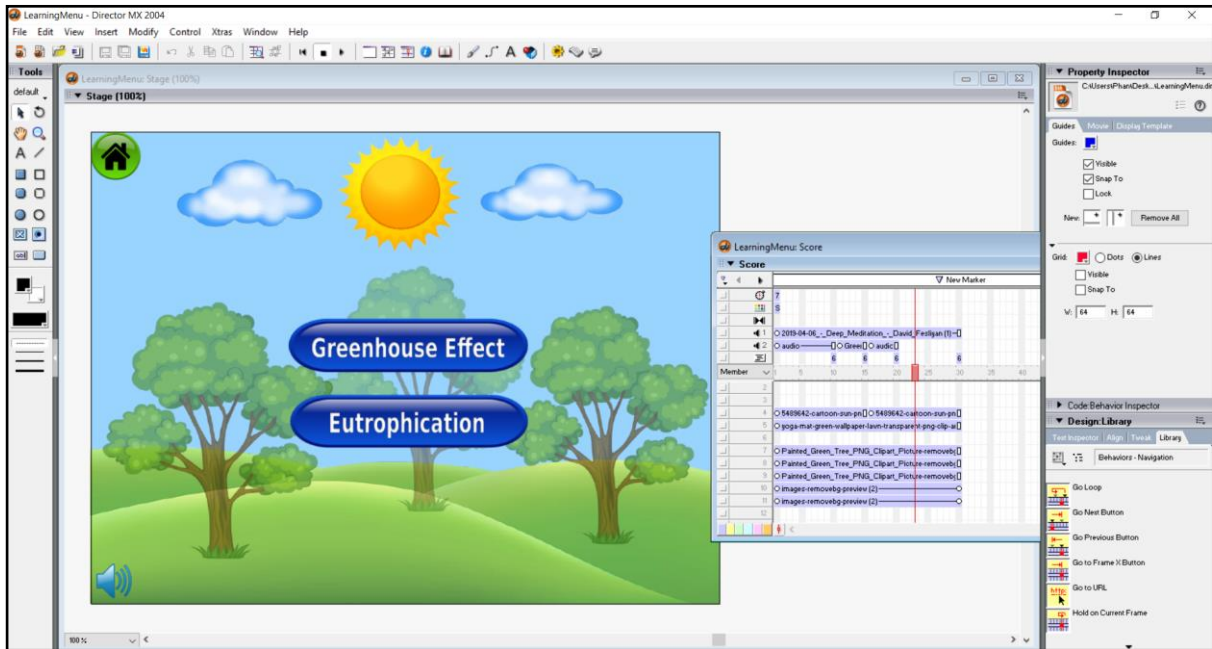
Figure 4.7 Screenshot of learning module's home page

There are two sub topics in the learning module which are greenhouse effect and eutrophication. When user click on the first button, it will direct the user to the topic of greenhouse effect. On the other hand, user can click on the second to learn the topic of eutrophication. User can click on the home button to go back to the main menu and click on the sound button to turn the sound.
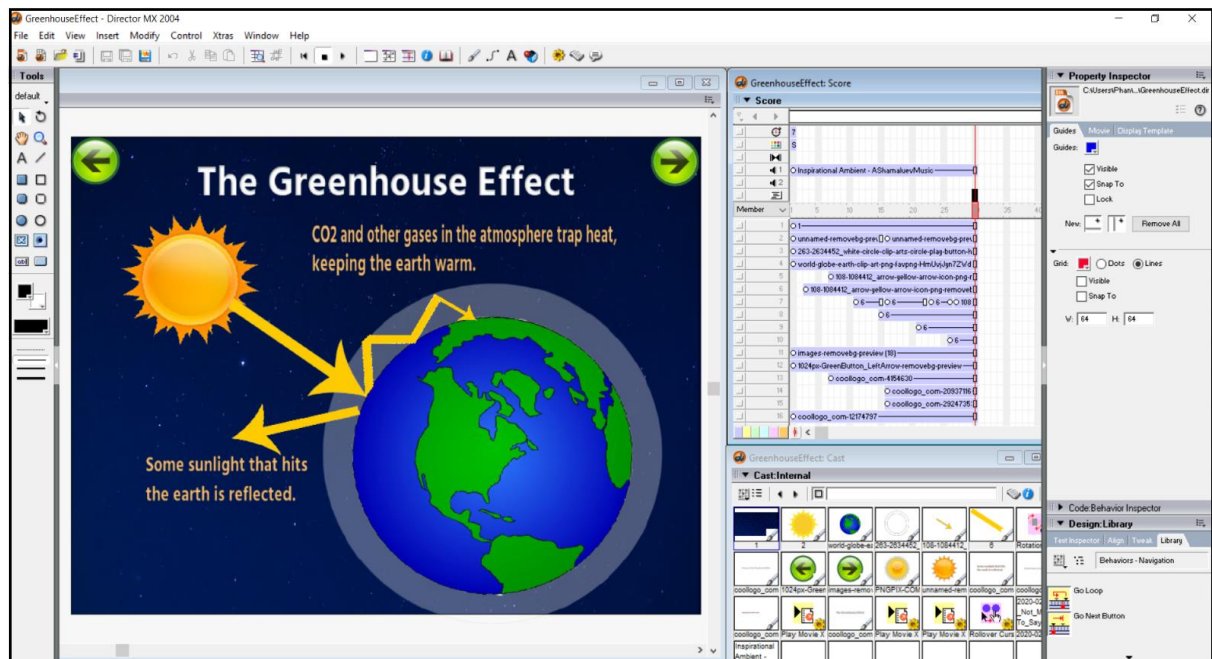
Figure 4.8 Screenshot of greenhouse effect design.

Figure 4.8 is the screenshot of learning module design which showed the process of greenhouse effect. The process of the greenhouse effect is showed in animated and it can attract the user to learn it. It also provides text to increase the understanding of the user. The top left button is a button which will link back to the previous page while the top right button is a button which will link to the next page of the learning module.
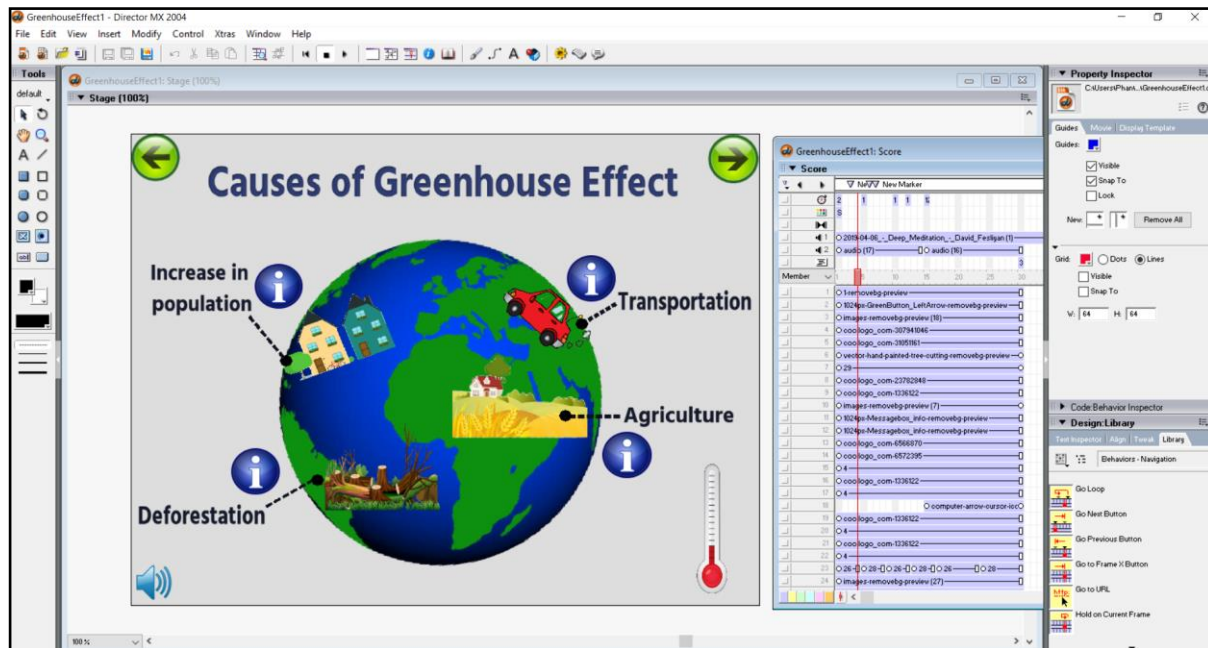
Figure 4.9 Screenshot of causes of greenhouse effect design.

Figure 4.9 is the screenshot of learning module design which showed the causes of greenhouse effect. The information is delivered in animated images to attract the user to learn it. There have four causes of greenhouse effect and user can click on the information button to know more information about it. The top left button is a back button which will link back to the previous page while the top right button is a button which will link to the next page of ways to reduce greenhouse effect.
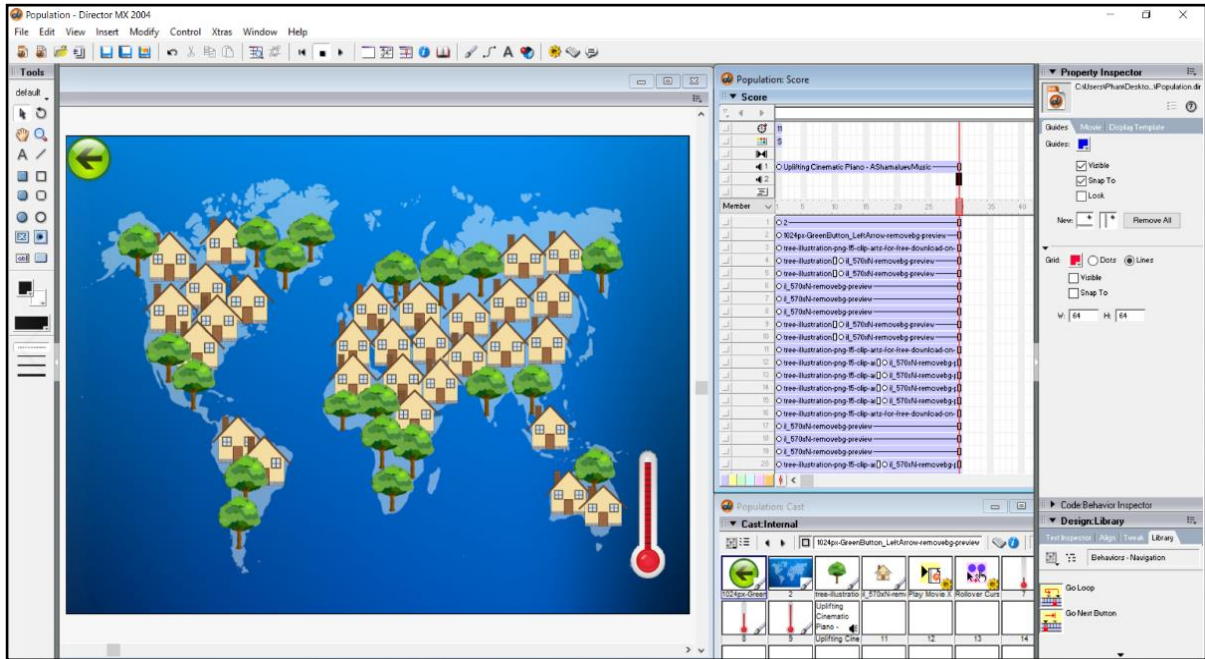
Figure 4.10 Screenshot of increase in population

Figure 4.10 is the screenshot of increase in population. It shows the animated house and animated trees in the map. When the house increase, the trees will be decreased. Moreover, the temperature of the earth also will be increased when the population increase. It has delivered the message of the effects of increase in population to the user instead of using text. So, user will be easy to understand through the animated images. Lastly, the top left button is a button which will link back to the previous page.
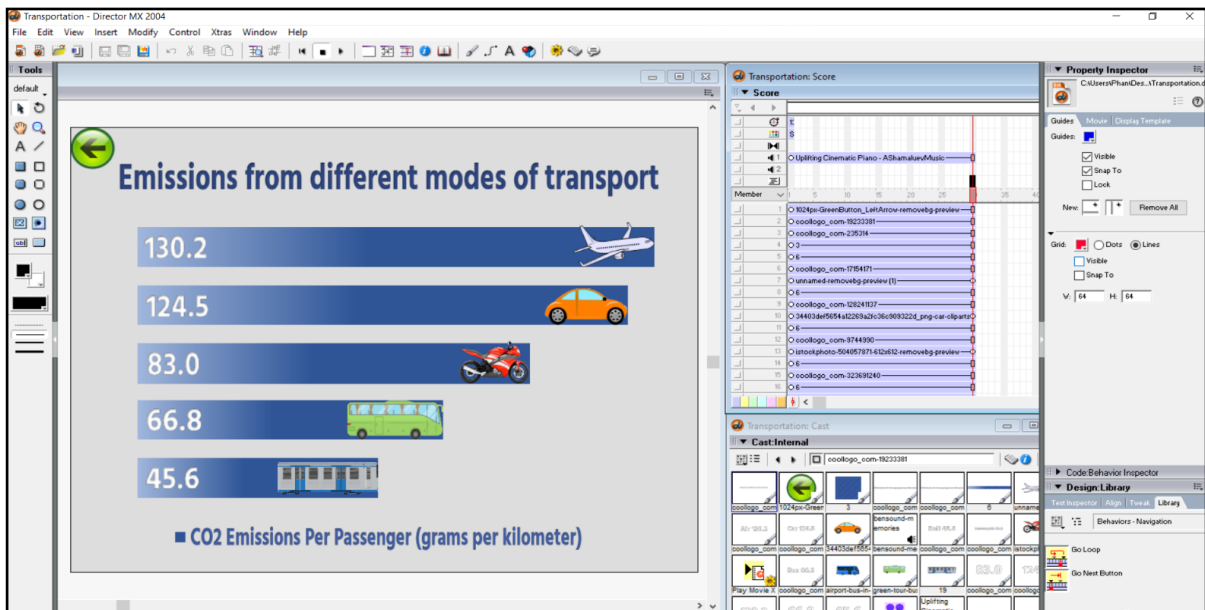
Figure 4.11 Screenshot of emissions from different modes of transport

Figure 4.11 shows the emissions from different modes of transport. It show the carbon dioxide emissions from different modes of transport which are aeroplane, car, motocycle, bus and train. Each of the transport has release different amount of carbon dioxide. The aeroplane which shows the highest number of emmision is put on the top of others while the train which shows the lowest number of emmision is put in the lowest. The transport are showed in animated images instead of word to attract the user. Lastly, the top left button is a button which will link back to the previous page.
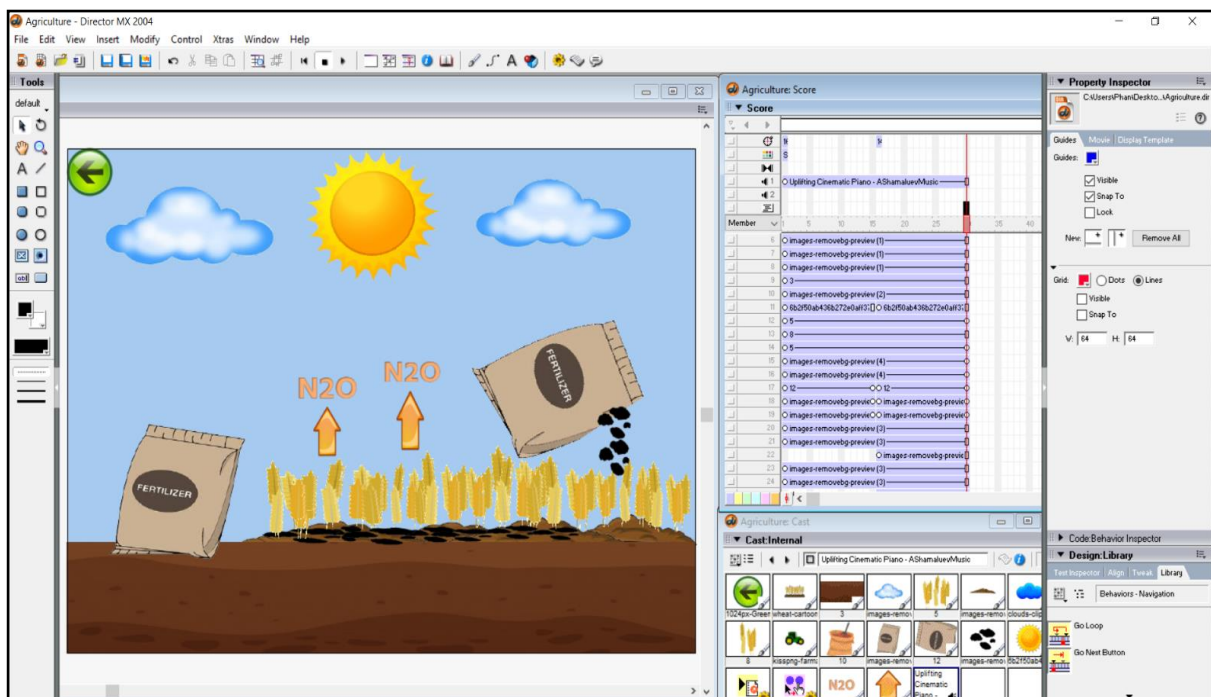
Figure 4.12 Screenshot of effect of agriculture to the environment

Figure 4.12 shows the effect of agriculture to the environment. It shows the fertiliser are poured into the wheat gradually. As a result, it will release nitrous oxide, a higly active greenhouse gas and it will cause greenhouse effect. The animated images and the text can increase the understanding of the user about the effect of agriculture activity. Lastly, the top left button is a button which will link back to the previous page.
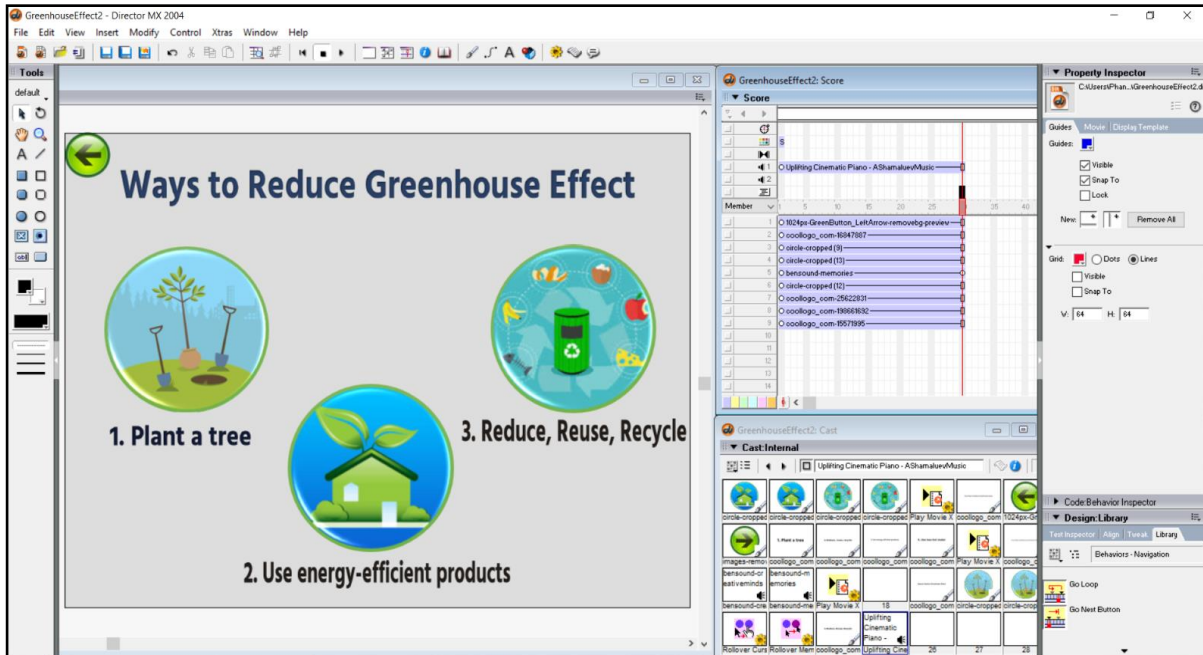
Figure 4.13 Screenshot of ways to reduce greenhouse effect.

Figure 4.13 shows the ways to reduce greenhouse effect. There are 3 ways to reduce greenhouse effect. The first way to reduce greenhouse effect is planting a tree. Hence, user can click on the first button to know more information about planting a tree. The second way to reduce greenhouse effect is using energy-efficient products. The user can click on the second button to know more information about the energy-efficient products. The third way to reduce greenhouse effect is reduce, reuse and recycle. So, user can click on the third button to know more information about it. Lastly, the top left button is a button which will link back to the previous page in the learning module.
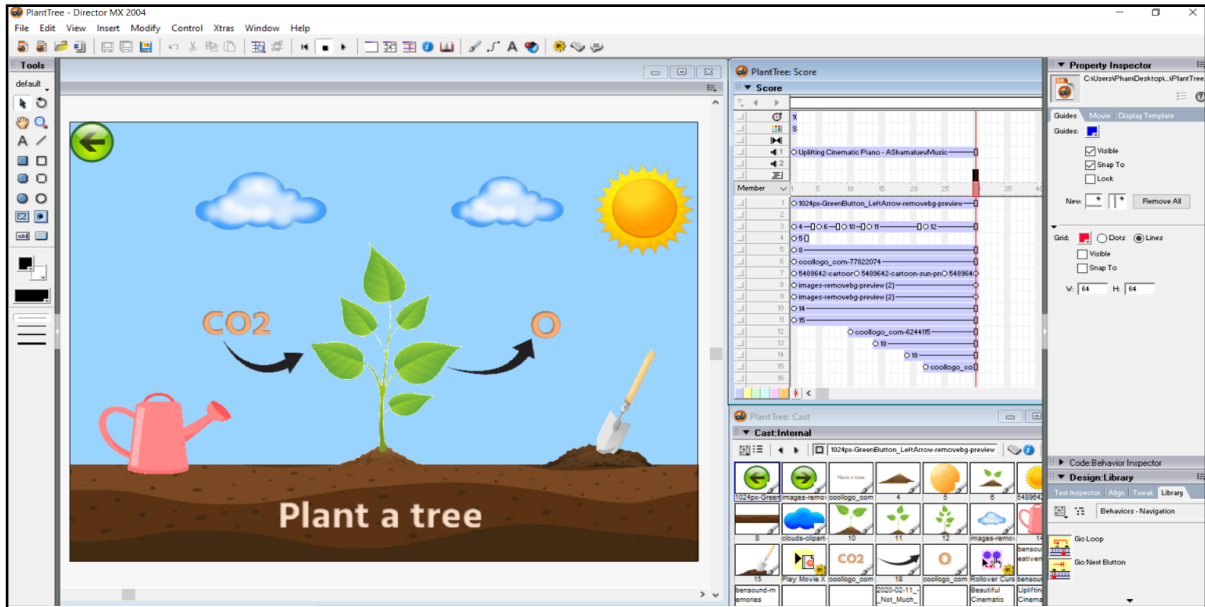
Figure 4.14 Screenshot of benefit of planting a tree

Figure 4.14 shows the benefit of planting a tree. It shows the young plant is growing up. At the same time, the young plant will absorb the carbon dioxide and release oxygen to the air. So, it shows that the planting tree can reduce the greenhouse effect. The importance of planting a tree can be delivered to the user by using the text and animated image. Lastly, the top left button is a button which will link back to the previous page.
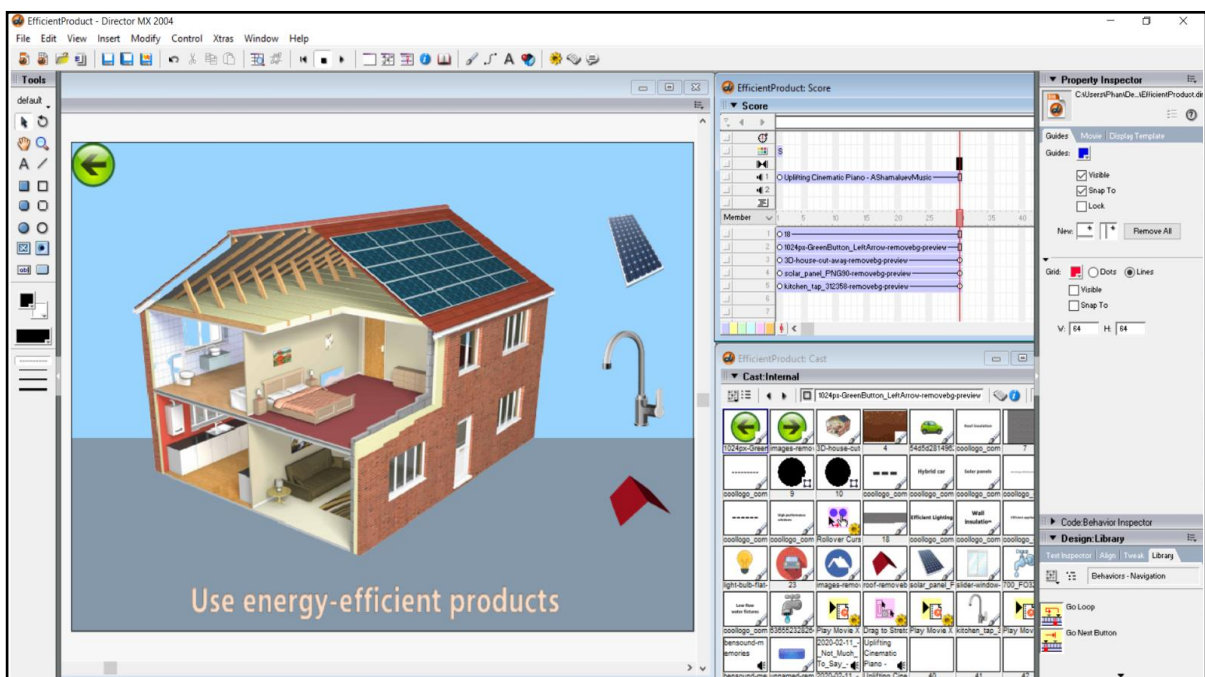
Figure 4.15 Screenshot of energy-efficient products in the house

Figure 4.15 shows the energy-efficient products in the house. User can zoom in and zoom out the house to see the structure of the house. Moreover, the energy-efficient products such as the solar panel, low-flow water feature faucet and insulated roof have listed in the right side of the page. Furthermore, the solar panel, low-flow water feature faucet and insulated roof are allowed user to click and it will link to another page respectively. Hence, user can know more information about the energy-efficient products. Lastly, the top left button is a button which will link back to the previous page.
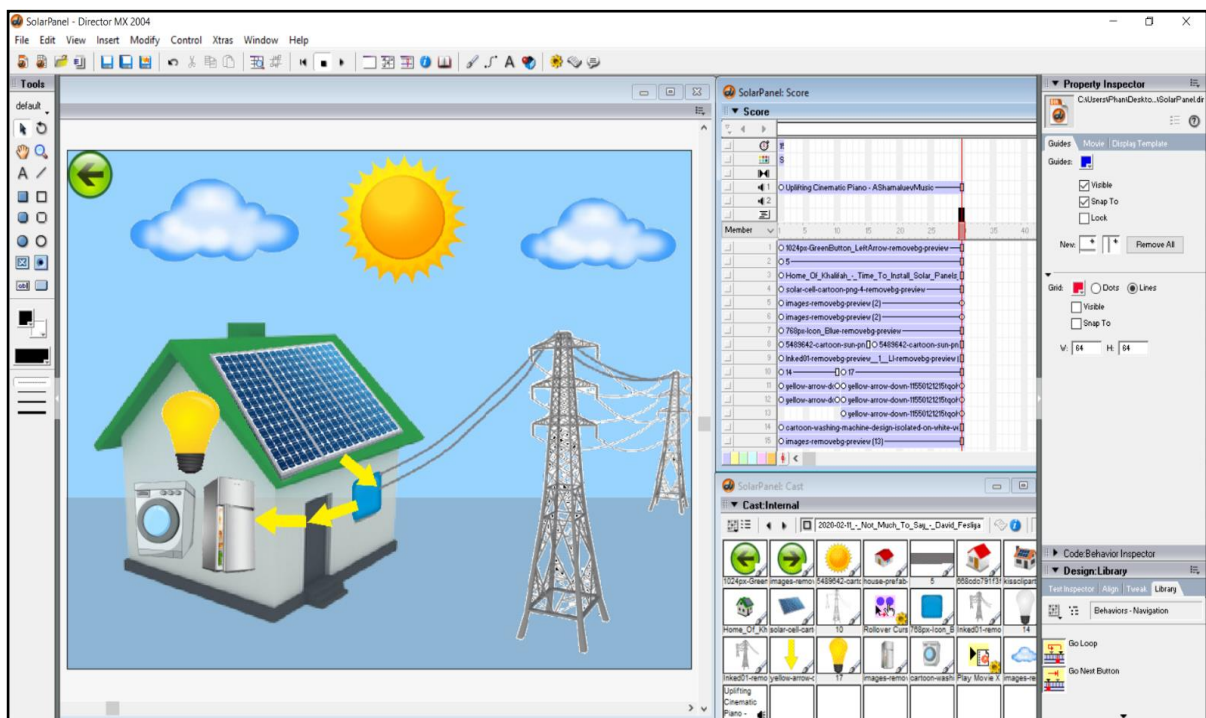
Figure 4.16 Screenshot of benefit of using solar panels in the house

Figure 4.16 shows the benefit of using solar panels in the house. The arrow shows the process of transmitting the solar energy from the solar panels to the house's applicants. At first, the light bulb is not light up in the house. After the solar panels change the solar energy to electrical energy, the bulb is light up. The process of transmitting the solar energy to electrical energy has been showed in animated images. Hence, it can increase the understanding of the user about the benefits of using the solar panels in the house. Lastly, the top left button is a button which will link back to the previous page.
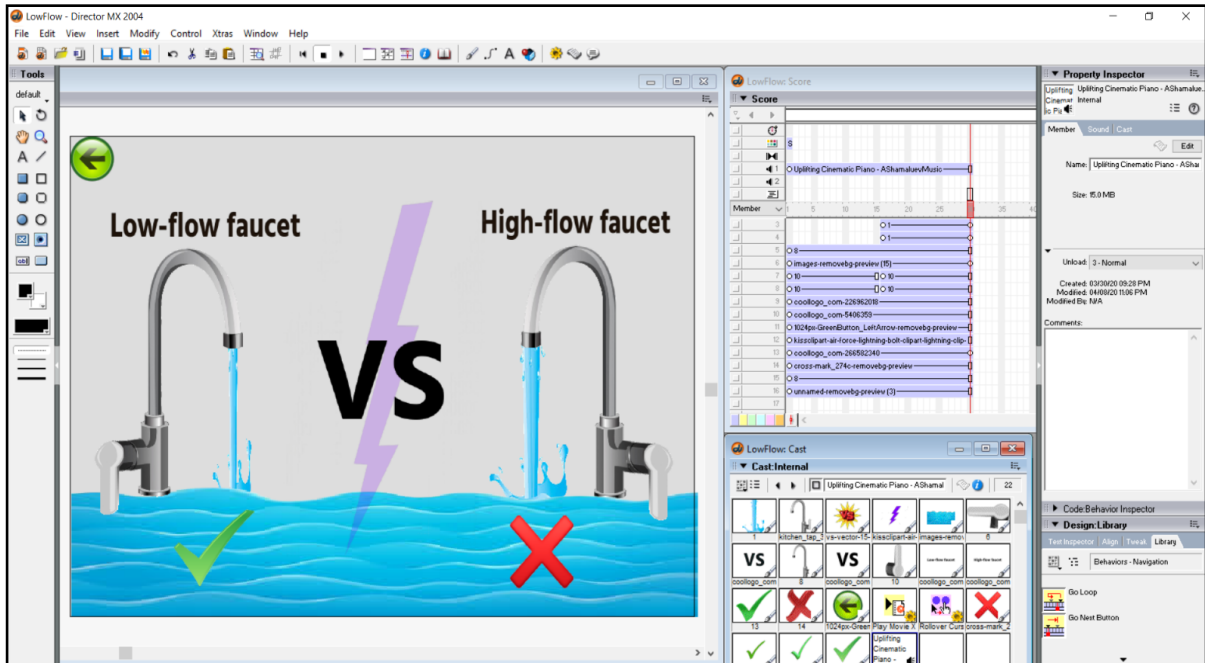
Figure 4.17 Screenshot of comparison between the low-flow faucet and high-flow faucet

Figure 4.17 shows the comparison between the low-flow faucet and high-flow faucet. The right faucet shows that it has low-flow water feature when the faucet is switch on while the left faucet shows that it has high-flow water feature when the faucet is switch on. Hence, it encourages the user to use the low-flow faucet compared to high-flow faucet because it can save a lot of water. Lastly, the top left button is a button which will link back to the previous page.
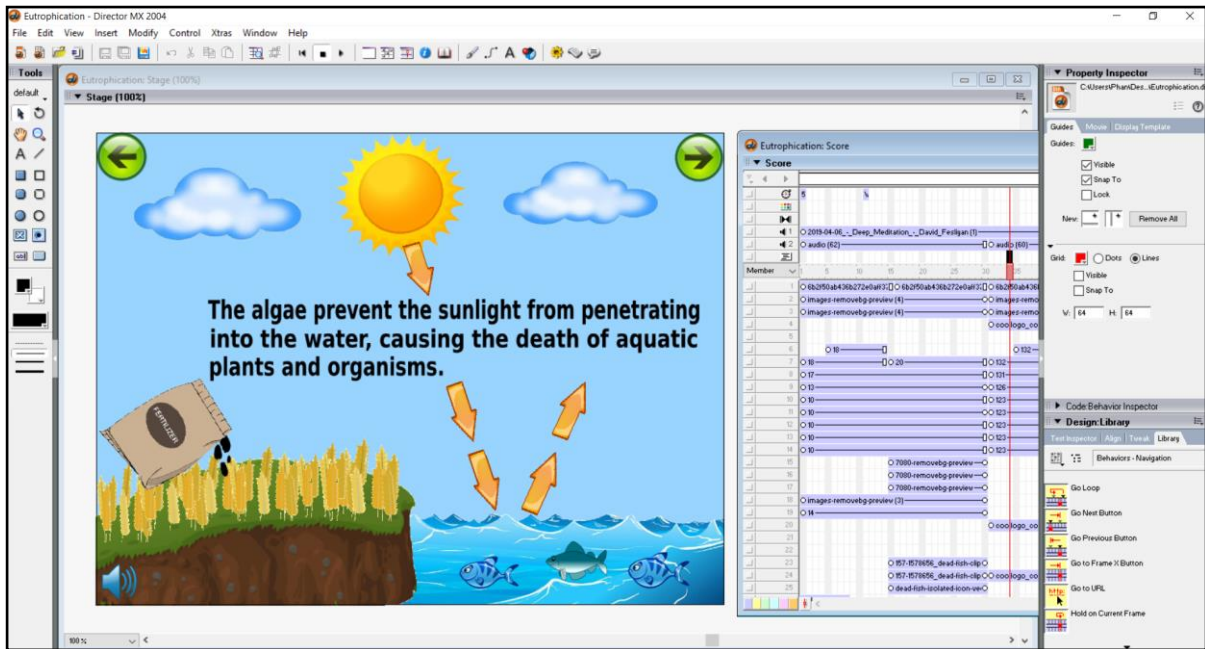
Figure 4.18 & Figure 4.19 Screenshot of eutrophication

Figure 4.18 and 4.19 shows the explanation of eutrophication. There has the audio to explain the forming of eutrophication along with the text and the animation images. Hence, it can increase the interest of the user to learn the topic of eutrophication. The top left button is the button to go back to the home page of learning module and the top right button is go to the next page of the eutrophication.
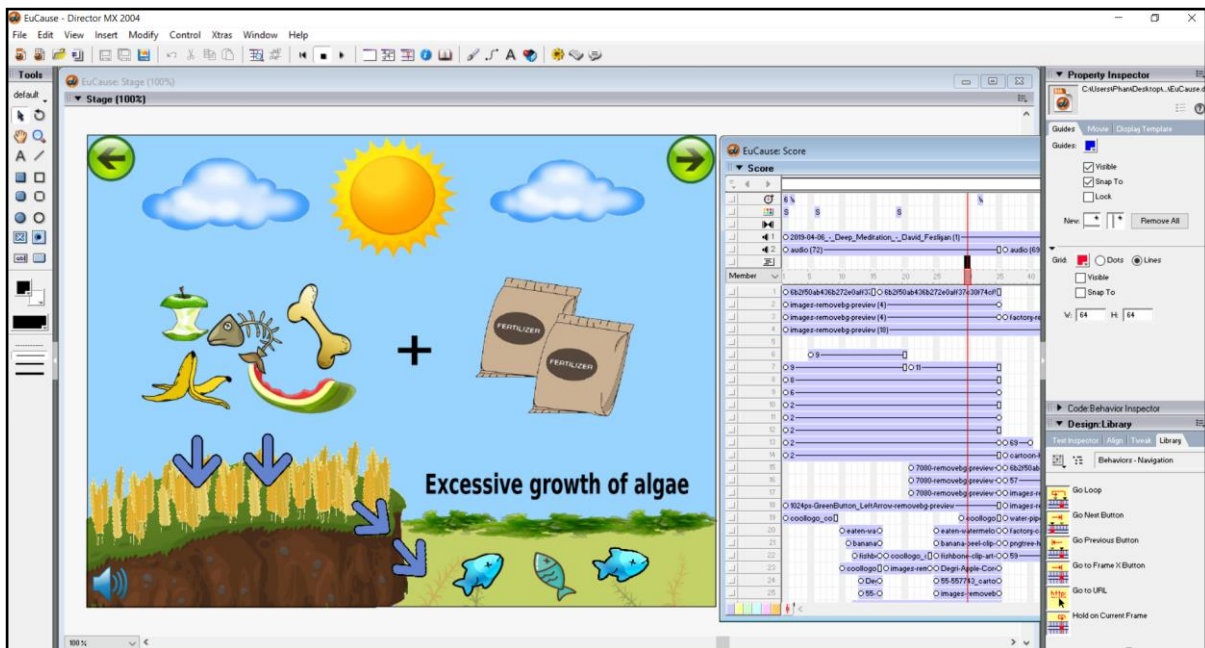
Figure 4.20 Screenshot of cause of eutrophication

Figure 4.20 shows the cause of eutrophication. The cause of eutrophication is described by using the animation images, graphics, audio and text to attract the user to learn it. The top left button is the button to go back to the previous page of eutrophication and the top right button is go to the next page of the effects of eutrophication.
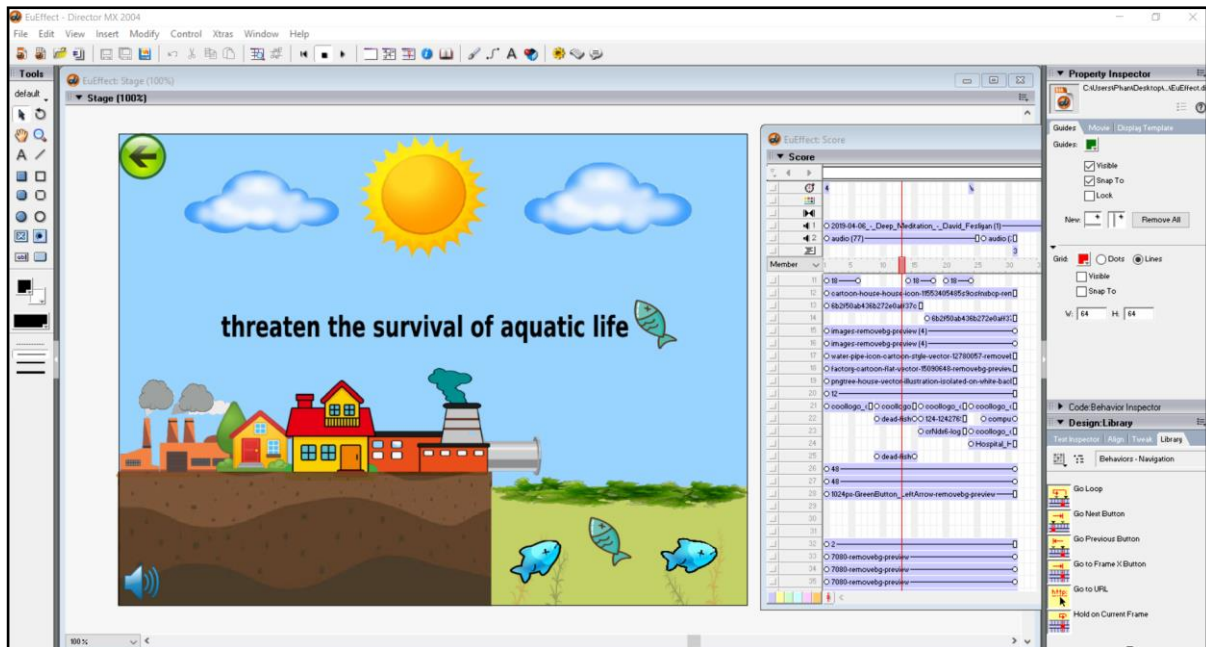
Figure 4.21 Screenshot of effect of eutrophication

Figure 4.21 shows the effects of eutrophication. The effect of eutrophication is described by using the animation images, graphics, audio and text to attract the user to learn it. For example, the user interface uses the images of house, industry, lake and fish to deliver the information of the effect of eutrophication. Lastly, the top left button is the button to go back to the previous page of eutrophication.

4.2.2.3 Experiment note module design
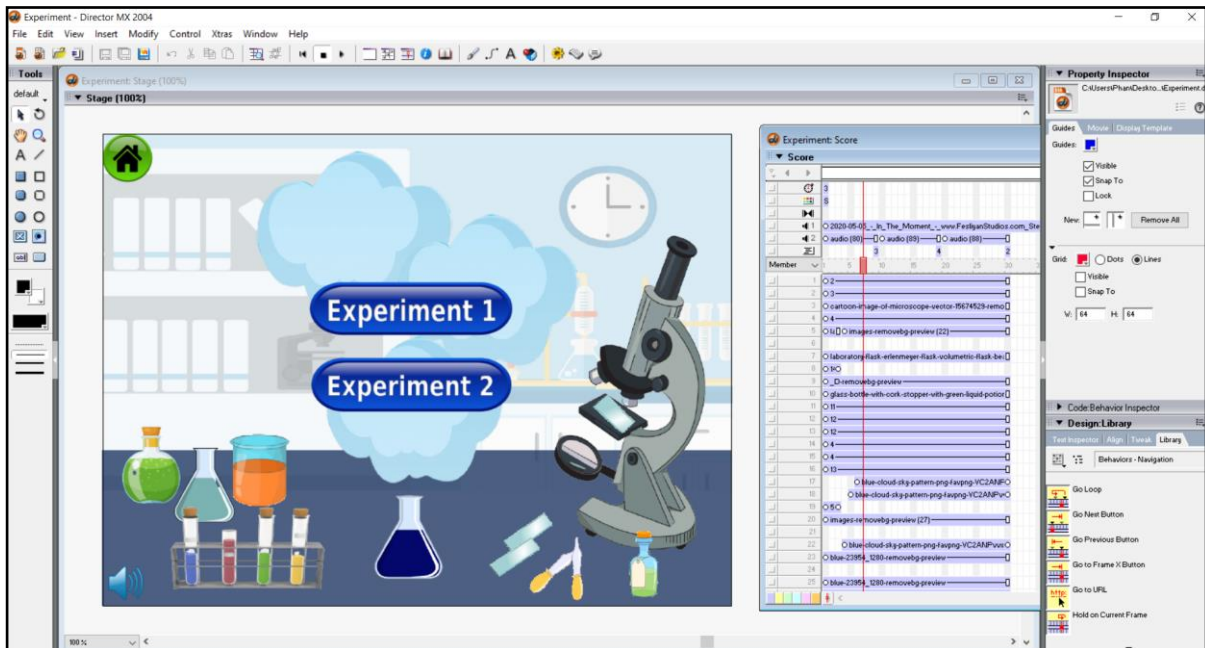
Figure 4.22 Screenshot of experiment note module

Figure 4.22 shows that there are two experiment in the experiment note module. The first button is the experiment 1 which will direct user to the experiment of comparing the solids pollutants in the air of different environments while the second button is the experiment 2 which will direct user to the experiment of investigating the level of pollution in several different sources of water. The top left button is the home page of main menu which allows user to click to the main menu of multimedia courseware.
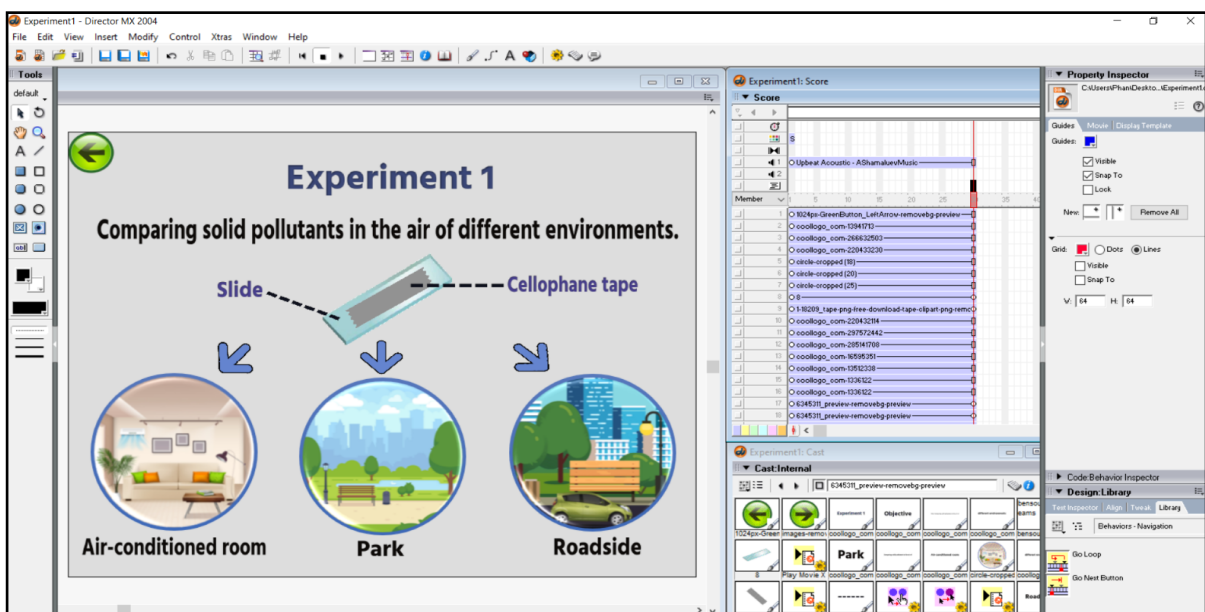
Figure 4.23 Screenshot of experiment 1

Figure 4.23 shows the first experiment. The objective of the experiment is to compare the solid pollutants in the air of different environments. The slide and cellophane tape are the apparatus and materials that are prepared in the experiment. It will be tested in 3 different environments which are air-conditioned room, park and roadside. The buttons have shown different environment. User can choose the environment that he would like to test by clicking on the button. After clicking on the button, it will link to the environment that the user chooses. Lastly, the top left button is a button which will link back to the home page of experiment note module.
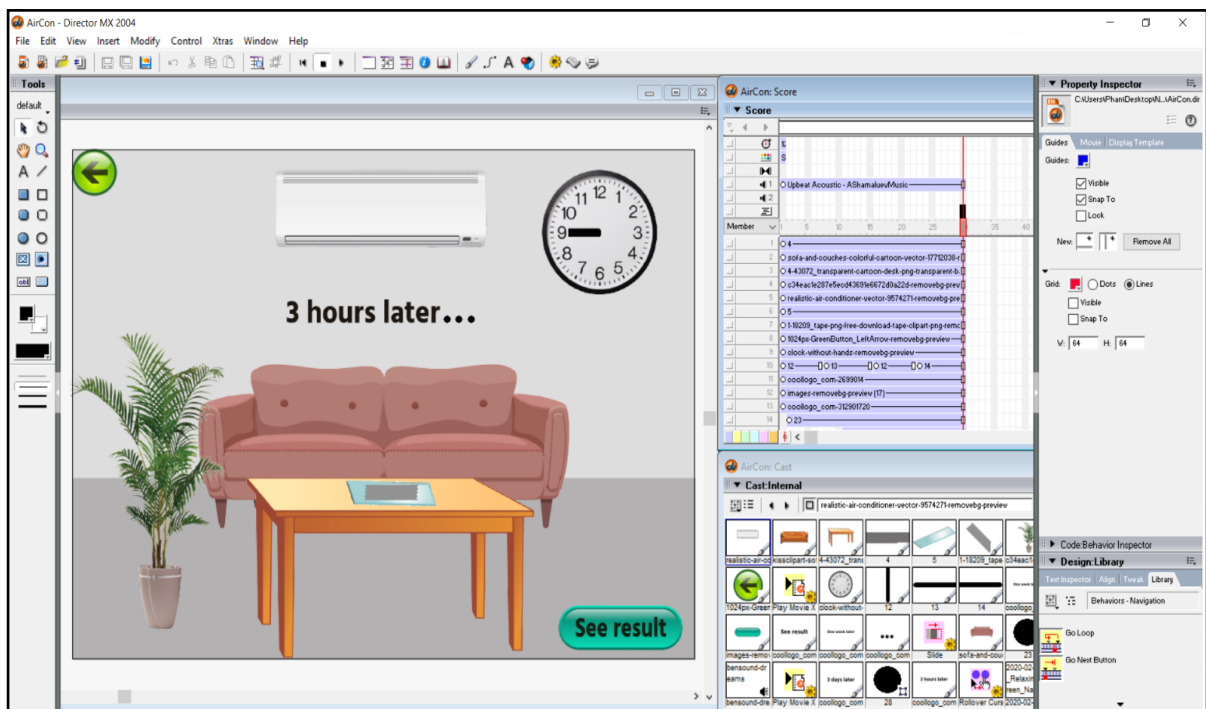
Figure 4.24 Screenshot of air-conditioned room

Figure 4.24 shows the environment that the user chooses in the experiment. It is an air-conditioned room with the door and windows are closed. The cellophane tape with the slide is placed on the table for 3 hours. The wall clock shows the time is passing. User can see the result by clicking on the "See result" button. Lastly, the top left button is a button which will link back to the previous page.
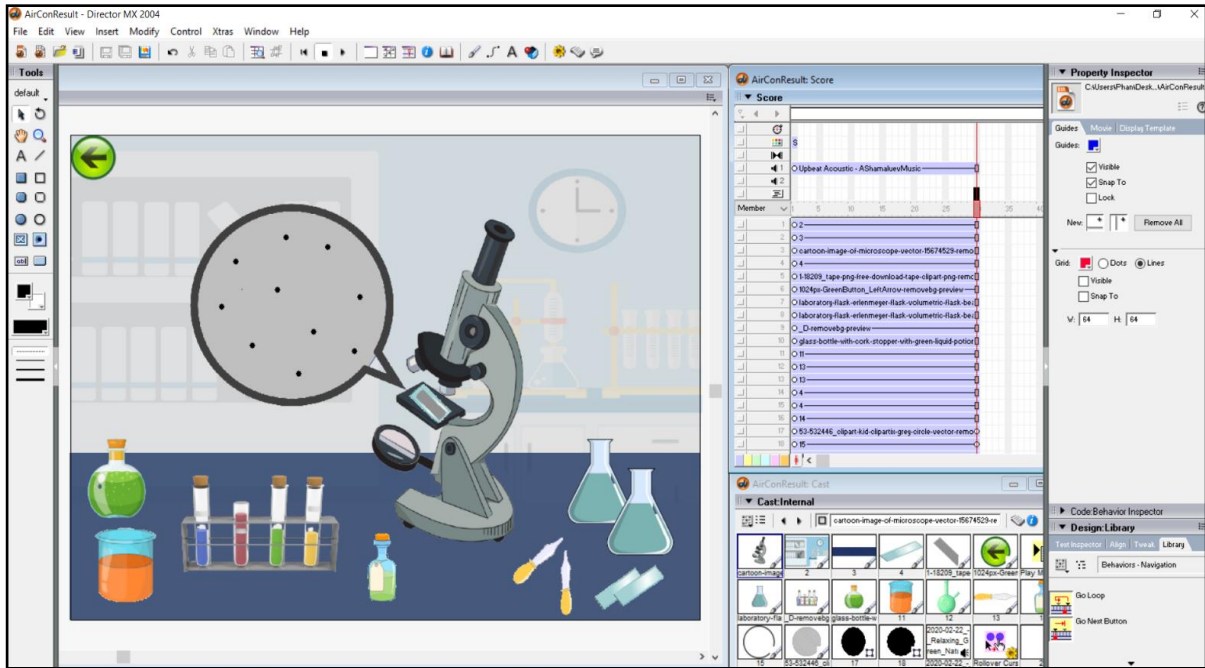
Figure 4.25 Screenshot of amount of pollutants when it placed in the air-conditioned room

Figure 4.25 shows the amount of pollutants when it placed in the air-conditioned room. The cellophane tape with the slide is placed under the microscope to observed. The cellophane tape has been enlarged to see the amount of pollutants. It shows that the cellophane tape contains very few particles. Hence, it can prove that the air-conditioned contains less dust and particles. Lastly, the top left button is a button which will link back to the previous page.
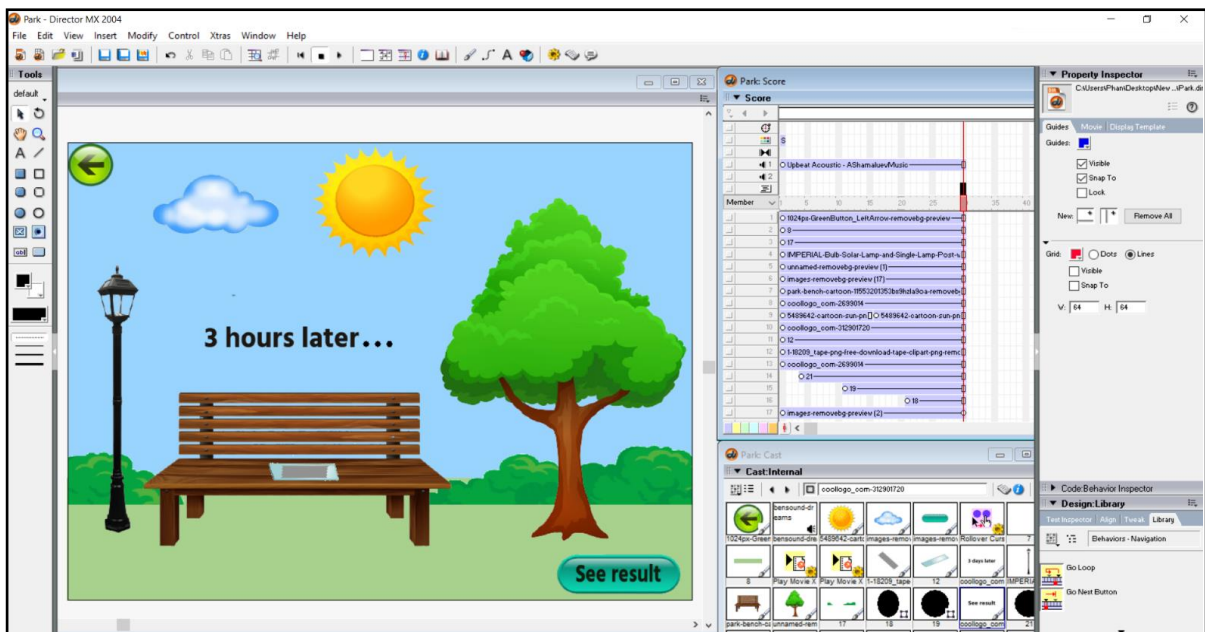
Figure 4.26 Screenshot of park

Figure 4.26 shows the environment that the user chooses in the experiment. It is a park and the weather are good. The cellophane tape with the slide is placed on the long chair in the park for 3 hours. User can see the result by clicking on the "See result" button. Lastly, the top left button is a button which will link back to the previous page.
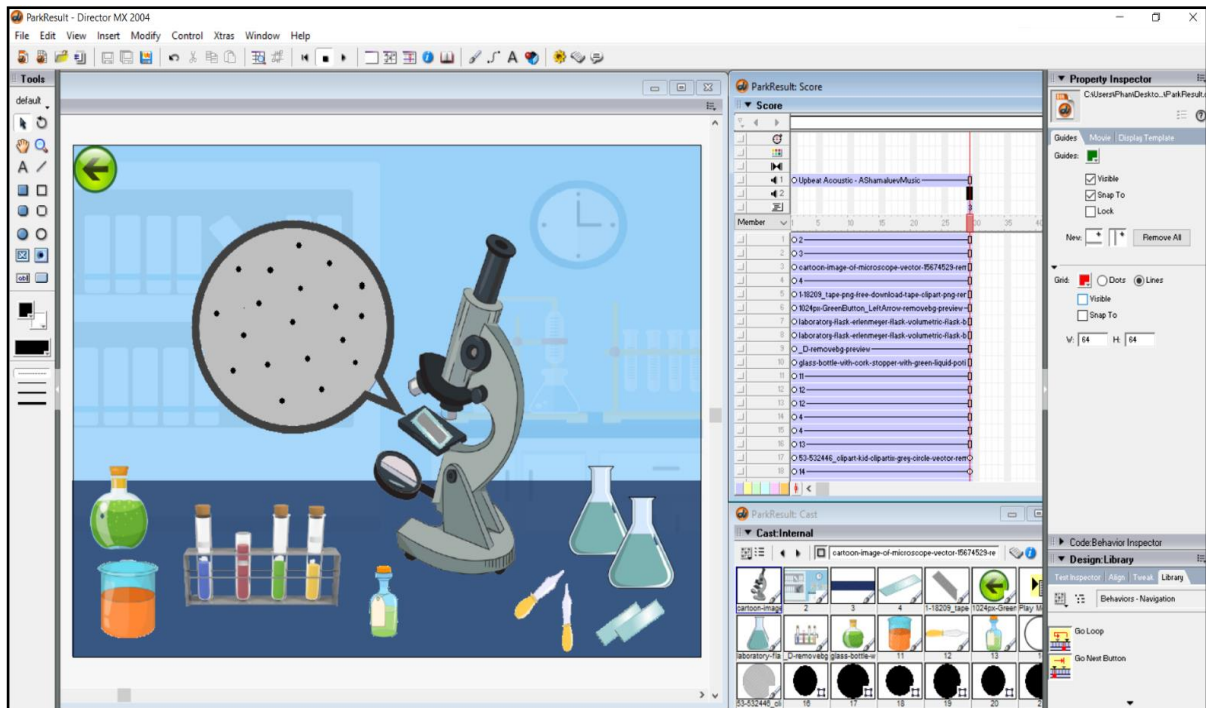
Figure 4.27 Screenshot of amount of pollutants when it placed in the park

Figure 4.27 is the screenshot of experiment note module design which shows the amount of pollutants when it placed in the park. The cellophane tape with the slide is placed under the microscope to observed. The cellophane tape has been enlarged to see the amount of pollutants. It shows that the cellophane tape contains more solid pollutants. Hence, it can prove that the air in an exposed area such as in the open field contains more particles than the air in the air-conditioned room. Lastly, the top left button is a button which will link back to the previous page.
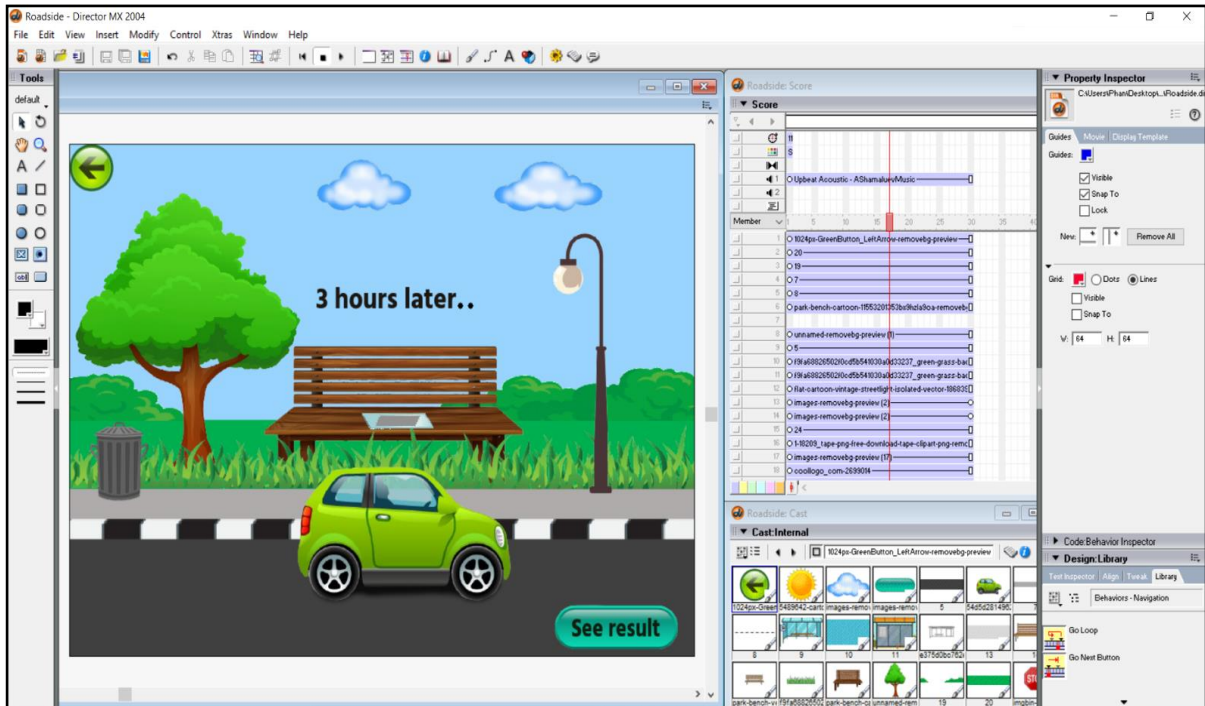
Figure 4.28 Screenshot of roadside

Figure 4.28 shows the environment that the user chooses in the experiment. It is a roadside with the car is driven on the road. The cellophane tape with the slide is placed beside the road for 3 hours. User can see the result by clicking on the "See result" button. Lastly, the top left button is a button which will link back to the previous page.
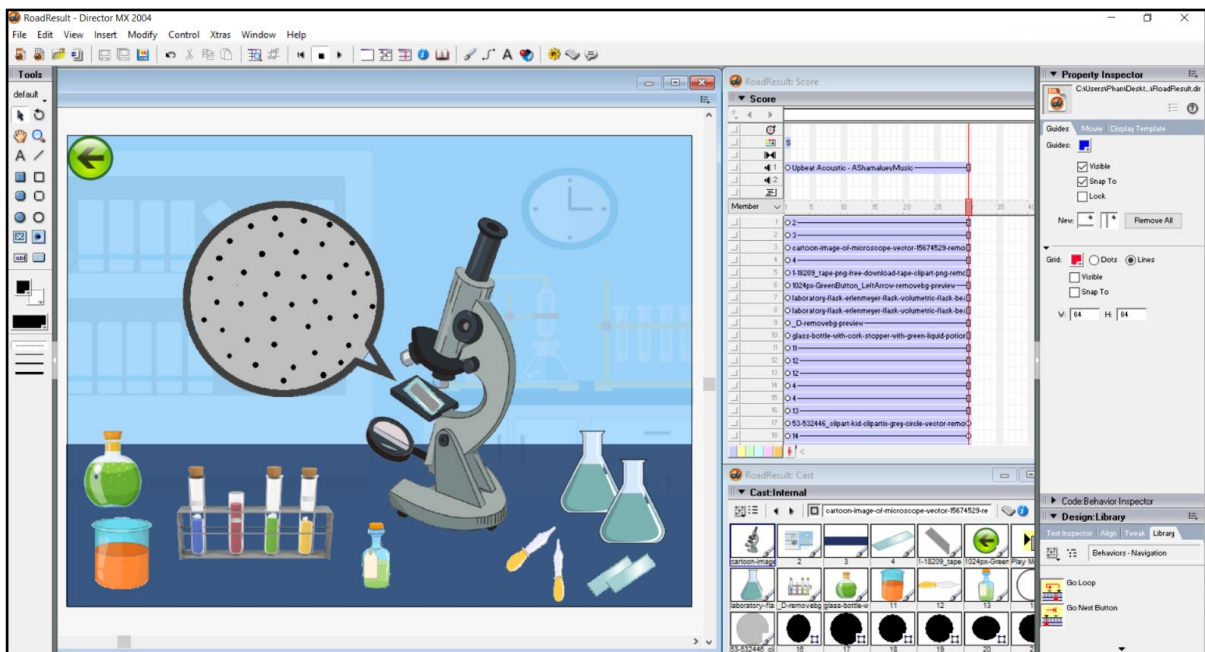
Figure 4.29 Screenshot of the amount of pollutants when it placed beside the road

Figure 4.29 shows the amount of pollutants when it placed beside the road. The cellophane tape with the slide is placed under the microscope to observed. The cellophane tape has been enlarged to see the amount of pollutants. It shows that the cellophane tape contains highest number of solid pollutants. Hence, it can prove that the exhaust fumes contain large number of particles and soot as a result of the combustion of fossil fuels in the car. Lastly, the top left button is a button which will link back to the previous page.
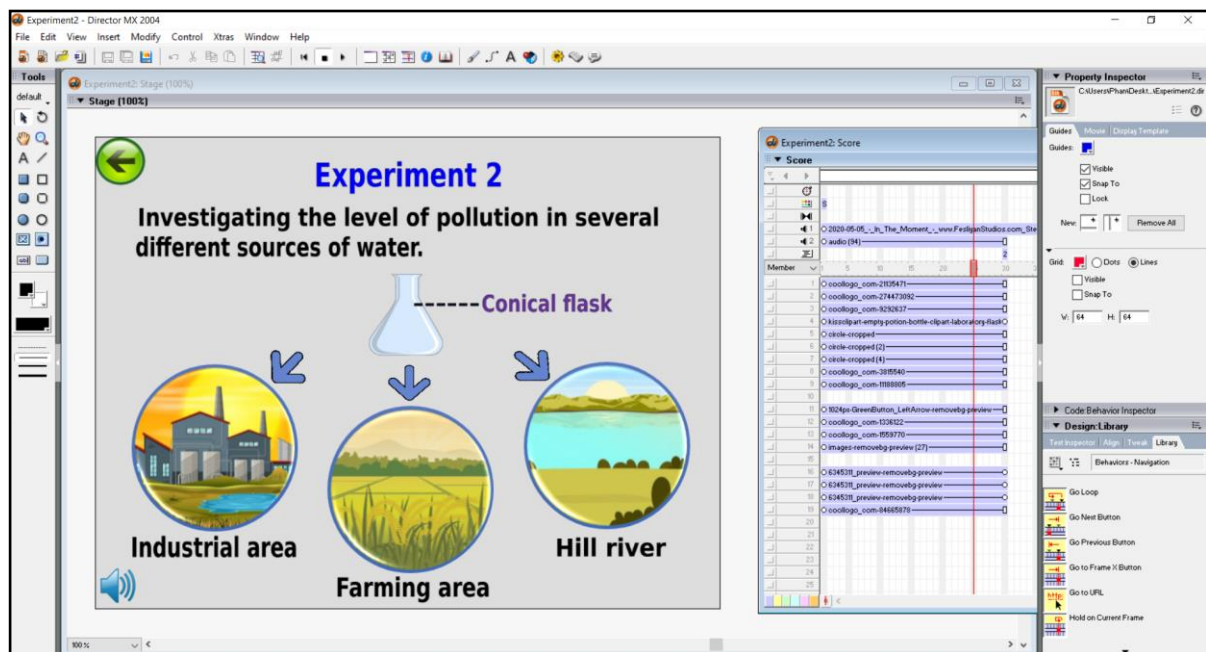
Figure 4.30 Screenshot of experiment 2

Figure 4.30 is the second experiment which investigate the level of pollution in several different sources of water. There have three buttons in experiment 2 which are industrial area, farming area and hill river. User can choose the environment that he would like to test by clicking on the button. After clicking on the button, it will link to the environment that the user chooses. Lastly, the top left button is a button which will link back to the home page of the experiment note module.
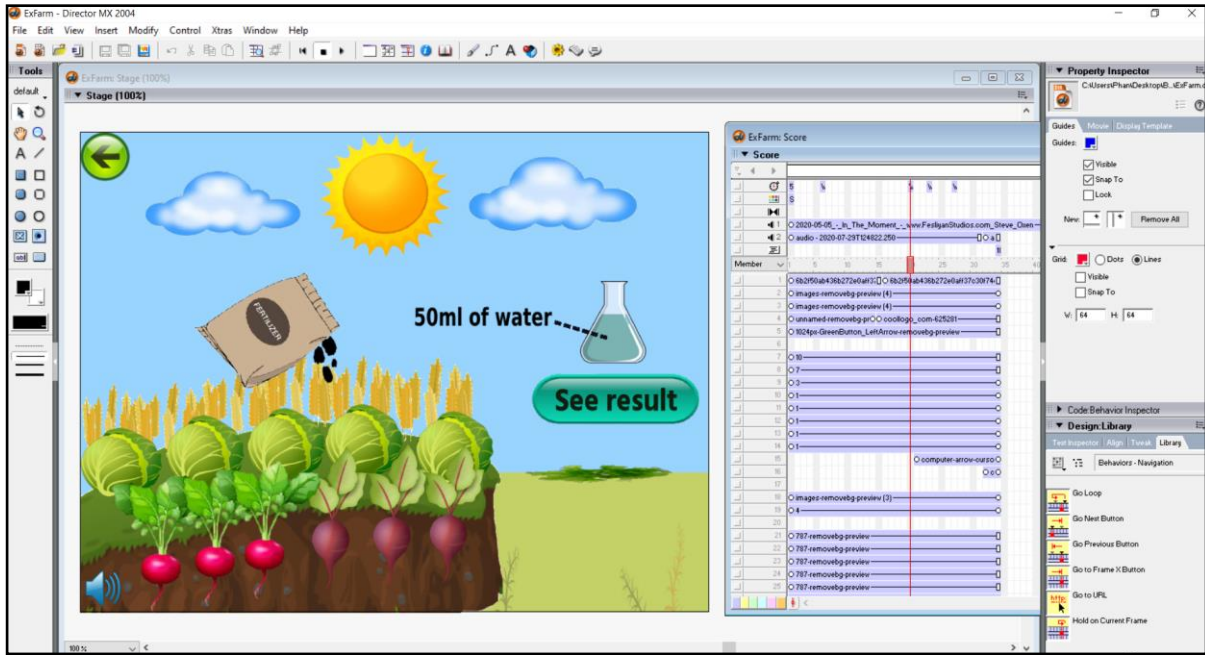
Figure 4.31 Screenshot of farming area

Figure 4.30 shows that the 50ml of water took from the lake of water in the farming area and the water is put into the conical flask. The water will be tested in the laboratory. User can click on the result button to see the level of pollution of the water in the conical flask. User also can click on the sound button to turn off the sound. Lastly, the top left button is a button which will link back to the previous page.
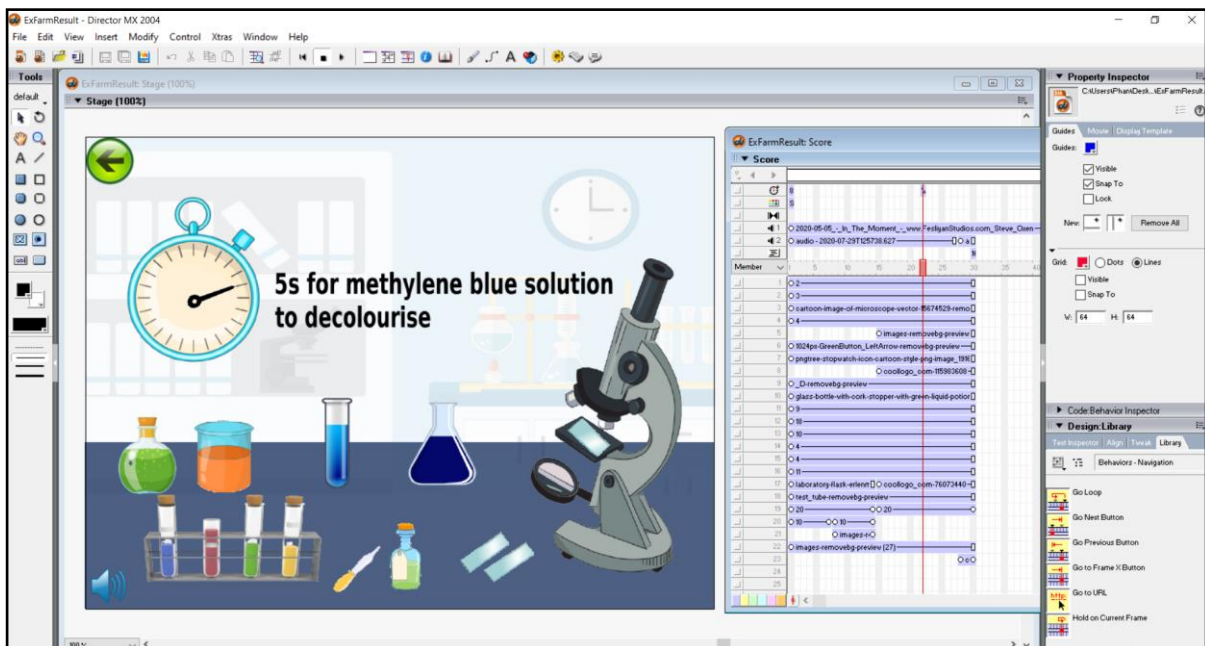
Figure 4.32 Screenshot of the time taken for methylene blue solution to decolourise

Figure 4.31 shows the time taken for methylene blue solution to decolourise. The stopwatch shows that the methylene blue solution took 5 seconds to decolourise. The colour of the water in the conical flask will changed to blue colour when the methylene blue solution drops into the water. Lastly, the top left button is a button which will link back to the previous page.

4.2.2.4 Quiz module design
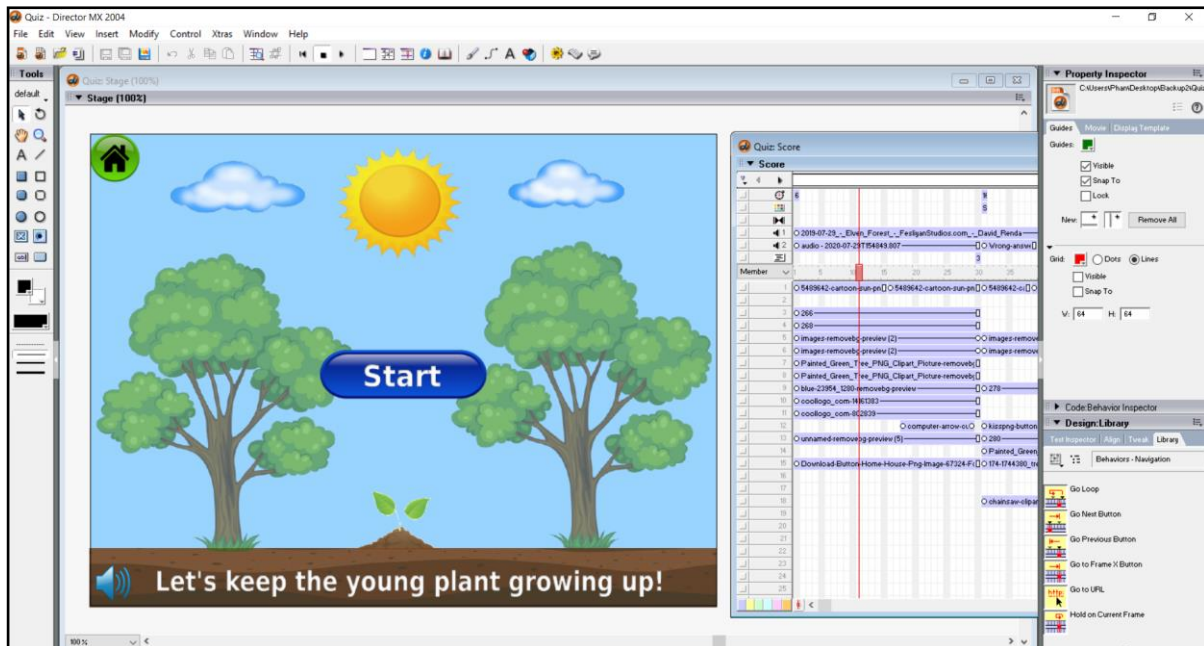
Figure 4.33 Screenshot of quiz's main menu

Figure 4.31 shows that there is a start button in the middle of the page and user need to click on the start button to start the quiz in the quiz module. The young plant is put between the left and right big tree so that user can easier to see the young plant growing up. After click on the start button, it will direct user to answer the first question.
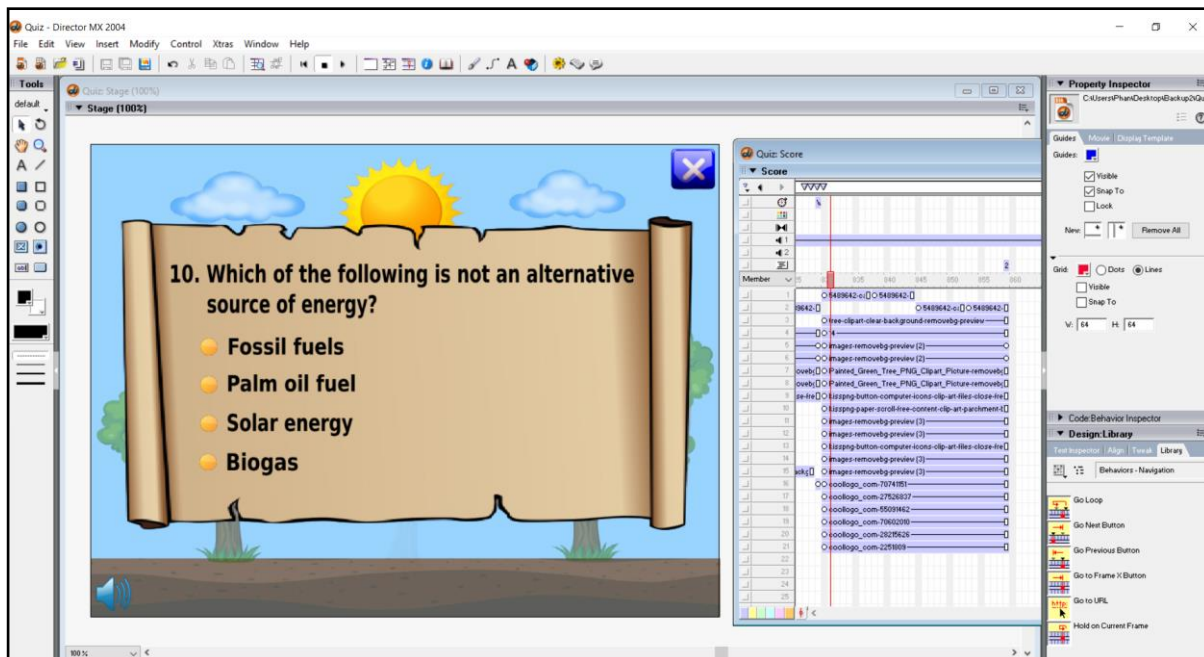
Figure 4.34 Screenshot of question 10
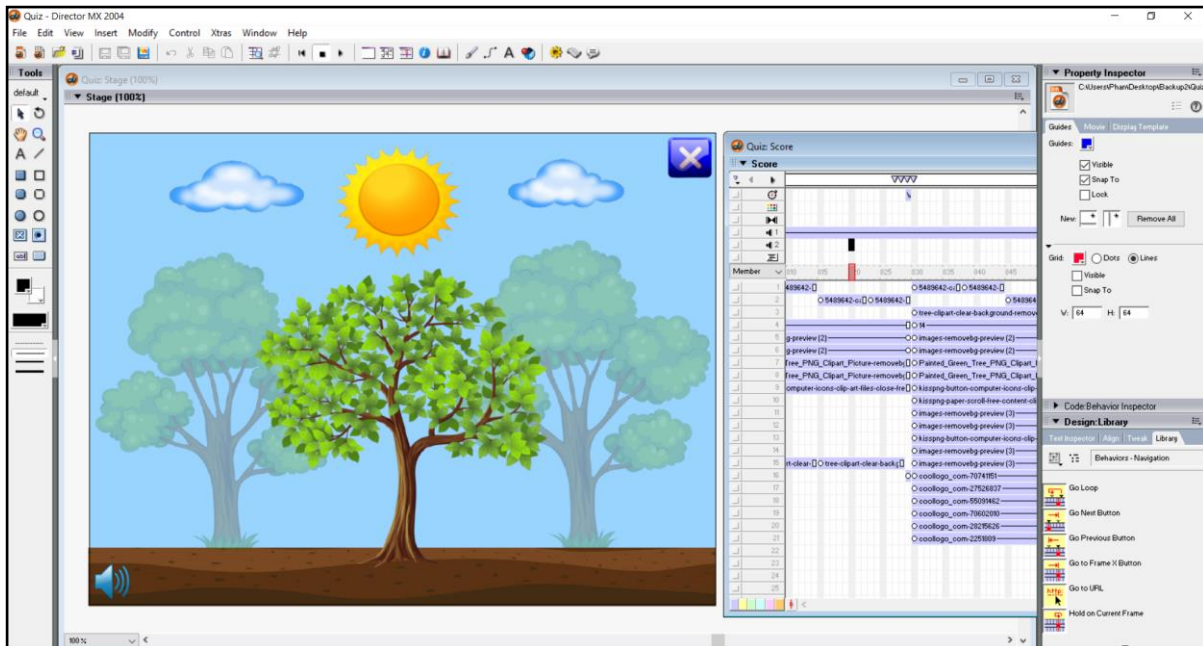
Figure 4.35 The plant is growing up when user answer correctly
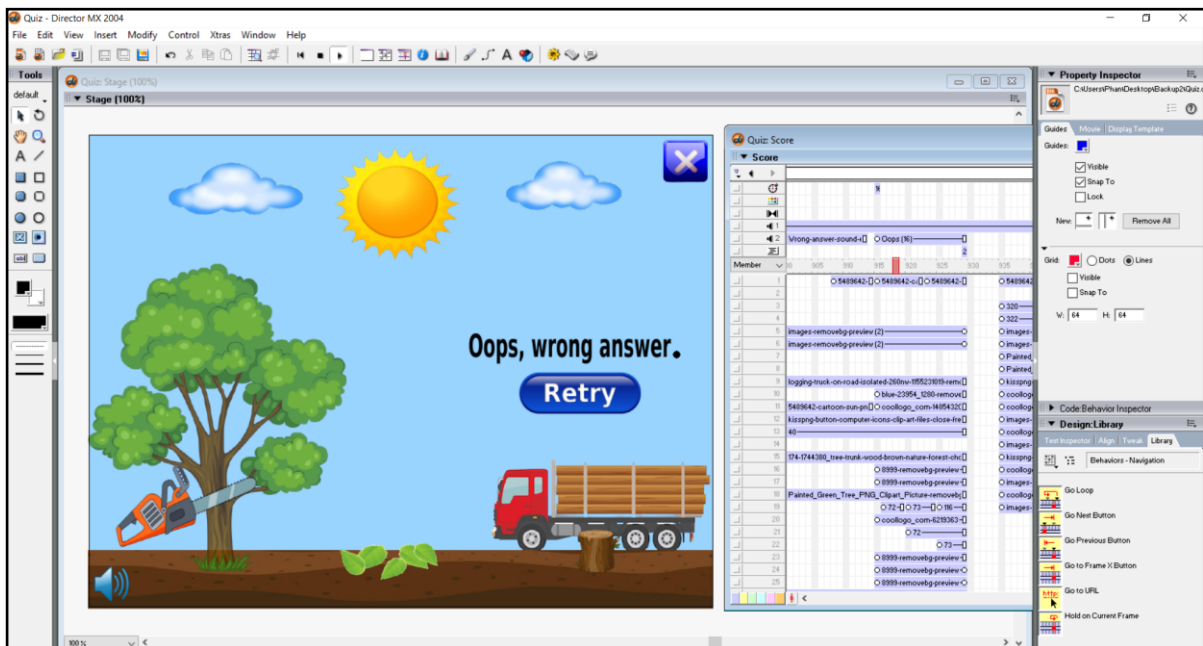
Figure 4.36 The plant died when user answer wrongly

Figure 4.32 shows that the screenshot of question and there have 10 questions in the quiz module. Figure 4.33 shows that when user answer correctly, the tree will be growing up. Figure 4.34 shows that user need to retry to answer the questions again when they answer wrongly. When the user answers all question correctly, the young plant will eventually become a big tree. The tree is animated so that user can see the effect of the tree when they answer the questions correctly. User also can click on the top right button to go back to the home page of the quiz.
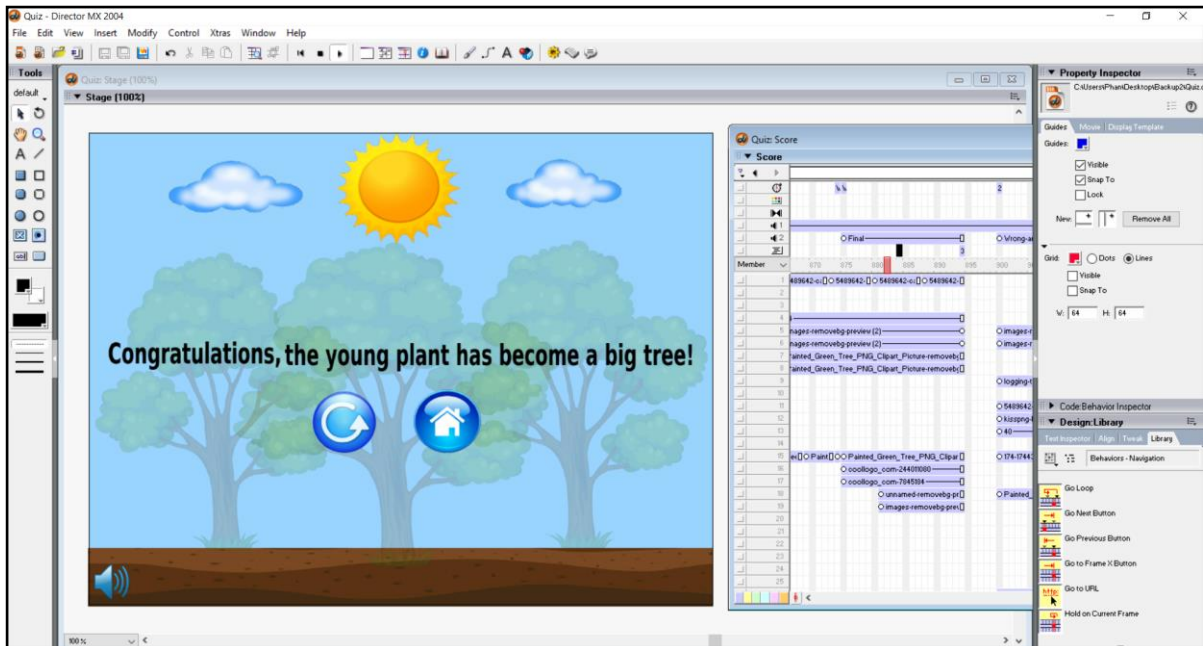
Figure 4.37 Screenshot of successfully answer all the questions

Figure 4.35 shows that after successfully answer all the question, the young plant will become a big tree. Then, it will show the two buttons which are redo button and home quiz button. User can redo the quiz by clicking the redo button and they can go back to the home page of the quiz by clicking the quiz's home button.

4.2.2.5 Past year paper module design
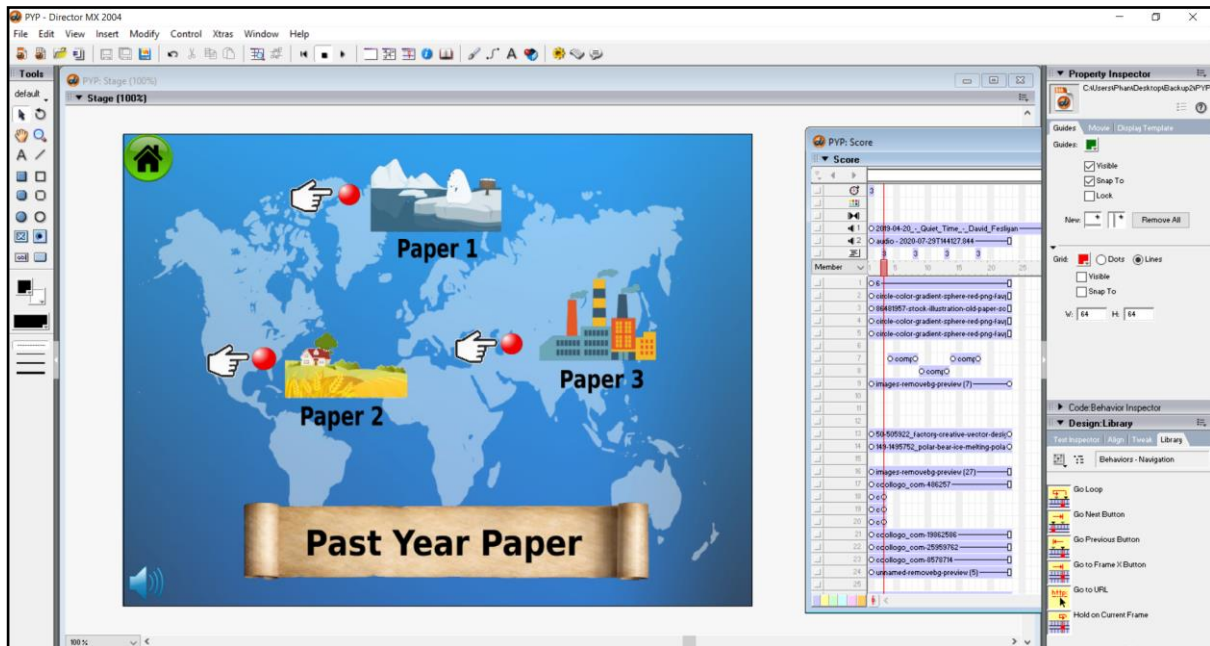
Figure 4.38 Screenshot of past year paper main menu

Figure 4.36 shows that there are 3 buttons in the main page of past year paper module which represents paper 1, paper 2 and paper 3. User can click on the paper 1 button and it will direct user to answer the paper 1 questions. On the other hand, user can click on the paper 2 button which will direct user to answer the paper 2 questions. Lastly, user need to click on the paper3 button and they can answer the paper 3 question in this past year paper. The top left home button is link back to the main menu of edutainment system.
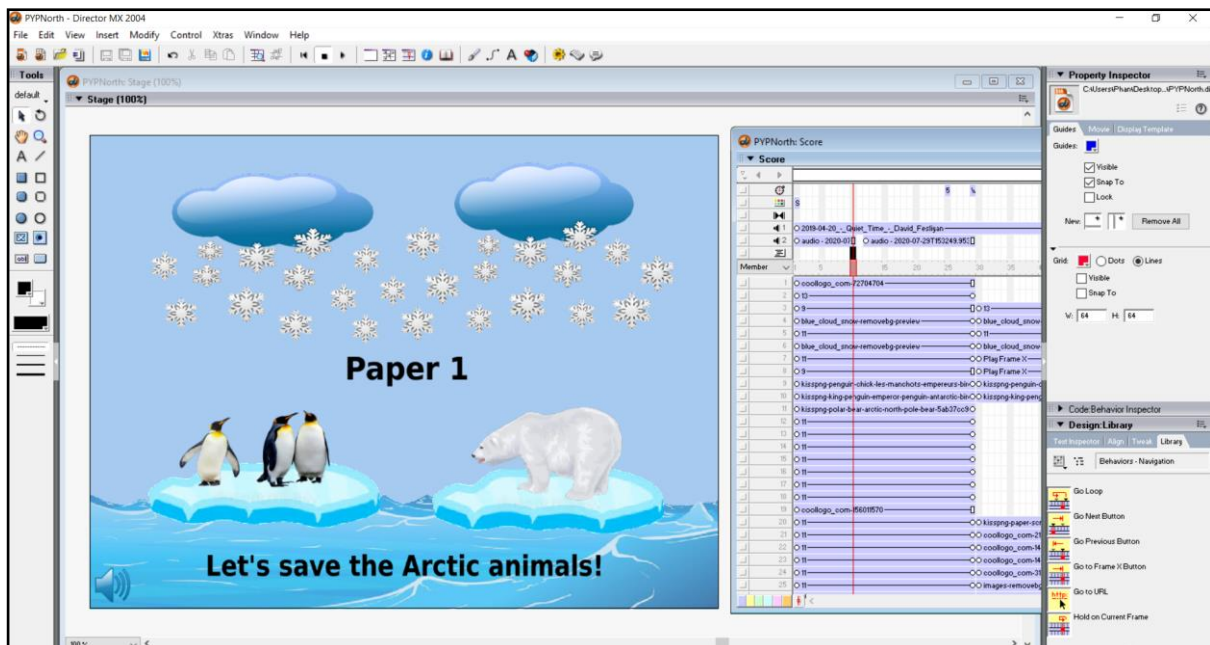
Figure 4.39 Screenshot of paper 1
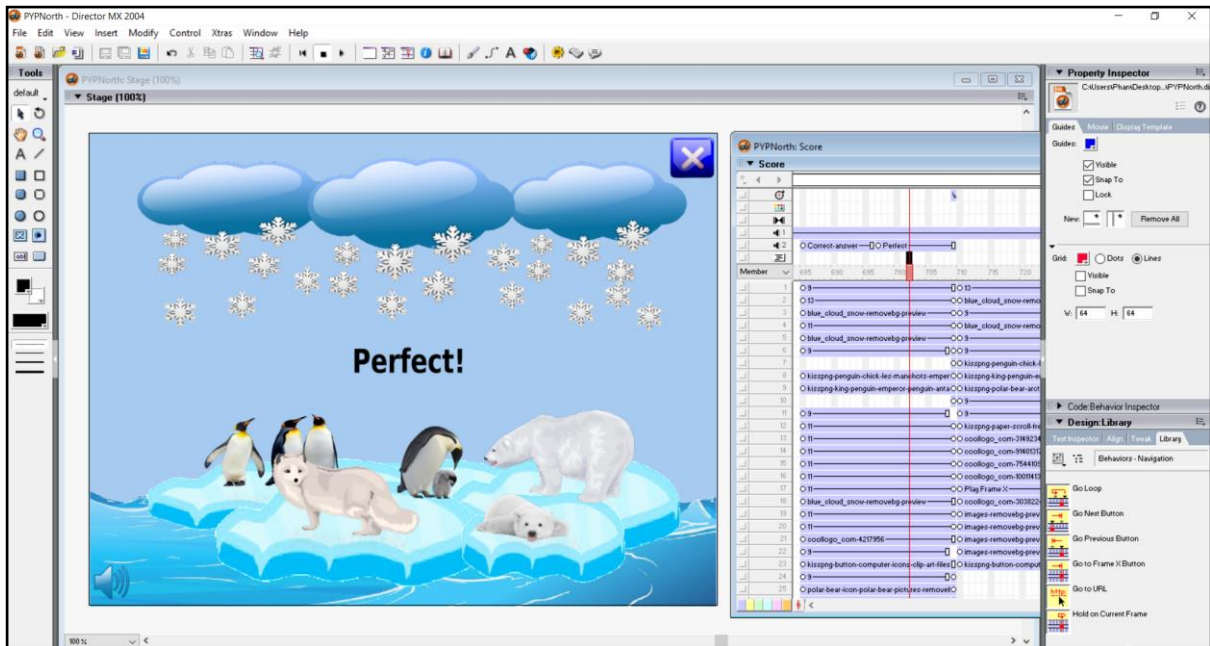
Figure 4.40 Screenshot when user answer the question correctly
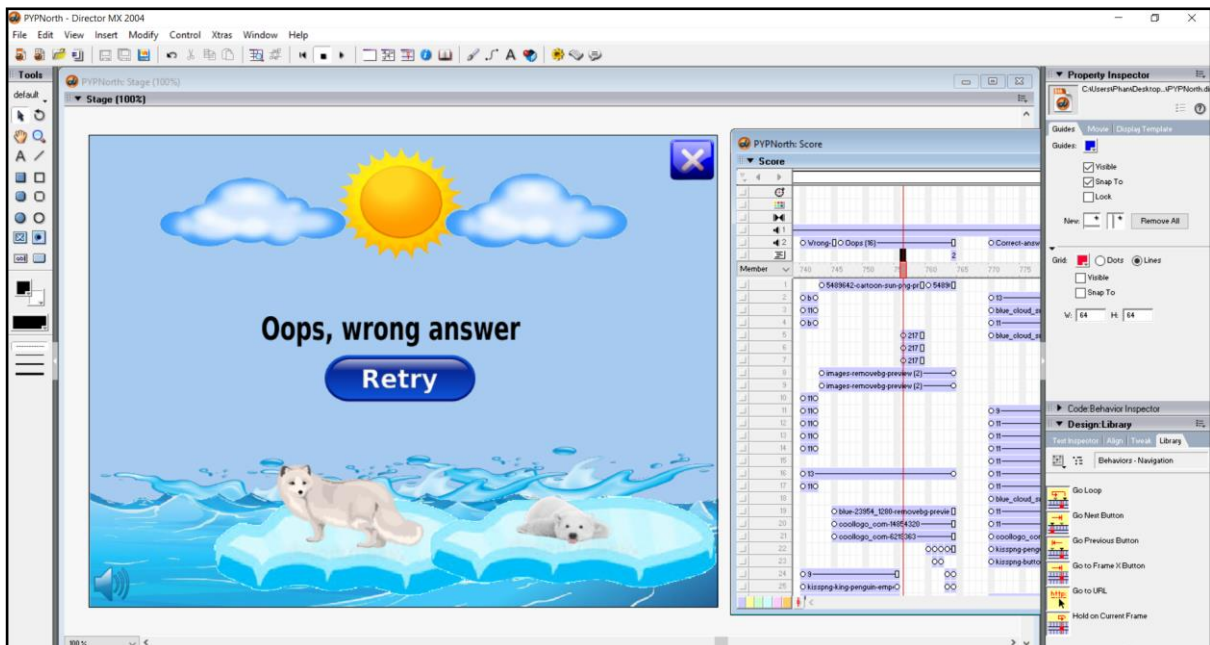
Figure 4.41 Screenshot when user answers the question wrongly

Figure 4.37 shows that the screenshot of question and there are 10 questions in the paper 1 and Figure 4.38 shows that once the user answers the question correctly, the north pole will be snowing and it will save the Arctic animals. Then, user can continue to answer the next question. Figure 4.39 shows that the sun will be coming out and the ice in the north pole will melting when the user answer wrongly. User need to click on the retry button to answer the question again. User can click on the top right button to go back to the past year paper's main menu and click on the sound button to turn off the background music.
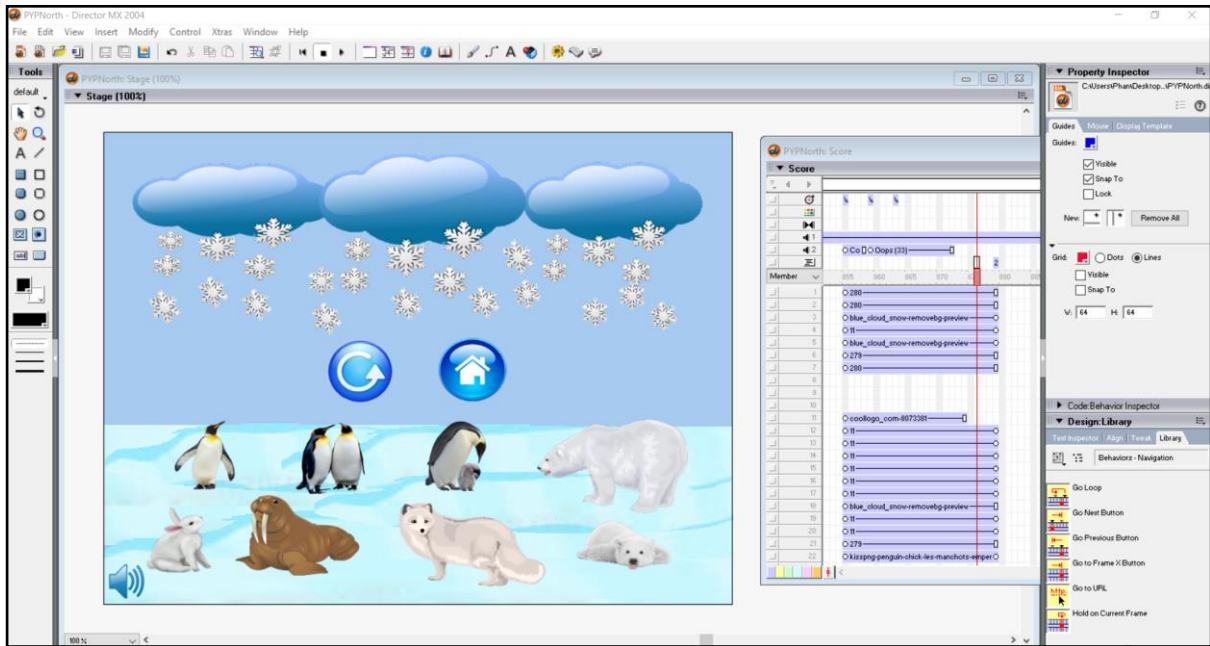
Figure 4.42 Screenshot when user successfully answer all the question

Figure 4.40 shows that after successfully answer all the question, the Arctic animals are able to be saved from the melting of ice in the North pole. It will show the two buttons which are redo button and home button. User can redo the paper 1 by clicking the redo button and they can go back to the home page of the past year paper module by clicking the home button.
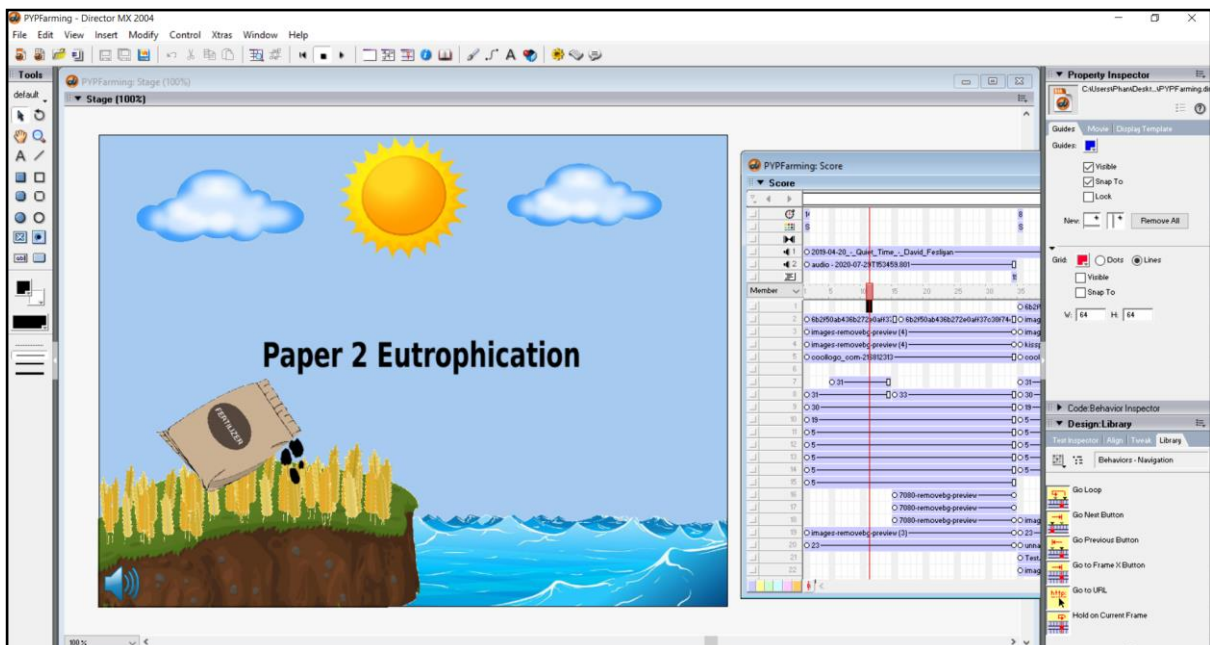
Figure 4.43 Paper 2
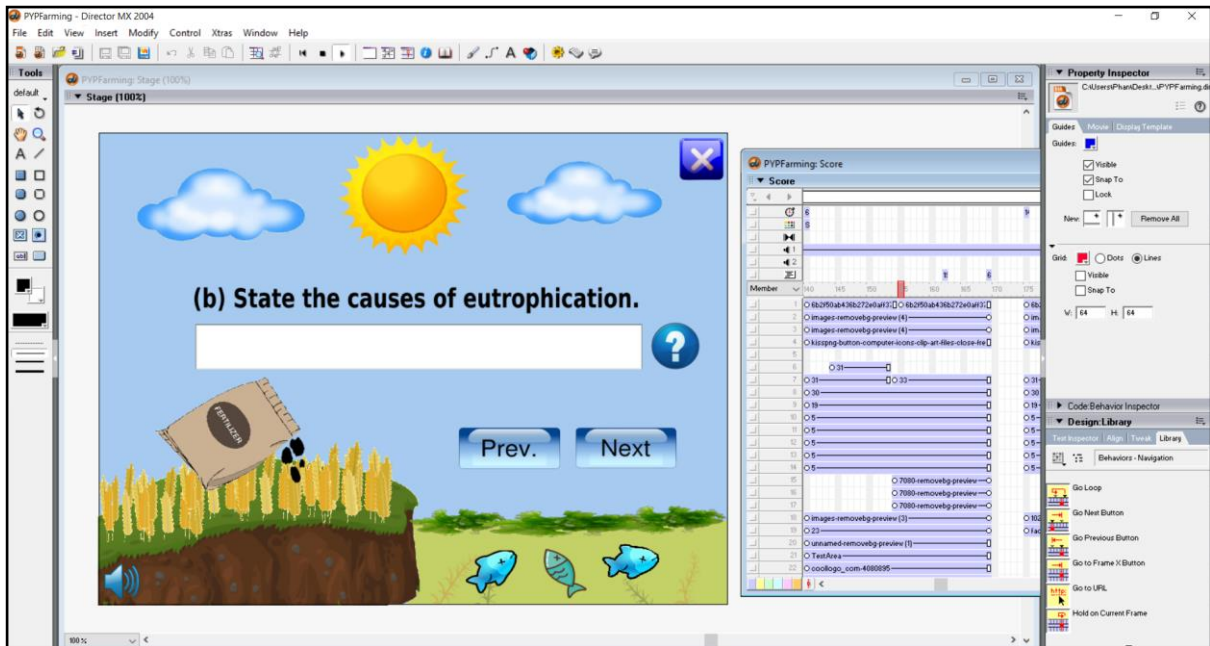
Figure 4.44 Question of paper 2
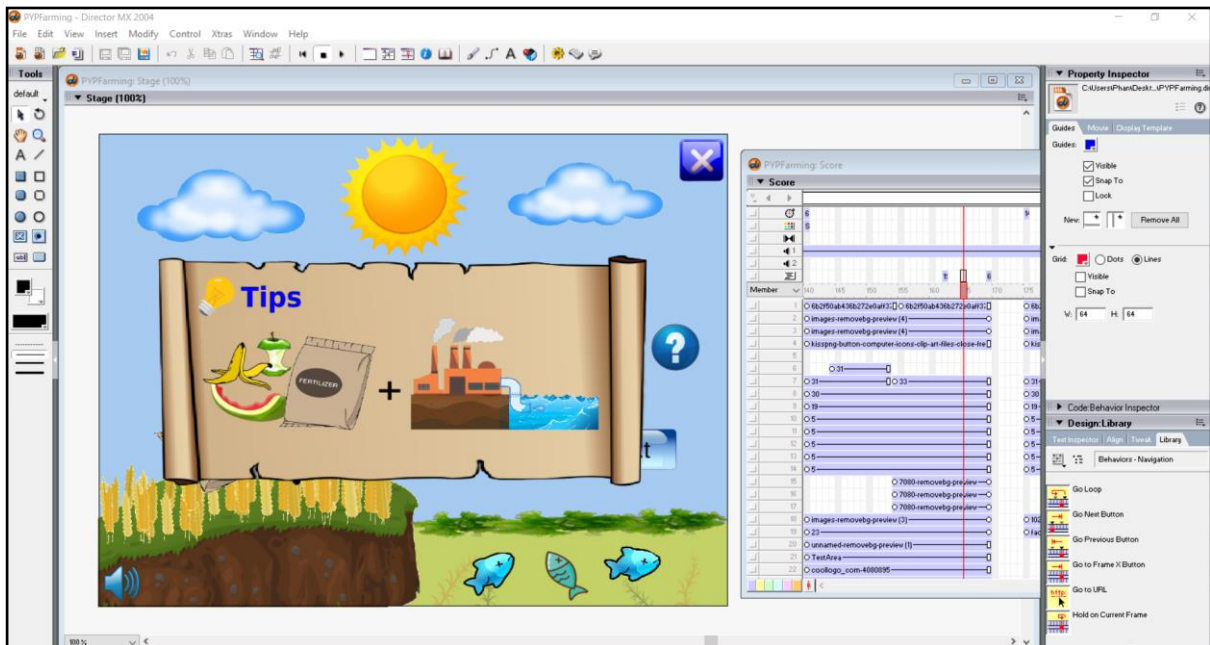
Figure 4.45 Tips of question when user hover on the question mark in paper 2

Figure 4.41 shows the paper 2 after user click on the paper 2 button in the past year paper's main menu. Figure 4.42 shows the question of paper 2 which the user can type in their answer in the text area and they can hover on the button of question mark to see the tips in Figure 4.43. User also can click on the next button to go the next question and click on the previous button to go back to the previous question in paper 2.
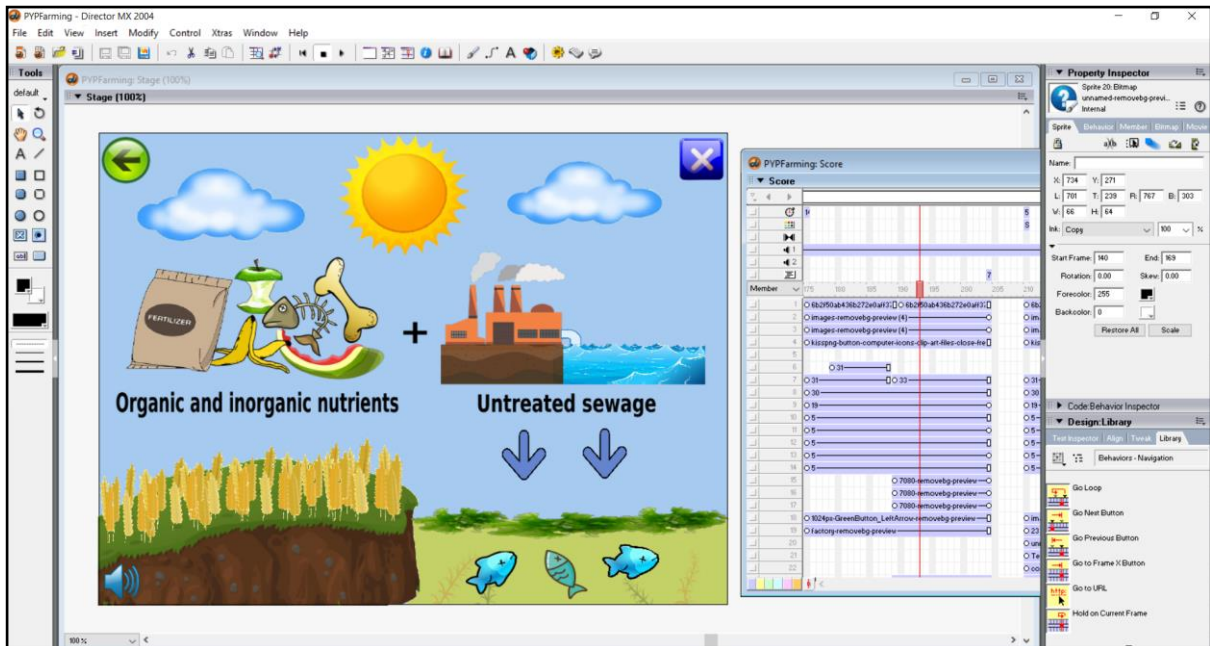
Figure 4.46 Answer of the question in paper 2

If the users really do not know how to answer the question, they can click on the question mark button and it will show the answer of the question in Figure 4.44. After that, user need to click on the top left button to go back to the questions. User can click on the exit button on the top right button to exit the paper 2 questions and click on the sound button to turn off the sound.
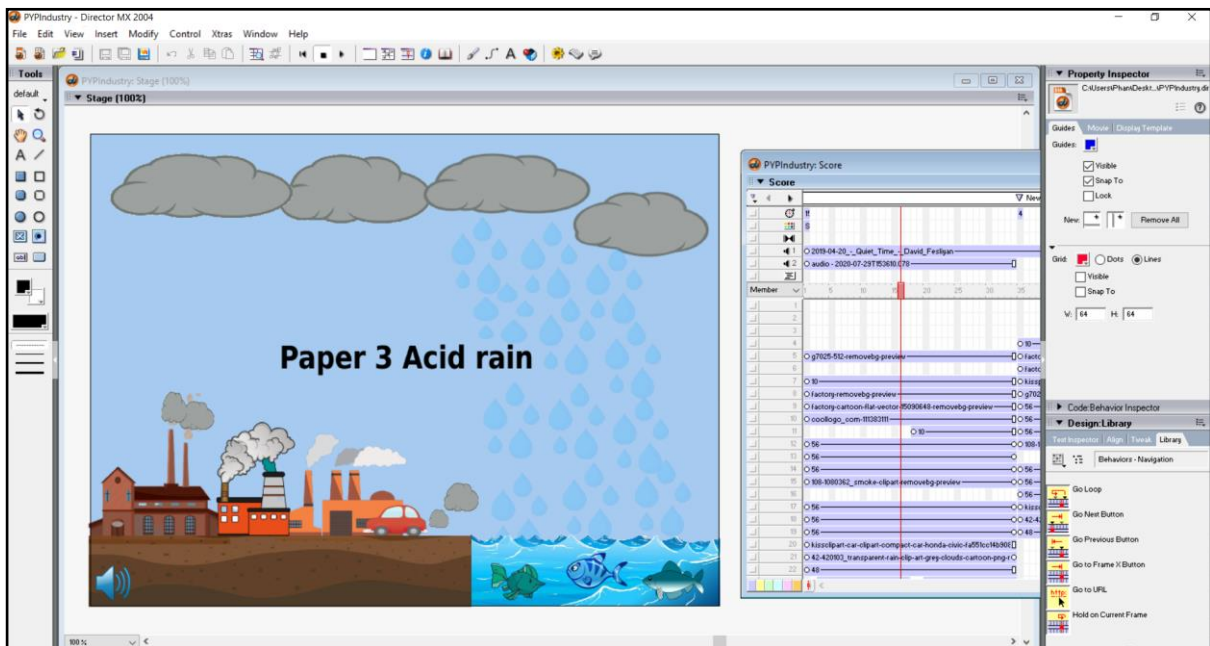
Figure 4.47 Paper 3
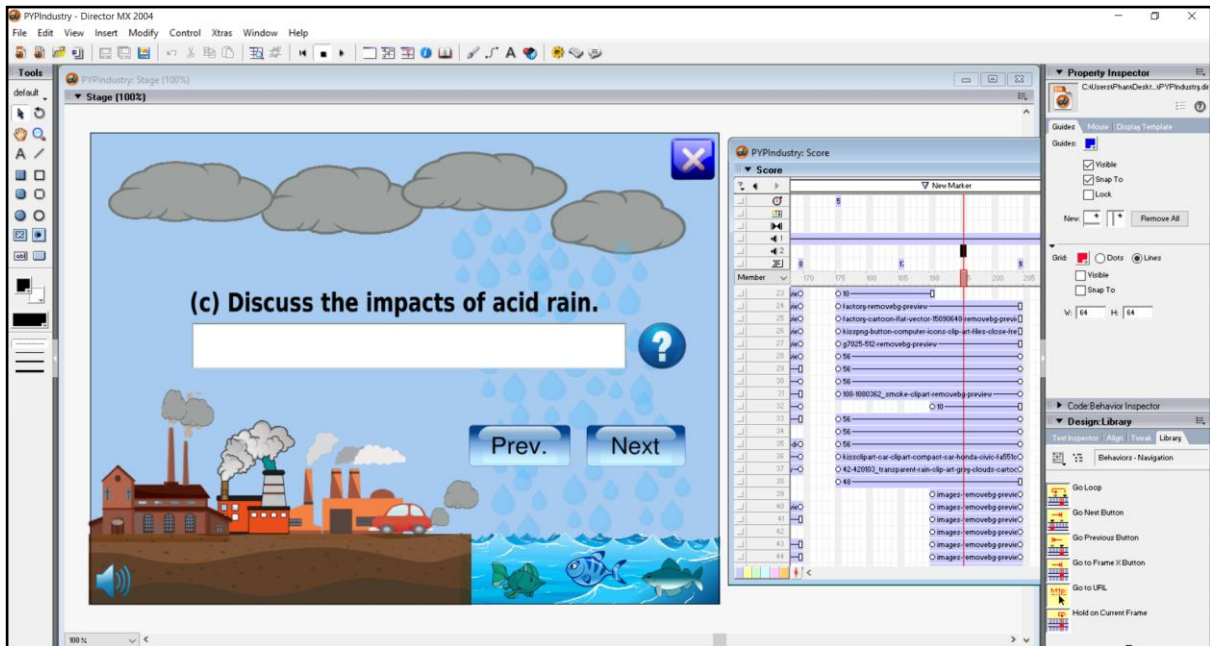
Figure 4.48 Question in paper 3
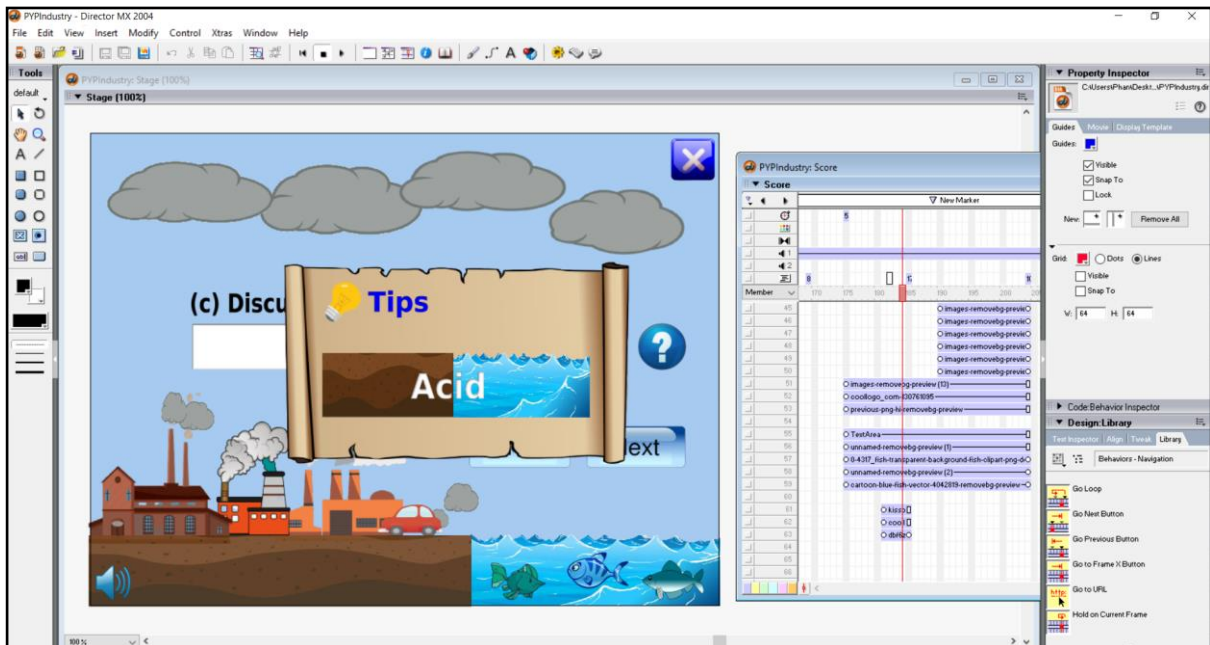
Figure 4.49 Tip of the question when user hover on the question in paper 3

Figure 4.45 shows the paper 3 after user click on the paper 3 button in the past year paper's main menu. Figure 4.46 shows the question of paper 3 which the user can type in their answer in the text area and they can hover on the button of question mark to see the tips in Figure 4.47. User also can click on the next button to go the next question and click on the previous button to go back to the previous question in paper 3.
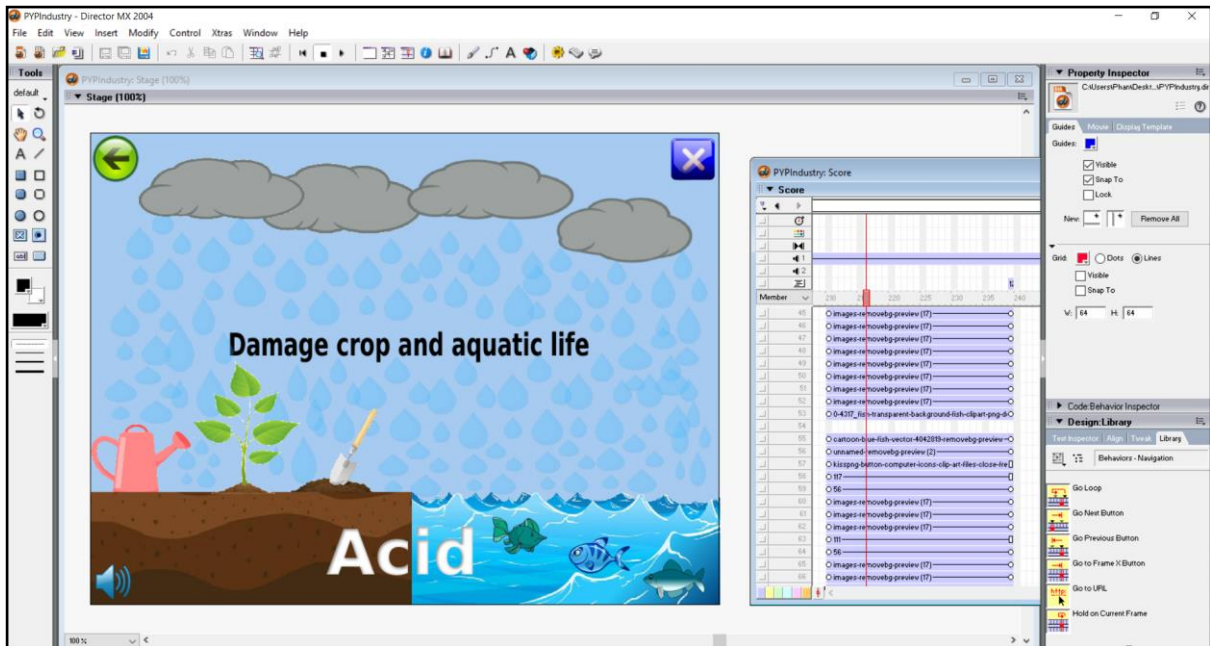
Figure 4.50 Answer of the question in paper 3

If the users really do not know how to answer the question, they can click on the question mark button and it will show the answer of the question in Figure 4.48. After that, user need to click on the top left button to go back to the questions. User can click on the exit button on the top right button to exit the paper 3 questions and click on the sound button to turn off the sound.

4.2.2.6 Game module design
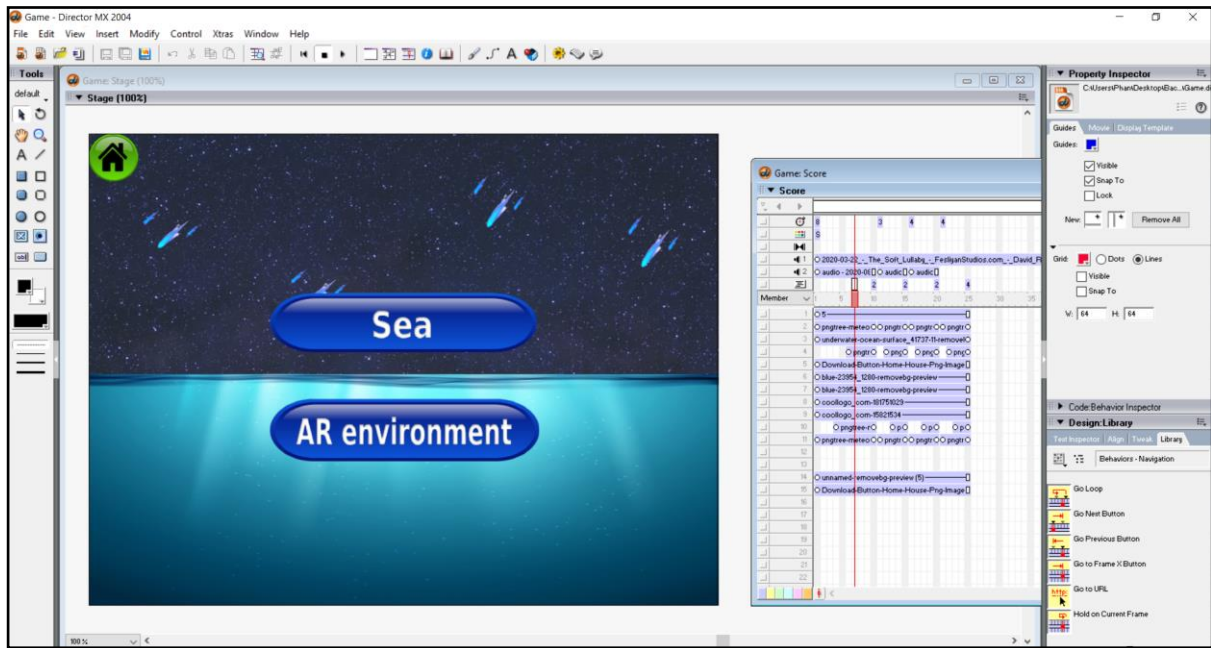
Figure 4.51 game module

Figure 4.49 shows that there are two buttons in the middle page of game module. The first button is the sea which will direct user to the sea game. The second button is the AR environment which will direct user to view the AR picture of nature environment. User can click on the top left button to go back to the main menu of multimedia courseware.
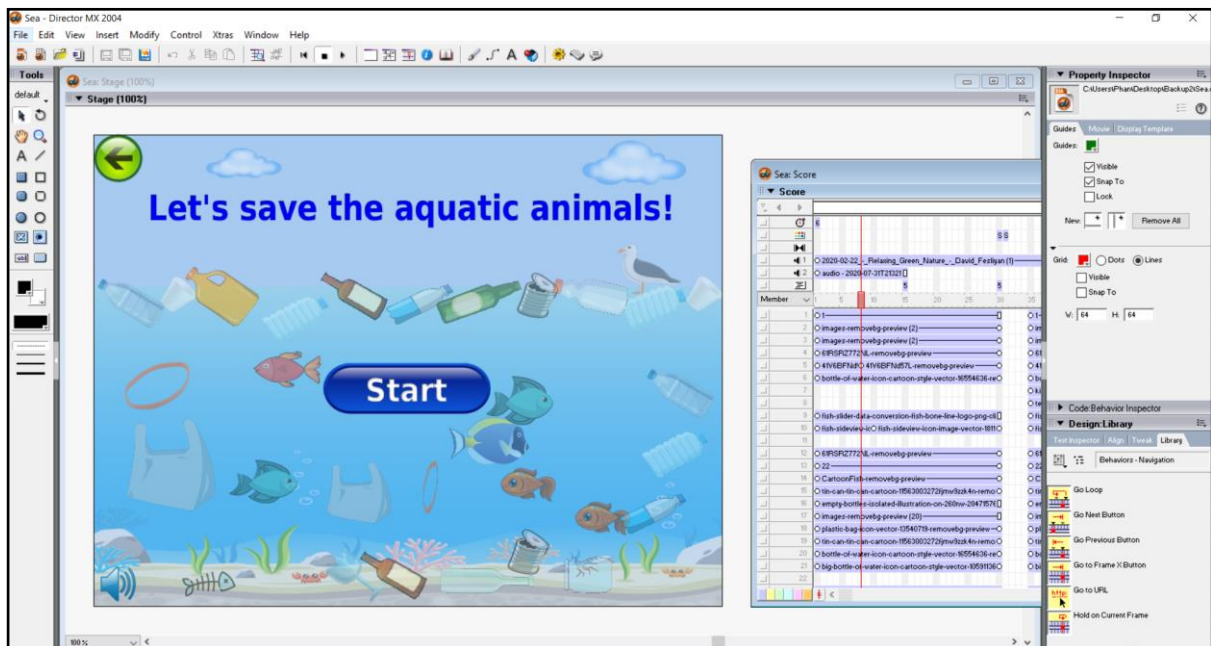
Figure 4.52 Sea game
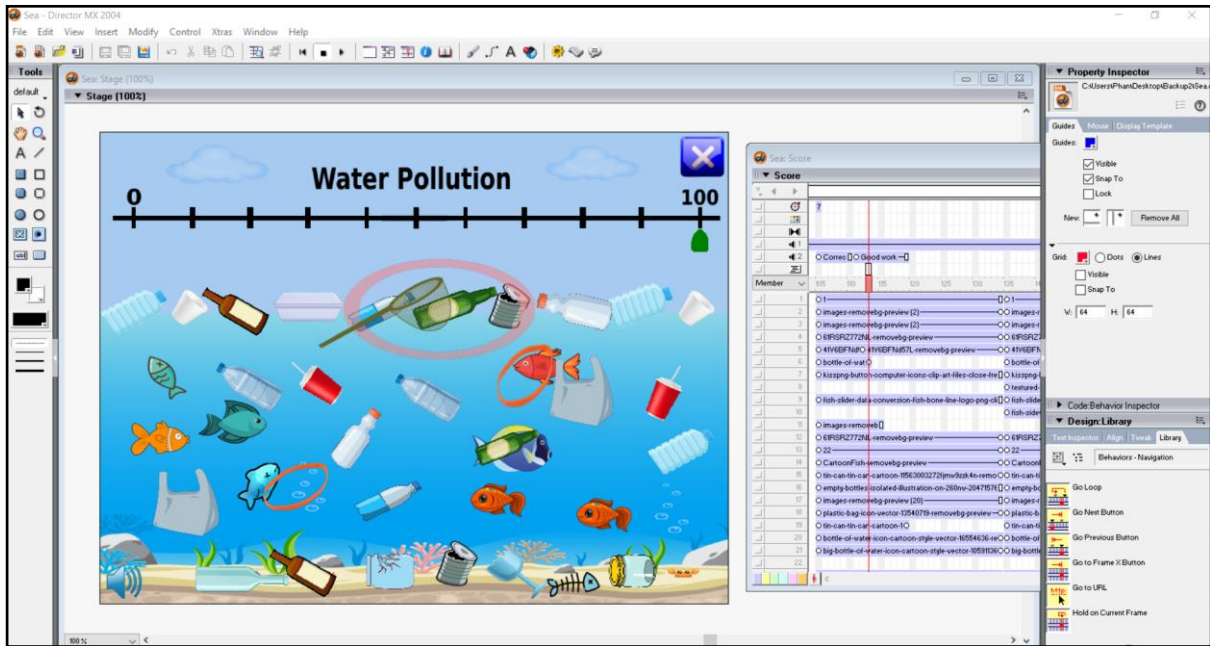
Figure 4.53 Rubbish are collected in the sea when the question answers correctly
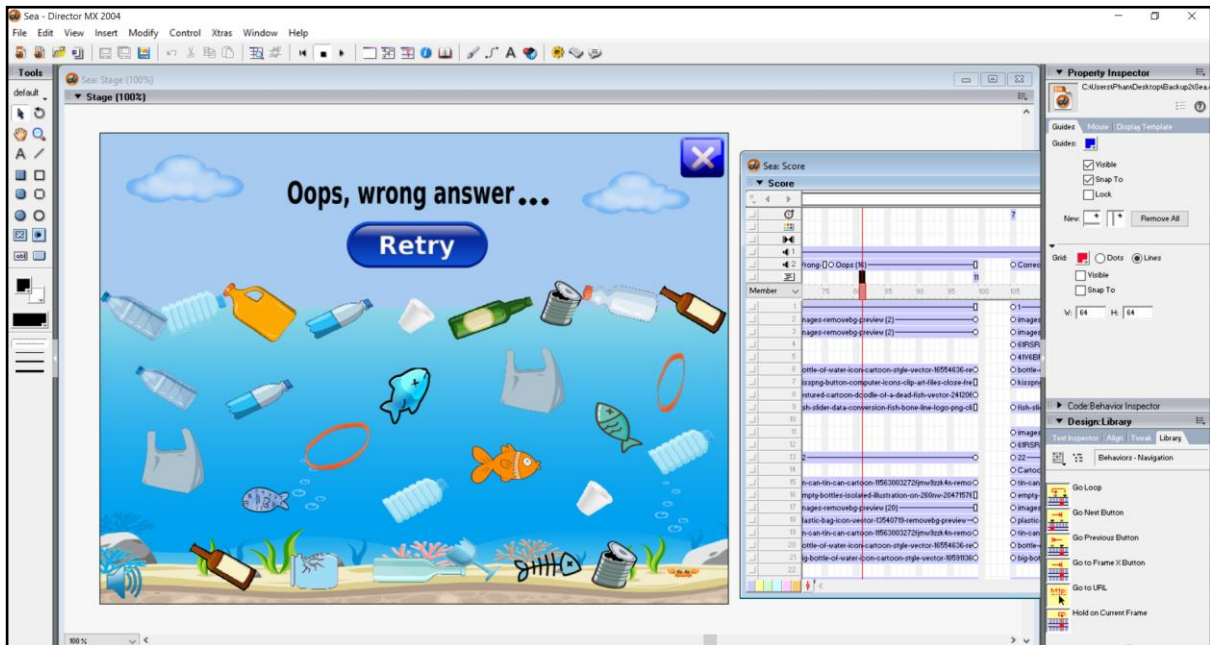
Figure 4.54 The fishes died when the user answers incorrectly

Figure 4.50 shows that there is a start button for the user to start the game when the user clicks on it. There are 10 questions in the sea game and user need to answer the 10 questions in the sea game to save the aquatic animals from the dirty sea. Figure 4.51 shows that once the user can answer the question correctly, the rubbish in the sea will be collected and the water pollution will be reduced. However, the fishes will die in the dirty sea when the user answer incorrectly which showed in Figure 4.52.
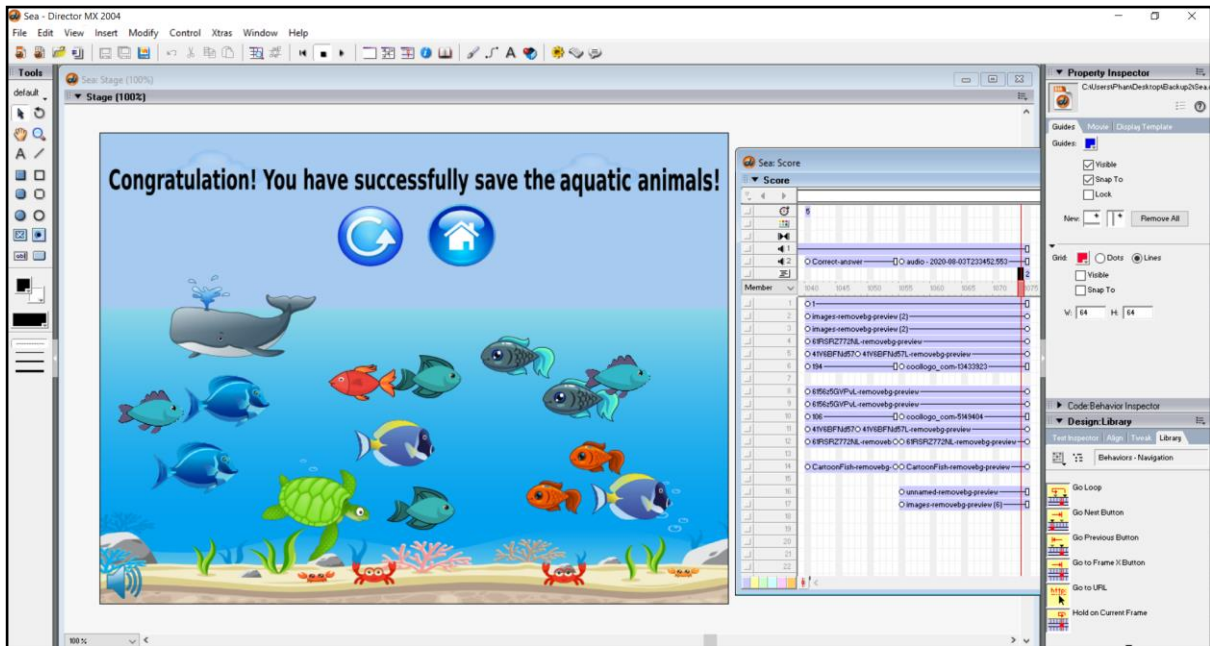
Figure 4.55 The sea becomes clean and the aquatic animals are saved

Figure 4.53 shows that the sea becomes clean and the aquatic animals are successfully saved from the higher pollution of sea when the user answers all the questions correctly. User can click on the replay button to replay the sea game and click on the sea game's home button to go back to the home page of the game module. User also can click on the sound button to turn off the sound.
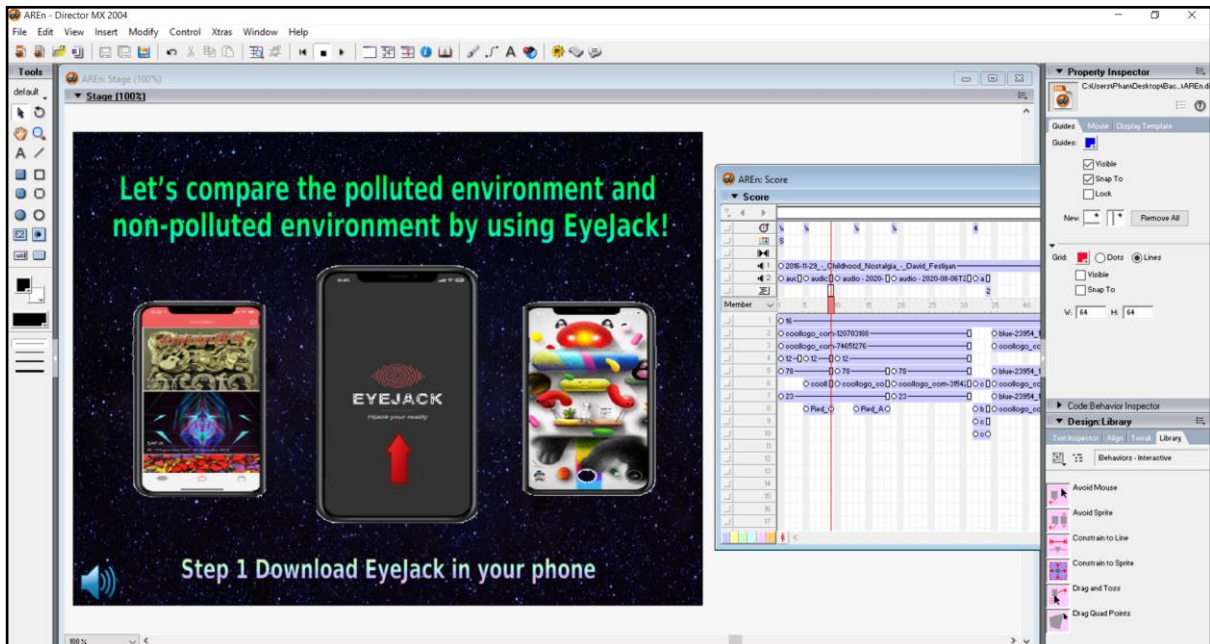
Figure 4.56 User can play the AR environment by downloading EyeJack

Figure 4.56 shows the AR environment game of the game module which compare the polluted environment and non-polluted environment by using EyeJack application. The first step of playing this game is downloading the EyeJack application in the mobile. Then, user need to scan on the QR code to view the AR images.
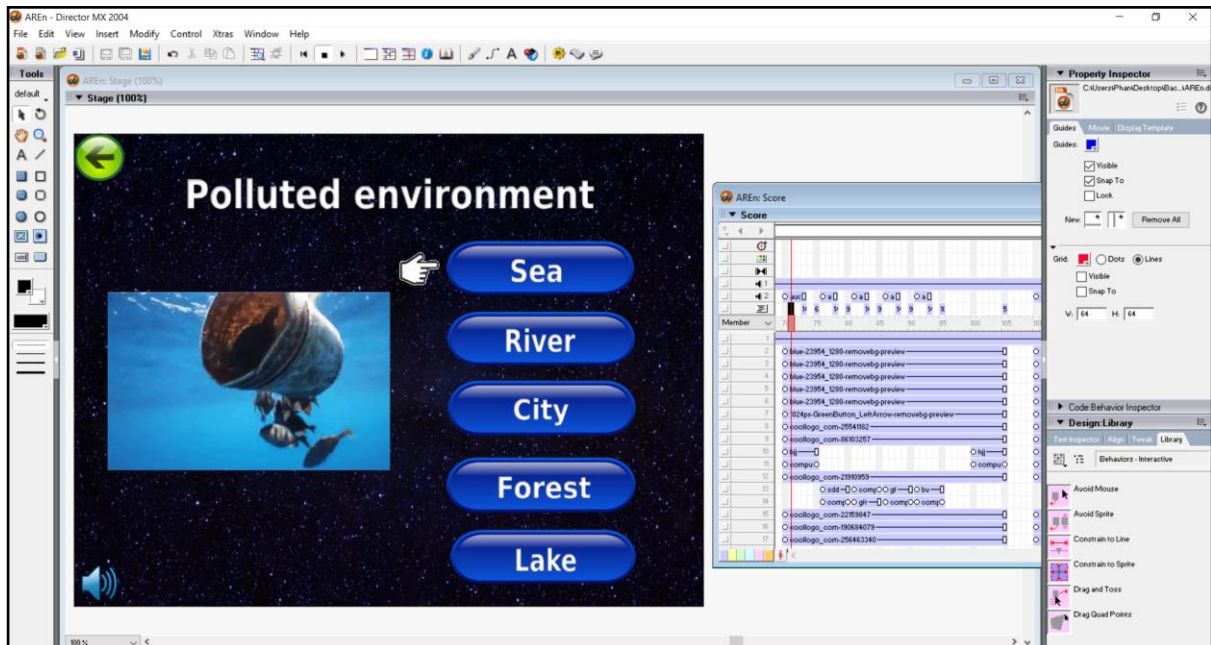
Figure 4.57 Polluted environment
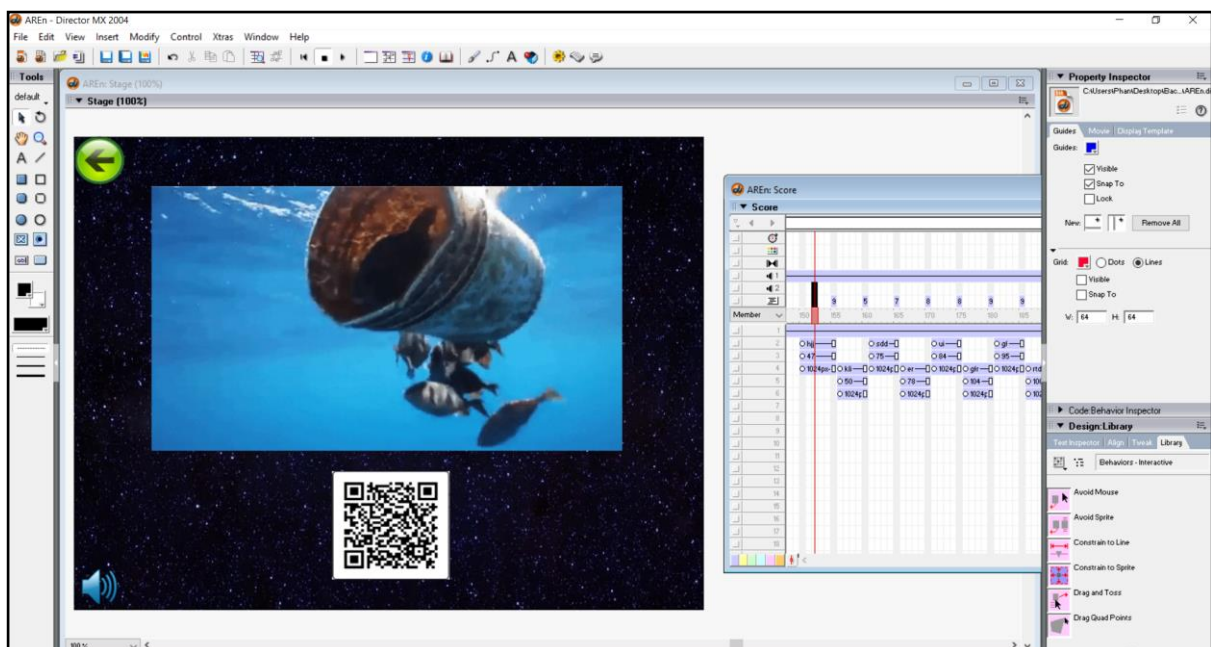
Figure 4.58 Scanning on the polluted sea image

Figure 4.57 shows that the user can view the AR polluted environment by clicking on the buttons which are sea, river, city, forest and lake. After click on the button, it will direct the user to the AR images which he wants to view. Then, user need to scan the QR code to view the AR images in Figure 4.58. After viewing it, user can click on the back button to go back to the previous page.
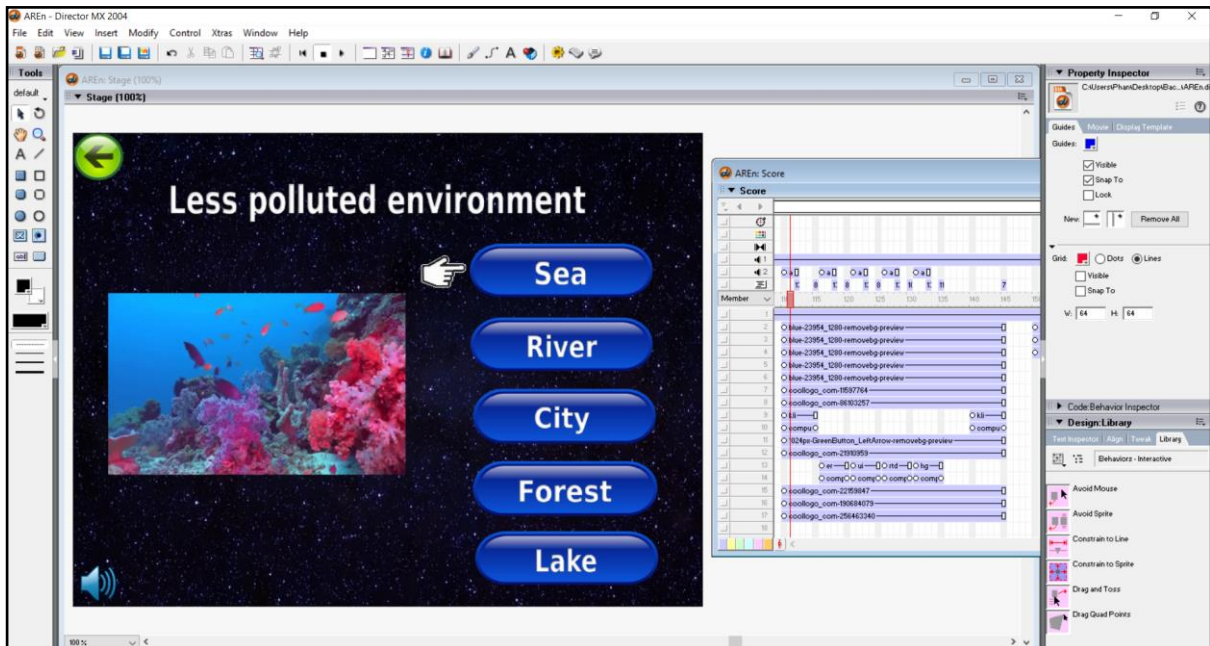
Figure 4.59 Less polluted environment
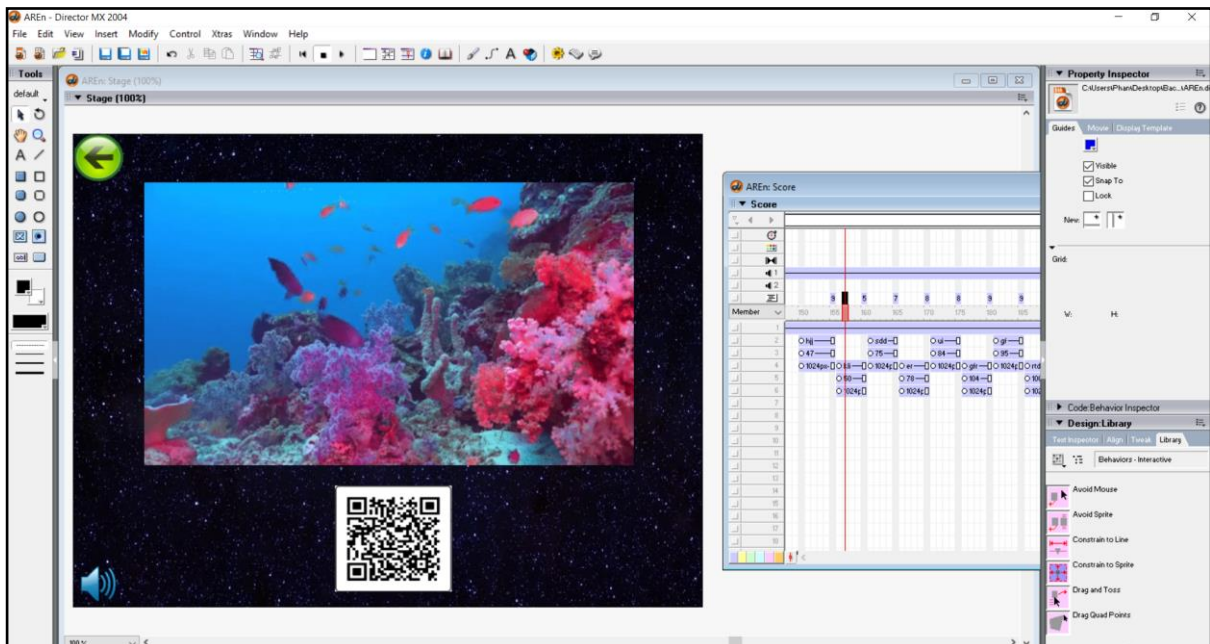
Figure 4.60 Scanning on the sea

Figure 4.59 shows that the user can view the AR less polluted environment by clicking on the buttons which are sea, river, city, forest and lake. After click on the button, it will direct the user to the AR images which he wants to view. Then, user need to scan the QR code to view the AR images in Figure 4.60. After viewing it, user can click on the back button to go back to the previous page.

4.2.3 Post-authoring Process
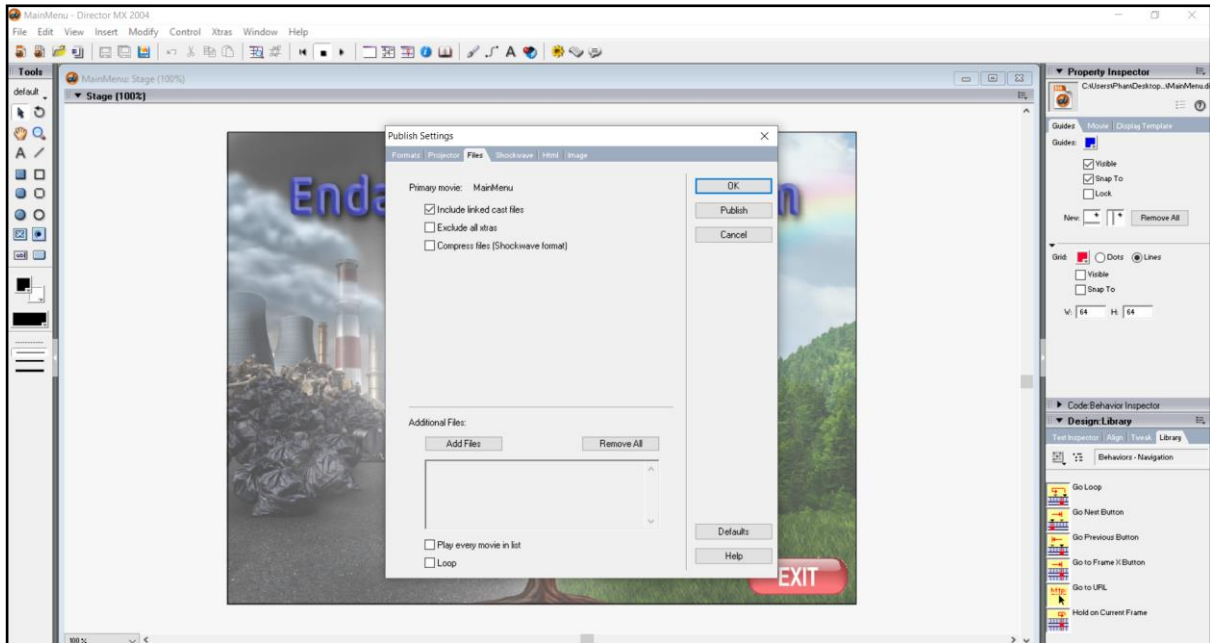
Figure 4.61 Set the publish setting to publish the multimedia courseware

Figure 4.62 Endangered ecosystem of multimedia courseware

Figure 4.61 shows that the process of publishing in Director is performed after finishing all the design of movie in Macromedia Director. The movies are published across platforms by creating stand-alone applications that runs in Windows. Click on the File and publish setting to do the publishing works. Then, click on the first option of projector and name the file accordingly. After, that, click on the projector tab and click on the full screen display as well as lock the stage size to movie's stage. Next, click on the files tab and click on the include linked cast files. Lastly, add all the files in the additional files portion and click on the publish button. The executable file will be in the same folder with all the source files. It can click on the executable file to see the output. Figure 4.62 shows that the endangered ecosystem of multimedia courseware. The multimedia courseware also gone through implementation and evaluation stage so that it can be launched and tested by the user to enhance the quality of the system. The feedbacks are received from the user to make improvement to the multimedia courseware.

Chapter 5 Testing, Results and Discussions

5.1 Overview

The overview of chapter 5 is the testing of multimedia courseware and the results are analysed and discussed. It has been done by using the online questionnaire which distribute to the respondents so that the results can be analysed. The questionnaire has been added a video which show the overall system of the multimedia courseware. The video shows the overall system such as the functionality of main menu, learning module, experiment note module, quiz module and game-based learning module so that the user can view and watch it. After watching the video, the respondent will answer the survey questions in the questionnaire. Hence, the feedbacks from the respondents will be analysed and recorded. The questionnaire method has been chosen because it is easier to analysis the result and the answer can be compared easily. The response from the questionnaire has been recorded and the statistical analysis had been performed. The multimedia courseware will be improved so that the multimedia courseware can achieve the 3 level of navigational interactivity, functional interactivity and adaptive interactivity. Hence, user can satisfy with the outcome of the development of the multimedia courseware in the future.

5.2 Method of testing

The method of testing the multimedia courseware is distributing the online questionnaire by adding a video of multimedia courseware into the online questionnaire and the respondents need to view the video before answering the survey questions. The overall process of multimedia courseware is recorded into the video such as the main menu, learning module, experiment note module, quiz module and past year paper module and game based learning module so that the respondent can view it. The video also shows the design of the user interface, functionality of the system and so on. After watching the video, user need to answer the online survey questionnaire. The questionnaire consists of different section which represent different part of module in the multimedia courseware. The total question of the online questionnaire is 15 questions which consist of open-ended and close-ended questions. The questionnaire has been distributed to 78 respondents to answer. The feedbacks from the respondents have been received and recorded. Then, the collected data will be analysed to make improvement to the multimedia courseware.

5.3 Testing Analysis

Section A Features of Edutainment System
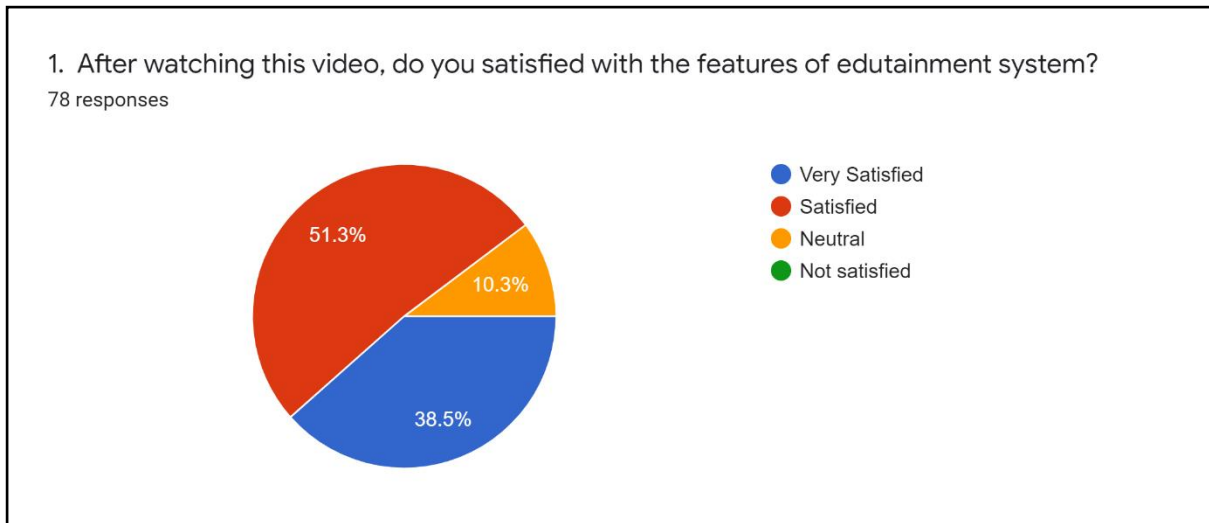
Figure 5.1 Pie chart of question 1

The pie chart shows the analysis result of question "After watching this video, do you satisfy with the features of edutainment system?". It shows that there are 40 respondents satisfied with the features of edutainment system which is 51.3% in the pie chart. On the other hand, there are 30 respondents very satisfied with the features of edutainment system which 38.5% in the result. However, there are 8 respondents are neutral satisfied with the features of edutainment system which shows 10.3% in the pie chart.
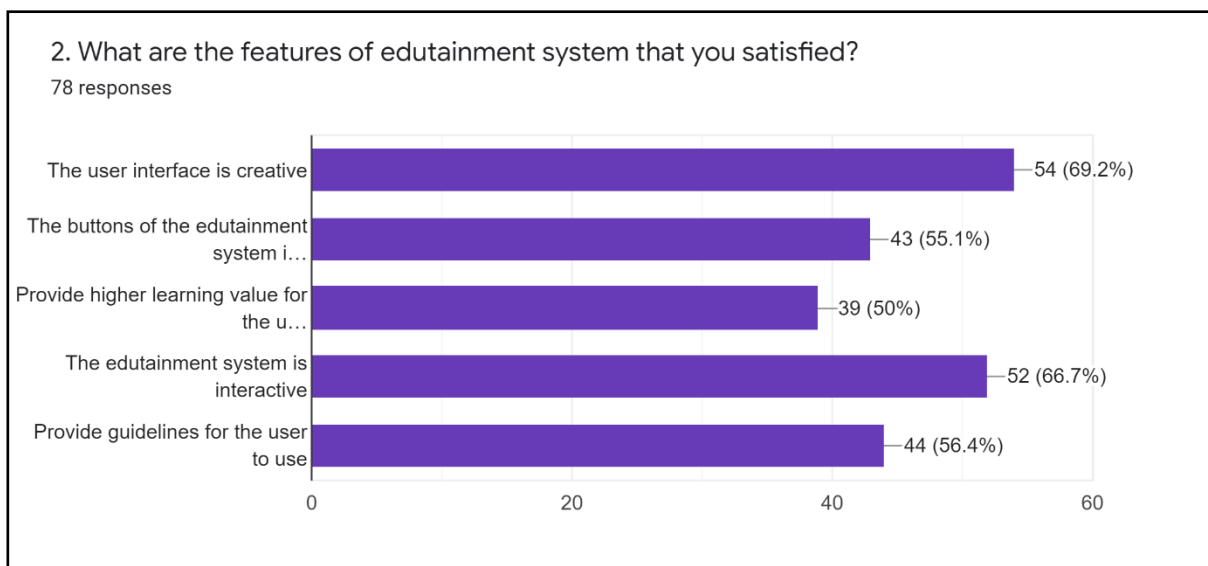
Figure 5.2 Pie chart of question 2

The bar chart shows the analysis result of question "What are the features of edutainment system that you satisfied?". The bar chart shows that there are 54 respondents satisfied with the feature of user interface is creative in the multimedia courseware and it is the highest response in the bar chart. The second higher response is the feature of edutainment system is interactive which show 66.7% in the bar chart. It shows that there are 52 respondents satisfied with the feature of interactive of the edutainment system. Moving on is the features of provide guidelines for the user to use and the buttons of the edutainment system is consistency in the multimedia courseware. Both of them occupy 56.4% and 55.1% in the bar chart which shows 44 respondents satisfied with the feature of providing the guidelines for the user to use and 43 respondents satisfied with the feature of buttons of the edutainment system is consistency in the multimedia courseware. Besides, there are 39 respondents satisfied with the features of provide higher learning value for the user which shows 50% in the bar chart.

Section B Main Menu of Edutainment System

3. What kind of features in the main menu of the edutainment system is user friendly?
78 responses

Feature	Value
User can access to different type of mo…	56 (71.8%)
User can turn on and off the sound	42 (53.8%)
User interface is structurable	41 (52.6%)
The button in the main menu is consiste…	47 (60.3%)
Provide guidelines for the user to use …	45 (57.7%)
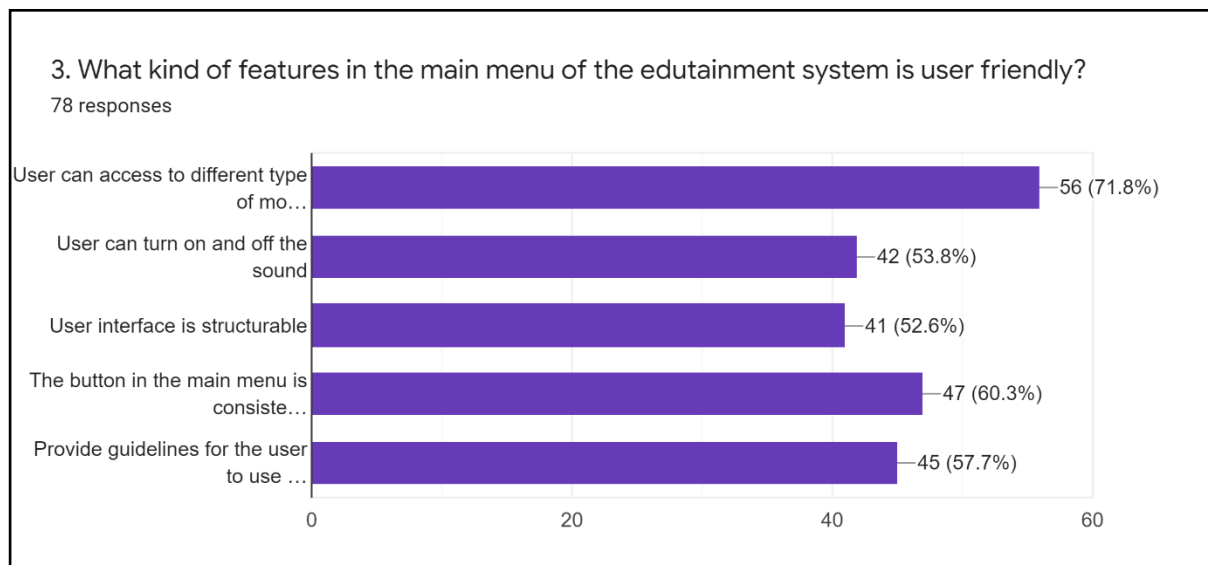
Figure 5.3 Pie chart of question 3

The bar chart shows the analysis result of question "What kind of features in the main menu of the edutainment system is user friendly?". The bar chart shows that 71.8% and 57.7% response to the feature of user can access to different type of module and the buttons in the main menu is consistency in the main menu of edutainment system. It shows that 56 respondents think that the main menu is user friendly which allows the user to access different type of module and 45 respondents think that the button in the main menu is consistency is the feature of user friendly in the main menu of edutainment system. There are 45 respondents think that the feature of

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provide guidelines for the user to use the edutainment system is user friendly. Next, there are 83 respondents think that the user can turn on and off the sound and the user interface is structural are user friendly in the main menu of edutainment system which shows 42 and 41 respondents respectively in the bar chart.
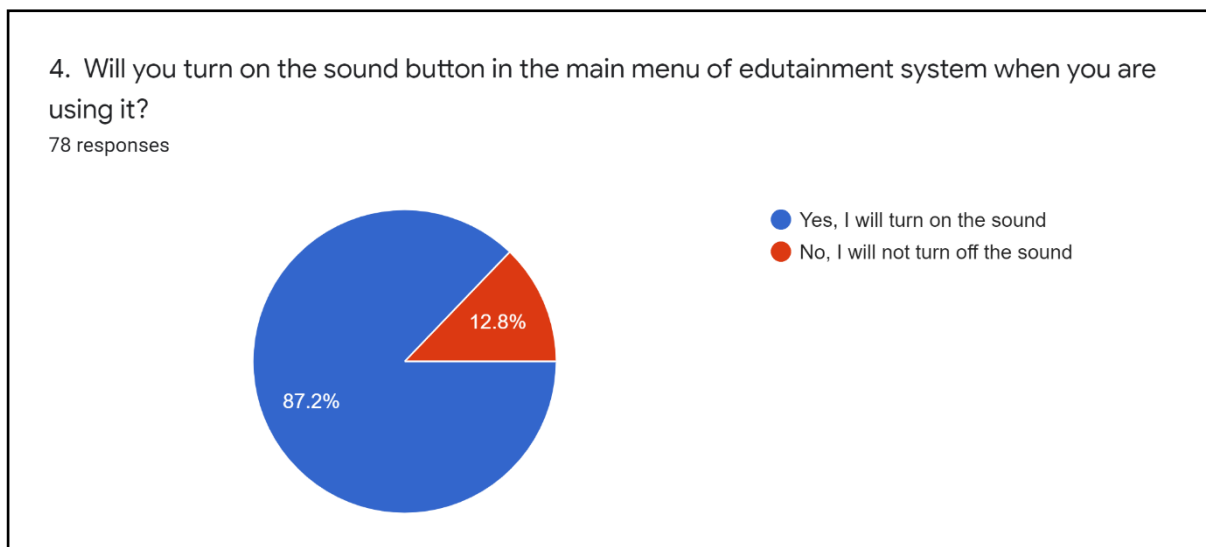
Figure 5.4 Pie chart of question 4

The pie chart shows the analysis result of question "Will you turn on the sound button in the main menu of edutainment system when you use the edutainment system?". The pie chart shows that there are 87.2% of response to the answer of "Yes, I will turn on the sound". It shows that there are 68 respondents will turn on the sound button in the main menu of edutainment system when using it. On the other hand, it shows that 12.8% response to the answer of "No, I will not turn off the sound" in the pie chart. It shows that there are 10 respondents will turn off the sound button in the main menu of edutainment system when using it.

Section C Learning Module

5. Do you think that the sub-topics of greenhouse effect and eutrophication are useful?

78 responses

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

56.4%
19.2%
24.4%
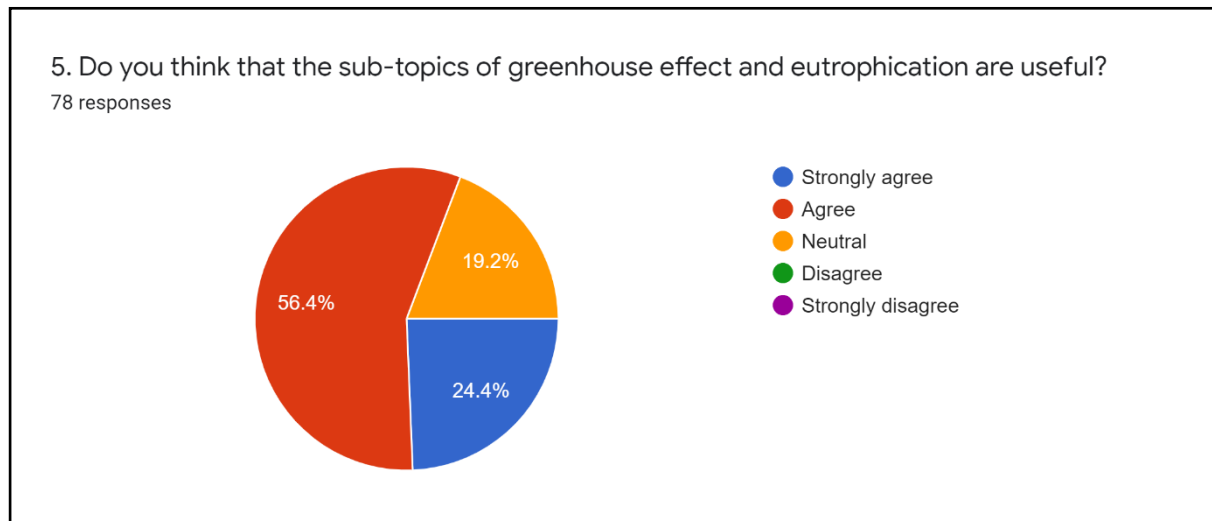
Figure 5.5 Pie chart of question 5

The pie chart shows the analysis result of question "Do you think that the sub-topics of greenhouse effect and eutrophication are useful?". The pie chart shows that there are 56.4% response to the answer of agree. It shows that there are 44 respondents are agreed that the sub-topics of greenhouse effect and eutrophication are useful. Besides, there are 24.4% response to the answer of strongly agree in the pie chart. It shows that there are 19 respondents are strongly agreed that the sub-topics of greenhouse effect and eutrophication are useful. Lastly, there are 19.2% response to the answer of neutral in the pie chart. It shows that there are 15 respondents neutral agreed that the sub-topics of greenhouse effect and eutrophication are useful.

6. What features of learning module can increase the understanding of the user to learn the lesson?

78 responses

The animations images that provide the …	44 (56.4%)
The sound explanation of the learning m…	61 (78.2%)
The text explanation provided in the le…	53 (67.9%)
The information button that link to fur…	57 (73.1%)
The information is enough for the user	39 (50%)
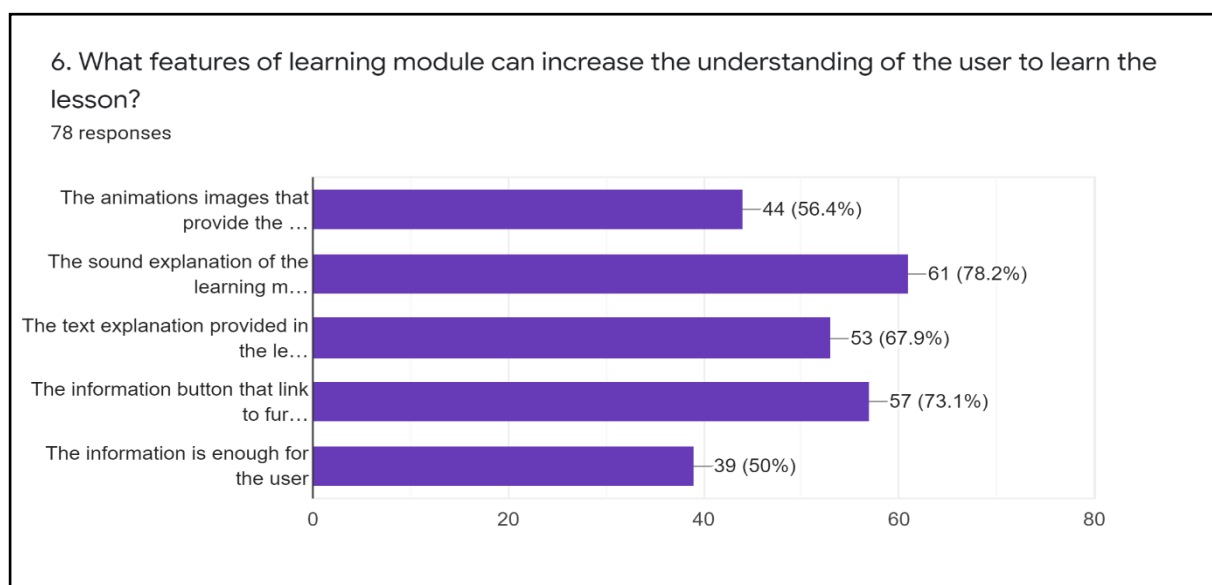
Figure 5.6 Pie chart of question 6

The bar chart shows the analysis result of question "What features of learning module can increase the understanding of the user to learn the lesson?". The bar chart shows that there are 78.2% response to the feature of the sound explanation of the learning materials which is the highest response among other features. It shows that there are 61 respondents think that the sound explanation of the learning materials in the learning module can increase the understanding of the user to learn the lesson. Moreover, 57 respondents think that the information button that link to further explanation can increase the understanding of the user to learn the lesson which shows 73.1% in the bar chart. The bar chart also shows that there are 53 respondents think that the feature of the text explanation provided in the learning module can increase the understanding of the user to learn the lesson which is 67.9% in the bar chart. Lastly, there are 44 and 39 respondents think that the feature of the animation images that provide the learning value and the feature of the information is enough for the user can increase the understanding of the user to learn the lesson in the learning module which show result 56.4% and 50% respectively in bar chart.

Section D Experiment Note Module
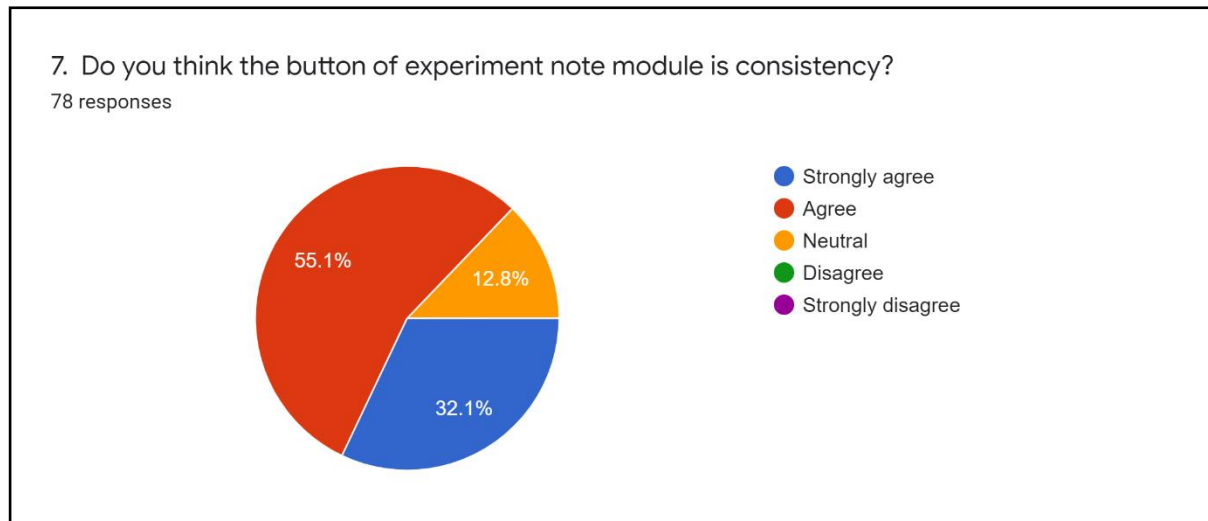
Figure 5.7 Pie chart of question 7

The pie chart shows the analysis result of question "Do you think the button of experiment note module is consistency?". The pie chart shows that there are 55.1% respond to the answer of agree in the pie chart. It shows that there are 43 respondents are agreed that the button in the experiment note module is consistency. Besides, there is also 32.1% respond to the answer of strongly agree in the pie chart. It shows that there are 25 respondents are strongly agreed that

the button of experiment note module is consistency. Lastly, there are 12.8% respond to the answer of neutral agreed in the pie chart. It shows that there are 10 respondents are neutral agreed that the button of experiment note module is consistency.
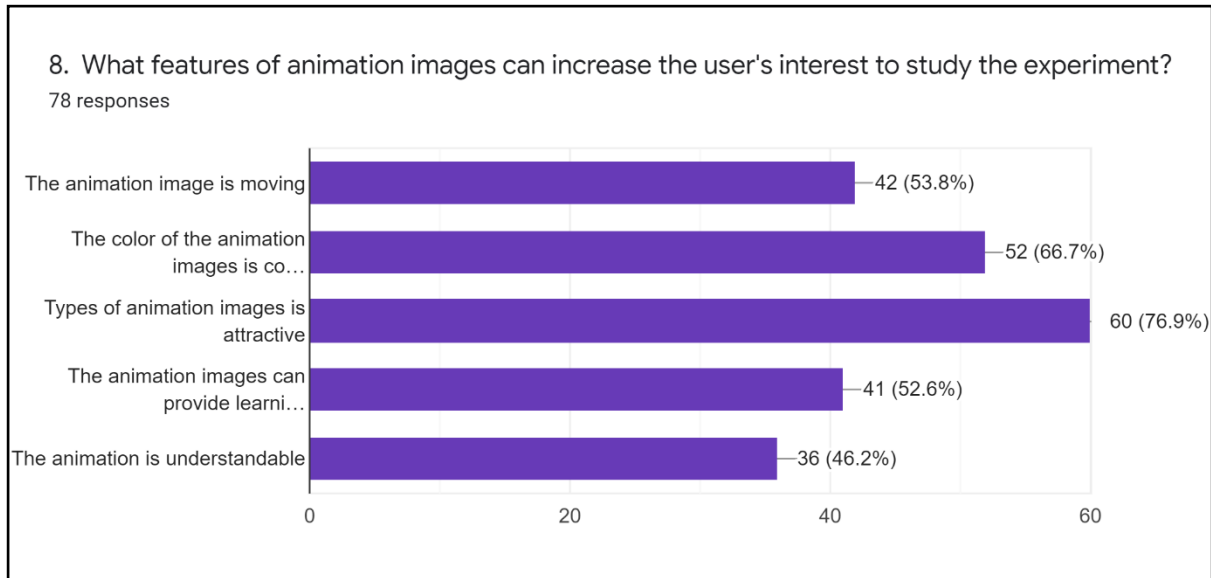
Figure 5.8 Pie chart of question 8

The bar chart shows the analysis result of question "What features of animation images can increase the user's interest to study the experiment?". There are 76.9% response to the answer of types of animation images is attractive in the bar chart. It shows that there are 60 respondents think that type of animation images is attractive can increase the user's interest to study the experiment. Besides, the bar chart shows that there are 66.7% response to the colour of the animation images is colourful. It shows that there are 52 respondents think that the colour of animation images is colourful can increase the user's interest to study the experiment. The bar chart also shows that there are 53.8% response to the feature of the animation image is moving. It shows that there are 42 respondents think that the feature of animation image is moving can increase the user's interest to study the experiment. Moreover, there are 41 and 36 respondents think that the feature of animation images can provide learning value and the feature of the animation is understandable can increase the user's interest to study the experiment which shows 52.6% and 46.2% in the bar chart.

Section E Quiz Module

9. Do you think the idea of making the tree growing up in the quiz module can motivate the user to answer the questions?

78 responses

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

48.7%

7.7%

43.6%
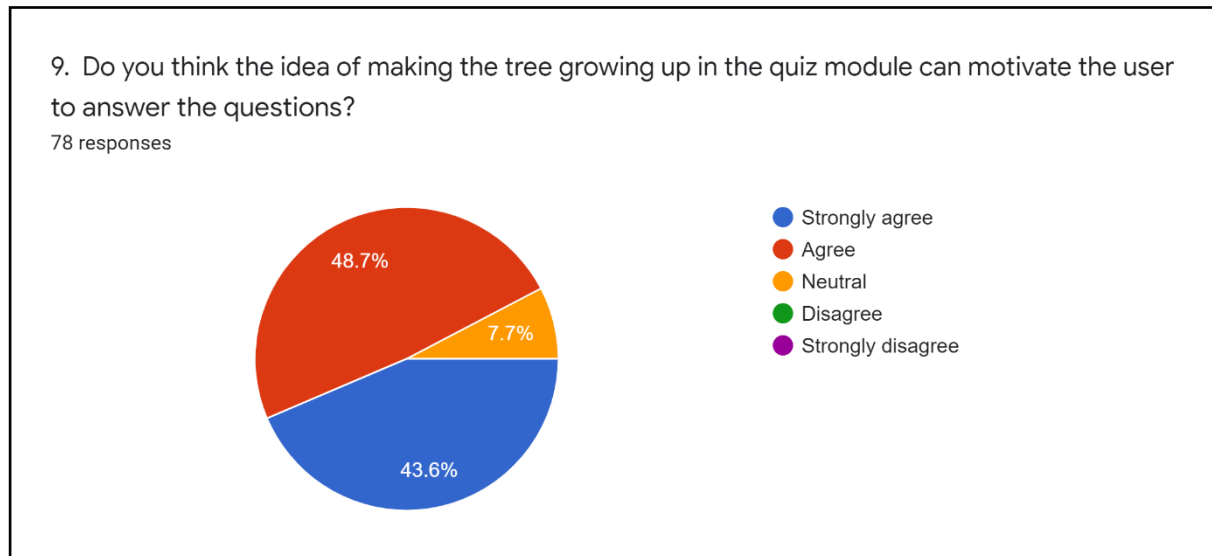
Figure 5.9 Pie chart of question 9

The pie chart shows the analysis result of question "Do you think the idea of making the tree growing up in the quiz module can motivate the user to answer the questions?". The pie chart shows that there are 48.7% response to the answer of agree. It shows that there are 38 respondents are agreed that the idea of making the tree growing up in the quiz module can motivate the user to answer the questions. Moreover, there are 43.6% response to the answer of strongly agree in the pie chart. It shows that there are 34 respondents are strongly agreed to the idea of making the tree growing up in the quiz module can motivate the user to answer the questions. The pie chart also shows that there are 7.7% response to the answer of neutral agree. It shows that there are 6 respondents are neutral agreed that the idea of making the tree growing up in the quiz module can motivate the user to answer the questions.

10. Do you think the quiz module can increase the user's understanding about the topic of lesson by answering the questions in the quiz module?

78 responses

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

34.6%

15.4%

48.7%

Figure 5.10 Pie chart of question 10

The pie chart shows the analysis result of question "Do you think the quiz module can increase the user's understanding about the topic of lesson by answering the questions?". There are 48.7% response to the answer of strongly agree in the pie chart. It shows that there are 38 respondents strongly agree that the quiz module can increase the user's understanding about the topic of lesson by answering the questions in the quiz module. Besides, there are 34.6% response to the answer of agree in the pie chart. It shows that there are 27 respondents agreed that the quiz module can increase the user's understanding about the topic of lesson by answering the questions in the quiz module. On the other hand, there are 15.4% response to the answer of neutral agree in the pie chart. It shows that there are 12 respondents are neutral agree that the quiz module can increase the user's understanding about the topic of lesson by answering the questions in the quiz module. However, there are 1.13% responds to the answer of disagree in the pie chart.

Section F Past Year Paper Module

11. Which paper do you think have the higher interactivity with the user in the past year paper module?
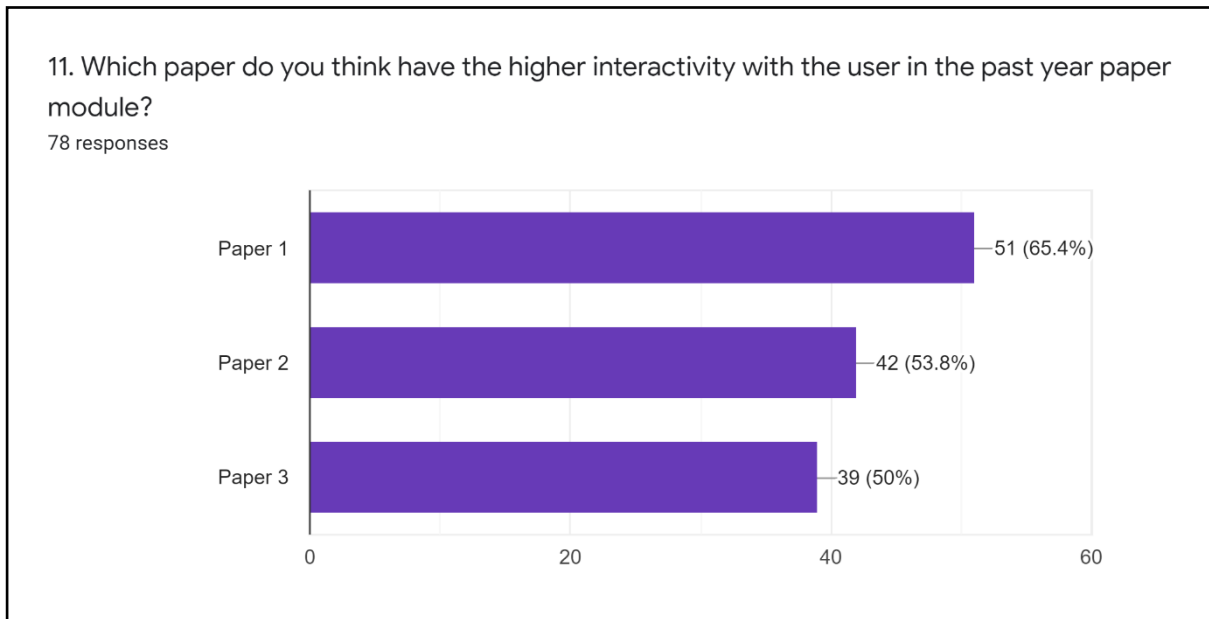
78 responses

Figure 5.11 Pie chart of question 11

The pie chart shows the analysis result of question "Which paper do you think have the higher interactivity with the user in the past year paper module?". There are 65.4% response to the answer of paper 1 in the bar chart. It shows that there are 51 respondents think that the paper 1 have the higher interactivity with the user in the past year paper module. Moreover, there are 53.8% response to the answer of paper in the bar chart. It shows that there are 42 respondents think that the paper 2 have the higher interactivity with the user in the past year paper module. Lastly, there are 50% response to the answer of paper 3 in the bar chart. It shows that there are 39 respondents think that the paper 3 have the higher interactivity with the user in the past year paper module.

Figure 5.12 Pie chart of question 12

The pie chart shows the analysis result of question "Do you think the tips that provided in the questions of paper 2 and paper 3 can increase the understanding for the user to answer the questions?". There are 48.7% response to the answer of agree in the pie chart. It shows that there are 38 respondents are agreed that the tips provided in the questions of paper 2 and paper 3 can increase the understanding of the user to answer the questions. Besides, there are 41% response to the answer of strongly agree in the pie chart. It shows that there are 32 respondents are strongly agreed that the tips which provided in the questions of paper 2 and paper 3 can increase the understanding of the user to answer the questions. Lastly, there are 10.3% response to the answer of neutral agree in the pie chart. It shows that there are 8 respondents are neutral agree that the tips that provided in the questions of paper 2 and paper 3 can increase the understanding of the user to answer the questions.

Section G Game-based Learning Module

Figure 5.13 Pie chart of question 13

The bar chart shows the analysis result of question "What characteristic is creative and interesting in the sea game of the game-based learning module?". There are 67.9% response to the rubbish in the sea game will reduced after the user answers correctly which is the highest in the bar chart. It shows that there are 53 respondents think that the characteristic of rubbish in the sea game will reduced after the user answers correctly is creative and interesting in the sea game of the game-based learning module. Besides, there are 62.8% and 60.3% response to the characteristic of sound effect after the user answers correctly and the characteristic of the level of pollution is reduced gradually after the user answers correctly in the bar chart respectively. It shows that there are 49 respondents think that the characteristic of sound effect after the user answer correctly and 47 respondents think that the characteristic of level of pollution is reduced gradually after user answers correctly are creative and interesting in the sea game of the game-based learning module. Moreover, there are 57.7% and 50% response to the characteristic of the aquatic animals is swimming in the sea and the characteristic of the aquatic animals become more after the user answer correctly in the bar chart respectively. It shows that there are 45 and 39 respondents think that the characteristic of aquatic animals is swimming in the sea and the characteristic of the aquatic animals become more after the user answers correctly are creative and interesting in the sea game of the game-based learning module.
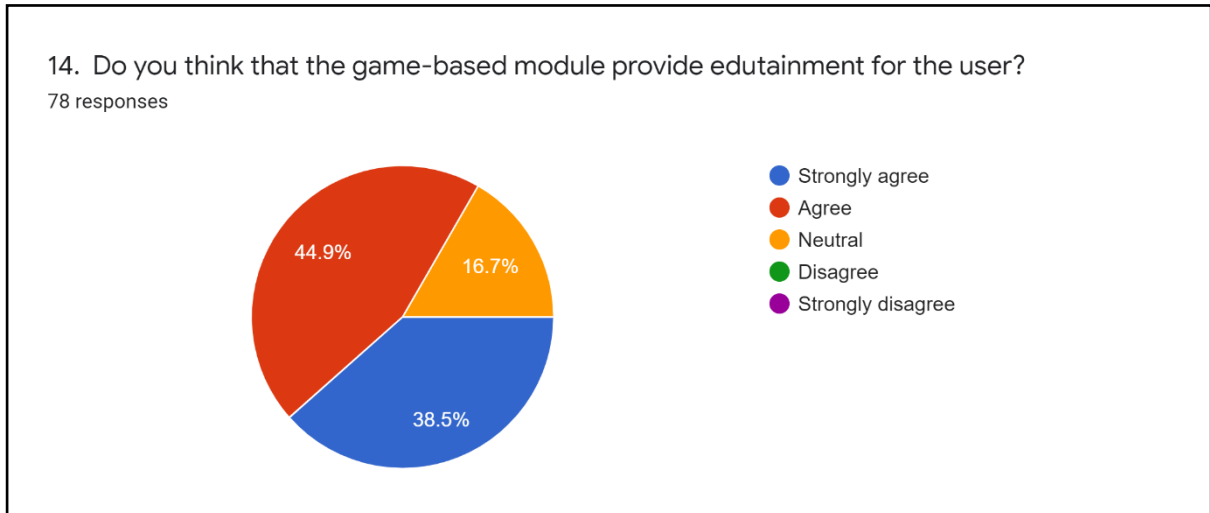
Figure 5.14 Pie chart of question 14

The pie chart shows the analysis result of question "Do you think that the game-based module provide edutainment for the user?". There are 44.9% response to the answer of agree in the pie chart. It shows that there are 44.9% agreed that the game-based module provide edutainment for the user. Moreover, there are 38.5% respond to the answer of strongly agree in the pie chart. It shows that there are 30 respondents are strongly agreed that the game-based module provide edutainment for the user. Lastly, there are 16.7% response to the answer of neutral agree in the pie chart. It shows that there are 13 respondents are neutral agreed that the game-based module provide edutainment for the user.

Section H Future Improvement

Table 5.1 Reponses of "Do you think what should be improved in the multimedia courseware?"

1. Given more test for the user	2. User can play the game with their friends
3. Hope the user can discuss with their teacher	4. Provide discussion forum for the user
5. Give more explanation for each module	6. User can link to the internet
7. It can set different level of difficulty to the user	8. Given more specific information in the experiment note

9. Tag some friend to join in the game	10. Students can see more learning materials in the learning module
11. Provide YouTube video	12. Result analysis in the quiz module
13. User can use the multimedia courseware in different device	14. Provide more images which can let user zoom in and zoom out

5.4 Results and Discussions

In overall, the questions above are responded positively from most of the respondents. Question 1 shows that most of the respondents are satisfied with the features of edutainment system. The respondents are satisfied with the features of the edutainment system is creative and interactive as well as it provides guidelines for the user to use it in question 2. Besides, some of the respondents also satisfied with the feature of edutainment system such as the button of the edutainment system is consistency and it provides higher learning value for the user to study. In question 3, most of the respondents prefer the features of the user can access to different type of module, the button in the main menu is consistency as well as it provides guidelines for the user to use. Some of the user also prefer the user can turn on and off the sound and the feature of user interface is structural in the main menu of edutainment system. Besides, more than half of respondents will prefer turn on the sound button rather than turn off the sound button when they using the edutainment system in question 4. In question 5, most of the respondents are agree that the sub-topics of greenhouse effect and eutrophication are useful in the learning module. Question 6 shows that most of the respondents think that the feature of sound explanation of the learning module, the information button that link to further explanation as well as the text explanation provided in the learning module can increase the understanding of the user to learn the lesson. Some of the respondents think that the animations images that provide learning value and the information is enough for the user in the leaning module can increase the user's understanding about the lesson.

In question 7, most of the respondents agreed that the button of experiment note module is consistency. Moreover, most of the respondents are agreed that the feature of types of animation images is attractive, the colour of the animation images is colourful and the animation images can provide learning value can increase the user's interest to study the experiment in question 8. Some of the respondents also think that the feature of animation image is moving and the animation is understandable can increase the user's interest to study

the experiment. In question 9, most of the respondents are agreed that the idea of making the tree growing in the quiz module can motivate the user to answer the questions. In question 10, mo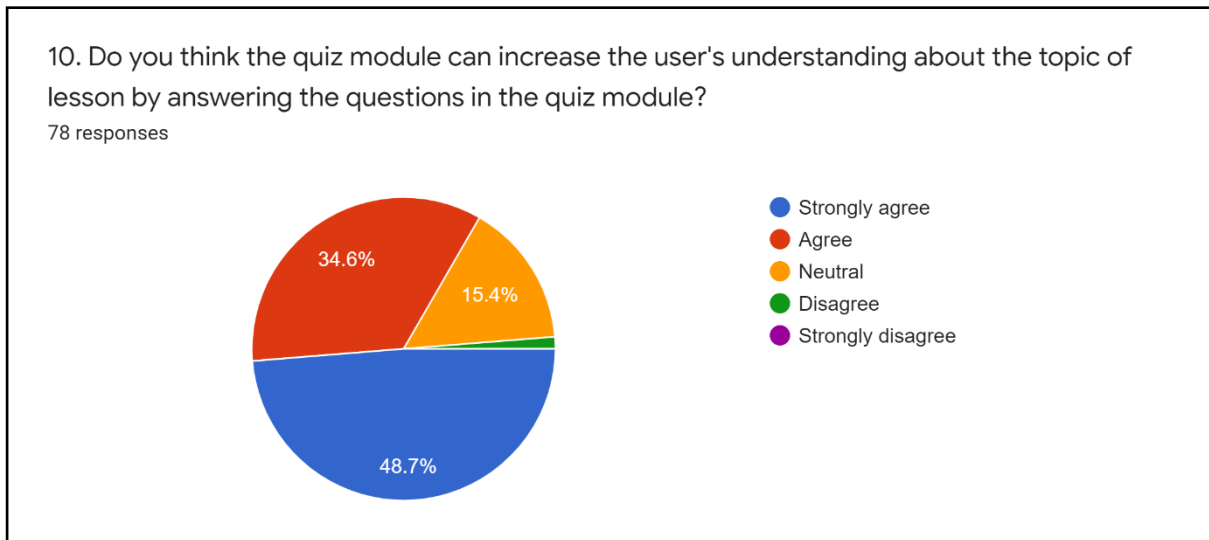st of the respondents strongly agreed that the quiz module can increase the user's understanding about the topic of lesson by answering the questions in the quiz module. In question 11, most of the respondents think that the paper 1 have higher interactivity with the user more than the paper 2 and paper 3 in the past year paper module. In question 12, most of the respondents agreed that the tips provided in the questions of paper 2 and paper 3 can increas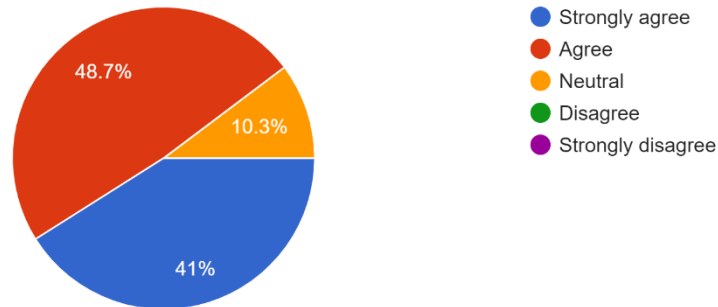e the understanding of the user to answer the questions. In question 13, most of the responde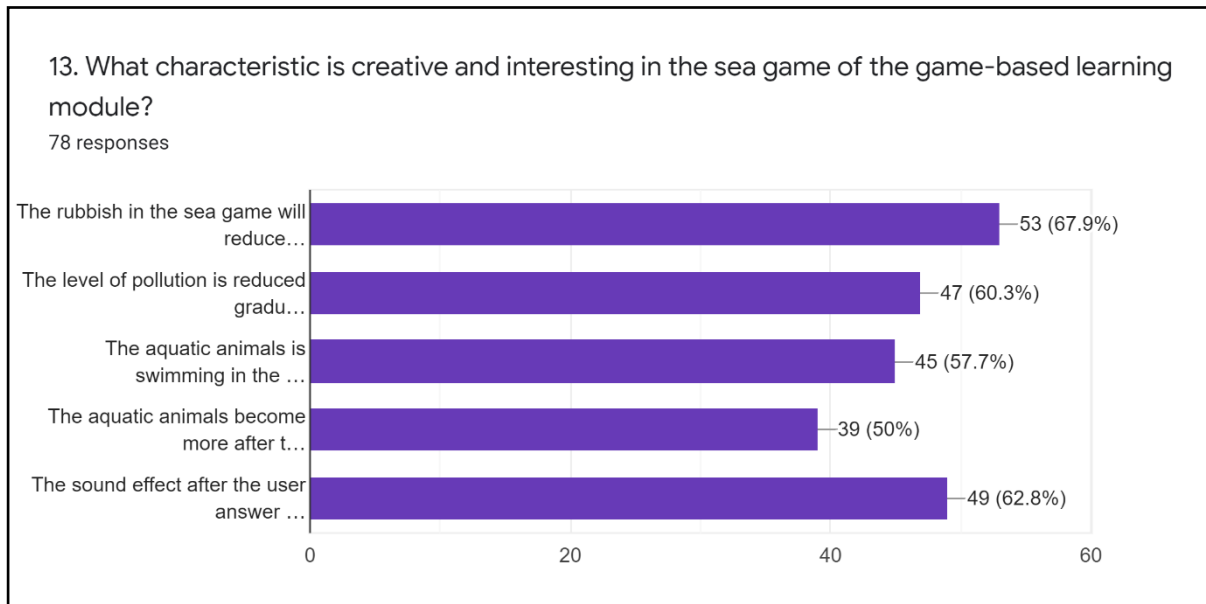nts think that the characteristic of the rubbish in the sea game will reduced after user answers correctly, the sound effect after the user answer correctly and the level of pollution is reduced gradually after user answers correctly are creative and interesting in the sea game of the game-based learning module. Moreover, some of the respondents think that the characteristics of the aquatic animals is swimming in the sea and the aquatic animals become more after the user answers correctly are creative and interesting in the sea game of the game-based learning module. In question 14, more than half of the respondents are agreed that the game-based module provide edutainment for the user. In question 15, there are different useful views from the respondents to improve the multimedia courseware.

Chapter 6 Conclusion

6.1 Overview

The overview of chapter 6 is the research finding of multimedia courseware, the problem faced by the author and knowledge gained by the author as well as limitations and future enhancement of multimedia courseware. The research findings have found that the multimedia courseware consists of different types of multimedia elements such as text, audio, video, graphics and animation images that can attract the user to learn the lesson. So, research findings have shown that the multimedia courseware has bring a lot of benefits to the user. Some of the problems also have been faced by the author in the process of developing the multimedia courseware such as creating the multimedia elements of graphics, audio, animation images and so on. The author also has gained a lot of knowledge during the process of developing multimedia courseware such as learn how to create different type of multimedia elements and design the user interface of the multimedia courseware. However, the multimedia courseware also has some limitations. There are some limitations in some module of the multimedia courseware. So, the multimedia courseware will be improved so that the features of multimedia courseware can be enhanced and it can satisfy and fulfil user's needs.

6.2 Research Findings

The research findings show that the analysed result from the collected data in chapter 5.4 of results and discussion have achieved the three objectives of multimedia courseware development. The first objective of "To analyse animation and image approaches used for studying biology concept in our life" has been achieved. This can be showed in the analysed result of question 8 which is "What features of animation images can increase the user's interest to study the experiment?". There are a lot of respondents approved that the characteristics of animation image is moving, the colour of the animation images is colourful and the types of animation images is attractive can increase the user's interest to study the experiment. Hence, it shows that that animation and image approaches has been used for studying biology concept in the experiment of multimedia courseware. Moreover, the second objective of "To design a highly interactive edutainment courseware to increase the engagement for the user to learn biology" also have been achieved. This can be showed in the analysed result of question 2 which is "What are the features of edutainment system that you satisfied?". It is because the option of the edutainment system is interactive has received the higher respond among the others. Hence, it has proved that the respondents are satisfied with the highly interactive of

multimedia courseware. The third objective of "To evaluate the effectiveness of the edutainment courseware to learn biology concept through benchmarking with similar leading apps" also have been achieved. This can be showed in the analysed result of question 5 which is "Do you think that the sub-topics of greenhouse effect and eutrophication are useful?". There are more than half respondents are agreed that the sub-topics of greenhouse effect and eutrophication are useful.

6.3 Problems Faced

There are some problems faced in the process of designing the multimedia courseware. The design of the interface of the multimedia courseware need to be adjust such as the background colour and it have to make sure the colour of the text and the buttons do not contrast with the colour of the background image. Besides, some images need to take a long time to find as not all images can be found in the internet. Moreover, the background music which the sound is too loud and complicated will disturb the user to learn the lesson because the background music and the sound explanation are mix together. Hence, it is need to confirm that the background music should be soft so that the user can be hear the sound explanation easily. Furthermore, the images need to be imported and adjusted on the interface of the stage so that it can make a good match with other images. Apart from that, it is required to find the different editing software to edit the multimedia elements such as the audio, video, images and so on. In short, all of the problem needs to be faced and solved so that the multimedia courseware can be functioned properly and it can attract the user to use it.

6.4 Knowledge Gained

The knowledge gained from the multimedia is the author has learned how to create a multimedia courseware by using multimedia elements such as text, graphic, animation images, audio and video. The author has learned how to edit the text, audio, graphics, animation and video by using different types of software. The author has also known how to design the user interface of the multimedia courseware, putting the background music and adjust the font size and shape of the images in the multimedia courseware. The author has to refer to the course of the subject in order to produce the multimedia courseware of the topic of endangered ecosystem which the target audience is form 4 students. So, it is required for the author to acquire the knowledge of the endangered ecosystem so that it can be used to develop the multimedia

courseware and deliver the knowledge of endangered ecosystem to the user. Moreover, author also has learned how to make the multimedia courseware become more interactive, attractive and functionality. The author has to make sure that the user can click on the buttons and it can link to other pages as well as ensuring the button of the multimedia courseware is consistency. In short, the author has learned a lot of experiences during the period of developing the multimedia courseware.

6.5 Limitations

The limitation of the multimedia courseware is the learning module only providing the sub-topics of greenhouse effect and eutrophication. So, the information in the learning module is limited because user can only gain the knowledge of greenhouse effect and eutrophication in the topic of endangered ecosystem. Furthermore, it does not provide buttons which can allows user to link to the online materials to learn more information about the knowledge of greenhouse effect and eutrophication in the learning module. Moreover, the experiments in the experiment note module do not provide variables such as manipulated variables, responding variable and fixed variable. Besides, user can directly view the tips and the answers of the questions even though they do not answer the questions in the paper 2 and paper 3 of past year paper module. Lastly, user cannot view the AR images in the AR environment game of the game based learning module by using Android handphone. It is because user only can use the iPhone device to view the AR images in the game-based learning module.

6.6 Future Enhancement

The Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach) will be undergoing future enhancement so that it can produce a good quality of multimedia courseware. The feedbacks from the respondents will be improved to satisfy the user's requirement. The features of multimedia courseware will be enhanced such as the functionality of the multimedia courseware and the design of the user interface. The intended enhancement on each module will be conducted such as the learning module, experiment note module, past year paper module, quiz module and game-based learning module. The learning module will be improved by increasing the information and also increase the sub-topic of the endangered ecosystem. Hence, user can gain more knowledge from the learning module. Besides, the experiment note module will be enhanced by providing more detailed information

such as the steps and variables of the experiment. The quiz and the past year paper will be enhanced by providing more questions for the user to answer so that they are more understanding about the topic of endangered ecosystem. The game based learning module will be designed to be more creative and interesting to attract the user's interesting in playing the game. In short, the multimedia courseware will be improved so that it can achieve the 3 level of navigational interactivity, functional interactivity and adaptive interactivity.

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UNIVERSITI TUNKU ABDUL RAHMAN
FACULTY OF INFORMATION AND
COMMUNICATION TECHNOLOGY(FICT)

Survey Questionnaire

Title: Computer Aided Instruction (CAI) for Biology Curriculum (Leaner Centered Approach)

My name is Phan Kar Yu and I am a final year undergraduate student pursuing Bachelor of Information Systems (Hons) Information Systems Engineering at Universiti Tunku Abdul Rahman. I am conducting a survey of Computer Aided Instruction (CAI) for Biology Curriculum (Leaner Centered Approach) which provides the knowledge of endangered ecosystem for the user. Your participation will greatly contribute to the success of the survey. I am deeply appreciating your help in participating in this survey. Thank you.

Please tick and answer the following questions.

1. Do human activities affect the ecosystem?

   [   ] Strongly agree

   [   ] Agree

   [   ] Neutral

   [   ] Disagree

   [   ] Strongly disagree

2. How concerned are you about the endangered ecosystem?

   [   ] Extremely concerned

   [   ] Very concerned

   [   ] Moderately concerned

   [   ] Slightly concerned

   [   ] Not at all concerned

3. Do you think the importance of the ecosystem should be educated to the students?

[   ] Strongly agree

[   ] Agree

[   ] Neutral

[   ] Disagree

[   ] Strongly disagree

4. Which do you think is the most important features that an edutainment system (computer software) should have? (Can tick more than one)

[   ] Good sound effect

[   ] Creative interface design

[   ] Interactive

[   ] Consistency of button

[   ] Informative

5. Which module do you prefer the most if an edutainment system (computer software) consists of?

[   ] Learning module

[   ] Experiment note module

[   ] Quiz module

[   ] Past year paper module

[   ] Game based learning module

6. Do you think the learning module of an edutainment system (computer software) should focus on what kind of information? (Can tick more than one)

[   ] Acid rain

[   ] Greenhouse effect

[   ] Water pollution

[   ] Noise pollution

[   ] Thermal pollution

7. Do you think the learning module of the edutainment system (computer software) is an effective way of learning when compared to textbook?

[   ] Strongly agree

[   ] Agree

[   ] Neutral

[   ] Disagree

[   ] Strongly disagree

8. Do you think the learning module should provide video learning for the user?

[   ] Strongly agree

[   ] Agree

[   ] Neutral

[   ] Disagree

[   ] Strongly disagree

9. Are the animation images that applied in the experiment note module can increase the interests of user to study it?

[   ] Strongly agree

[   ] Agree

[   ] Neutral

[   ] Disagree

[   ] Strongly disagree

10. The quiz module should provide explanation for each question?

[   ] Strongly agree

[   ] Agree

[   ] Neutral

[   ] Disagree

[   ] Strongly disagree

11. The past year paper module should include the marking scheme?

    [   ] Strongly agree

    [   ] Agree

    [   ] Neutral

    [   ] Disagree

    [   ] Strongly disagree

12. The game based module can motivate students to learn the ecosystem?

    [   ] Strongly agree

    [   ] Agree

    [   ] Neutral

    [   ] Disagree

    [   ] Strongly disagree

13. Can you accept an edutainment system (computer software) without game based module?

    [   ] Yes

    [   ] No

14. The paper 1, paper 2 and paper 3 should be categorized in the past year paper module?

    [   ] Strongly agree

    [   ] Agree

    [   ] Neutral

    [   ] Disagree

    [   ] Strongly disagree

15. If there any additional information that you would like to provide for the new edutainment system (computer software)?

Computer Aided Instruction (CAI) for Biology Curriculum (Leaner Centered Approach)

I am the final year students of Bachelor of Information (Hons) Information System Engineering form Universiti Tunku Abdul Rahman (UTAR). I am currently conducting a survey on the final year project with the topic of Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach). It is an edutainment system (computer software) that provides interactive learning of the topic of endangered ecosystem for the user. Your cooperation in answering this survey is very appreciated. Thank you.

Video of Edutainment System

Please view this video before answering the survey questions. Thank you.

http://www.youtube.com/watch?v=dheQlchg_9E&feature=emb_title

Section A Features of Edutainment System

1. After watching this video, do you satisfy with the features of edutainment system?

O   Very Satisfied

O   Satisfied

O   Neutral

O   Not satisfied

2. What are the features of edutainment system that you satisfied?

[ ] The user interface is creative

[ ] The buttons of the edutainment system is consistency

[ ] Provide higher learning value for the user

[ ] The edutainment system is interactive

[ ]   Provide guidelines for the user to use

Section B Main Menu of Edutainment System

3. What kind of features in the main menu of the edutainment system is user friendly?

[ ]   User can access to different type of modules

[ ]   User can turn on and off the sound

[ ]   User interface is structural

[ ]   The button in the main menu is consistency

[ ]   Provide guidelines for the user to use the edutainment system

4. Will you turn on the sound button in the main menu of edutainment system when you are using it?

O   Yes, I will turn on the sound

O   No, I will turn off the sound

Section C Learning Module

5. Do you think that the sub-topics of greenhouse effect and eutrophication are useful?

O   Strongly agree

O   Agree

O   Neutral

O   Disagree

O   Strongly disagrees

6. What features of learning module can increase the understanding of the user to learn the lesson?

[ ] The animations images that provide the learning value

[ ] The sound explanation of the learning materials

[ ] The text explanation provided in the learning module

[ ] The information button that link to further explanation

[ ] The information is enough for the user

Section D Experiment Note Module

7. Do you think the button of experiment note module is consistency?

O   Strongly agree

O   Agree

O   Neutral

O   Disagree

O   Strongly disagrees

8. What features of animation images can increase the user's interest to study the experiment?

[ ] The animation image is moving

[ ] The colour of the animation images is colourful

[ ] Types of animation images is attractive

[ ] The animation images can provide learning value

[ ] The animation image is understandable

Section E Quiz Module

9. Do you think the idea of making the tree growing up in the quiz module can motivate the user to answer the questions?

O   Strongly agree

O Agree

O Neutral

O Disagree

O Strongly disagrees

10. Do you think the quiz module can increase the user's understanding about the topic of lesson by answering the questions in the quiz module?

O Strongly agree

O Agree

O Neutral

O Disagree

O Strongly disagrees

Section F Past Year Paper Module

11. Which paper do you think have the higher interactivity with the user in the past year paper module?

[ ] Paper 1

[ ] Paper 2

[ ] Paper 3

12. Do you think the tips that provided in the questions of paper 2 and paper 3 can increase the understanding of the user to answer the questions?

O Strongly agree

O Agree

O Neutral

O Disagree

O Strongly disagrees

Section G Game-based Learning Module

13. What characteristics are creative and interesting in the sea game of the game-based learning module?

[ ] The rubbish in the sea game will reduced after user answers correctly

[ ] The level of pollution is reduced gradually after user answer correctly

[ ] The aquatic animals are swimming in the sea

[ ] The aquatic animals become more after the user answers correctly

[ ] The sound effect after the user answer correctly

14. Do you think that the game-based module provide edutainment for the user?

O Strongly agree

O Agree

O Neutral

O Disagree

O Strongly disagrees

Section H Future Improvement

15. Do you think what should be improved about the multimedia courseware?

Poster

Universiti Tunku Abdul Rahman

Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Phan Kar Yu

Introduction

Biology is an important subject for the students because it involves the study of life and the natural world. However, most of the students percieved that the biology subject is difficult and boring. It causes the students are less of interest in study the biology subjects. Hence, an edutainment courseware is designed specialized for the form 4 students to study the biology. It provides the useful and summarised information of biology to the students. Students will find it interesting and fun by using the multimedia courseware to learn biology.
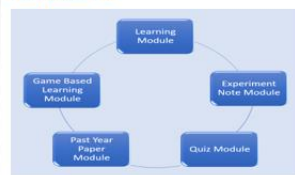
Problem Statement

i) The explanation and examples provided from the topic of the biology is limited and not detailed.

ii) Lack of multimedia elements such as audio, video and animation to present the information.

iii) The learning process of biology is static and lack of interactive for the user.

iv) The answer provided in the question of the test and quiz does not provide description and explanation.

Objectives

i) To analyse animation and image approaches used for studying biology concept in our life.

ii) To design a highly interactive edutainment courseware to increase the engagement for user to learn biology.

iii) To evaluate the effectiveness of the edutainment courseware to learn biology concept through benchmarking with similar leading apps.
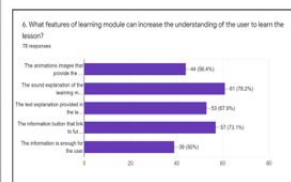
Project Scope

Learning Module
Game Based Learning Module
Experiment Note Module
Past Year Paper Module
Quiz Module

Literature Review

System/ Application	Advantages	Disadvantages	Critical Comments
3D Bones and Organs (Education Mobile, 2013)	-Provide virtual learning -Can zoom in and out the 3D images	-Cannot see clearly when zoom in the 3D images	-It should provide clearly 3D images for the user to see
Anleon Anatomy (Emily Pohlando, 2019)	-Provide AR and 3D learning	-The 3D images is not clearly when the user zoom in	-It should provide clearly 3D image for the user to zoom in
Biology eBook & Quiz (Sana Edutech, 2016)	-Provide visual and verbal learning -Can adjust the font size	-Does not provide the learning level of quiz	-It can provides the low, medium and high level of quiz
SPM Biology (Oxford Fajar, 2016)	-Provide study cards	-Information is limited and not detailed	-It should provide detailed and sufficient information about the topic

ADDIE model

Analysis
Design
Development
Evaluation
Implementation

User Testing

5. Do you think that the sub-topics of greenhouse effect and eutrophication are useful?
78 responses

6. What features of learning module can increase the understanding of the user to learn the lesson?
78 responses

System Display

Endangered Ecosystem
Learning
Experiment Note
Quiz
Past Year Paper
Game
EXIT

Start
Let's keep the young plant growing up!
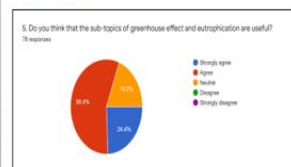
FINAL YEAR PROJECT WEEKLY REPORT

(Project I / <u>Project II</u>)

Trimester, Year: Trimester 2, Year 4	**Study week no.:** Week 1
Student Name & ID: Phan Kar Yu, 1600300	
Supervisor: Ts. Dr. Lee Chen Kang	
Project Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)	

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1. WORK DONE

[Please write the details of the work done in the last fortnight.]

1. The left part of the greenhouse effect topic in the learning module has complete such as the causes of greenhouse effect and the ways to reduce greenhouse effect.
2. The left part of the experiment 1 in the experiment note module has been done.

2. WORK TO BE DONE

1. Quiz module in the edutainment system.

3. PROBLEMS ENCOUNTERED

1. Do not know need to create how many questions in the quiz module.

4. SELF EVALUATION OF THE PROGRESS

1. Create 10 questions in the quiz module.

Lee Chen Kang

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Supervisor's signature   Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project I / <u>Project II</u>)

Trimester, Year: Trimester 2, Year 4	**Study week no.:** Week 2
Student Name & ID: Phan Kar Yu, 1600300	
Supervisor: Ts. Dr. Lee Chen Kang	
Project Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

1. Ten quiz questions and the design of the quiz in the quiz module has been completed.

2. WORK TO BE DONE

1. Proceed to past year paper module to do the paper 1, paper 2 and paper 3.

3. PROBLEMS ENCOUNTERED

1. Do not know how to put the sound effect in the quiz module.

4. SELF EVALUATION OF THE PROGRESS

1. Using the doc to mp3 converter to convert the words to the sound in order to put in the quiz module.

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FINAL YEAR PROJECT WEEKLY REPORT

(Project I / <u>Project II</u>)

Trimester, Year: Trimester 2, Year 4	**Study week no.:** Week 3
Student Name & ID: Phan Kar Yu, 1600300	
Supervisor: Ts. Dr. Lee Chen Kang	
Project Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

1. Putting the sound effect to the quiz questions after the user answers the questions correctly and wrongly has been done.
2. Done the paper 1, paper 2 and paper 3 in the past year paper module.

2. WORK TO BE DONE

1. Proceed to game module.

3. PROBLEMS ENCOUNTERED

1. No pop-up windows for the user to see the tips on each question in paper 2 when they hover on the question mark button before they click on it.

4. SELF EVALUATION OF THE PROGRESS

1. Create the pop-up windows when the user hover on the question mark button on each question in the paper 2 of the past year paper module.

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FINAL YEAR PROJECT WEEKLY REPORT

(Project I / <u>Project II</u>)

Trimester, Year: Trimester 2, Year 4	**Study week no.:** Week 4
Student Name & ID: Phan Kar Yu, 1600300	
Supervisor: Ts. Dr. Lee Chen Kang	
Project Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

1. The pop-up windows when the user hover on the question mark button on each question in the paper 2 of the past year paper module has been created.
2. Done the sea game in the game module.

2. WORK TO BE DONE

1. Create the topic of eutrophication in the learning module.
2. Create the experiment 2 in the experiment note module.

3. PROBLEMS ENCOUNTERED

1. The learning module, experiment note module need to have two sub modules.

4. SELF EVALUATION OF THE PROGRESS

1. Create the topic of eutrophication in the learning module.
2. Create the experiment 2 in the experiment note module.

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FINAL YEAR PROJECT WEEKLY REPORT

(Project I / <u>Project II</u>)

Trimester, Year: Trimester 2, Year 4	**Study week no.:** Week 5
Student Name & ID: Phan Kar Yu, 1600300	
Supervisor: Ts. Dr. Lee Chen Kang	
Project Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

1. The topic of eutrophication in the learning module has been created such as the meaning of eutrophication, causes of eutrophication and effect of eutrophication.
2. The experiment 2 in the experiment note module has been created which investigate the level of pollution in several different sources of water.

2. WORK TO BE DONE

1. Provide guidelines and sound explanation for the user to use the multimedia courseware.
2. Change the sea game into more interactivity.

3. PROBLEMS ENCOUNTERED

1. No guidelines for the user to use the learning module, experiment note module.
2. The sea game is not interactive in the game module.

4. SELF EVALUATION OF THE PROGRESS

1. Provide guidelines and sound explanation for the user to use the multimedia courseware.

2. Increase the interactivity for the user to play the sea game.

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FINAL YEAR PROJECT WEEKLY REPORT

(Project I / <u>Project II</u>)

Trimester, Year: Trimester 2, Year 4	**Study week no.:** Week 6
Student Name & ID: Phan Kar Yu, 1600300	
Supervisor: Ts. Dr. Lee Chen Kang	
Project Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

1. The guidelines and sound explanation for the user to use the multimedia courseware has been provided.
2. The sea game has changed into more interactive and more challenging.

2. WORK TO BE DONE

1. Change the title of the main menu of the multimedia courseware into 3D text.
2. Change the buttons of the main menu of the multimedia courseware into 3D button.
3. Change the background of the main menu of multimedia courseware into another images.

3. PROBLEMS ENCOUNTERED

1. The title of endangered ecosystem and the text in the multimedia courseware is too flat.
2. The button in the main menu of the multimedia courseware is too flat.
3. The background image is not suitable for the multimedia courseware.

4. SELF EVALUATION OF THE PROGRESS

1. Change the title of the main menu of the multimedia courseware into 3D text.
2. Change the buttons of the main menu of the multimedia courseware into 3D button.
3. Change the background of the main menu of multimedia courseware into another images.

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FINAL YEAR PROJECT WEEKLY REPORT

(Project I / <u>Project II</u>)

Trimester, Year: Trimester 2, Year 4	**Study week no.:** Week 7
Student Name & ID: Phan Kar Yu, 1600300	
Supervisor: Ts. Dr. Lee Chen Kang	
Project Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)	

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1. WORK DONE

[Please write the details of the work done in the last fortnight.]

1. The title of the main menu of the multimedia courseware had changed into 3D text.
2. The buttons of the main menu of the multimedia courseware had changed into 3D button.
3. The background of the main menu of multimedia courseware had changed into another images.

2. WORK TO BE DONE

1. Create the AR environment in the game module which provide user to see the AR images.

3. PROBLEMS ENCOUNTERED

1. Do not know using what application to create the AR environment in the game module.

4. SELF EVALUATION OF THE PROGRESS

1. Using EyeJack creator to develop the AR environment in the game module.

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FINAL YEAR PROJECT WEEKLY REPORT

(Project I / <u>Project II</u>)

Trimester, Year: Trimester 2, Year 4	**Study week no.:** Week 8
Student Name & ID: Phan Kar Yu, 1600300	
Supervisor: Ts. Dr. Lee Chen Kang	
Project Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

1. The EyeJack creator has been used to develop the AR environment in the game module.
2. The AR environment in the game module has done developed which a allows user to see the AR images in the AR environment.

2. WORK TO BE DONE

1. Do the chapter 4 of development in the fyp2 report.
2. Comparing the pollution and non-pollution environment by putting 5 images of AR pollution environment and 5 images of AR non-pollution images in the AR environment.

3. PROBLEMS ENCOUNTERED

1. The AR environment in the game module do not contain education value for the user.

4. SELF EVALUATION OF THE PROGRESS

1. Compare the pollution and not pollution images of environment so that the AR environment contain the education value for the user.

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Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project I / <u>Project II</u>)

Trimester, Year: Trimester 2, Year 4	**Study week no.:** Week 9
Student Name & ID: Phan Kar Yu, 1600300	
Supervisor: Ts. Dr. Lee Chen Kang	
Project Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

1. Done the chapter 4 of development in the fyp2 report.
2. Comparing the pollution and non-pollution environment has been created in the AR environment of game module.

2. WORK TO BE DONE

1. Create the survey of testing in the google form in order to collect the feedbacks from the user.

3. PROBLEMS ENCOUNTERED

1. Do not know the preliminary work of chapter 4 which done in the fyp1 need to include in the chapter 4 of fyp2.
2. Do not know create how many questions for the user to do the testing survey.

4. SELF EVALUATION OF THE PROGRESS

1. Do not need to include the preliminary work in the chapter 4 of fyp2.

2. Create 12 or 13 questions for the user to do the testing survey.

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FINAL YEAR PROJECT WEEKLY REPORT

(Project I / <u>Project II</u>)

Trimester, Year: Trimester 2, Year 4	**Study week no.:** Week 10
Student Name & ID: Phan Kar Yu, 1600300	
Supervisor: Ts. Dr. Lee Chen Kang	
Project Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

1. Developed the questionnaire which has 15 questions included the video of the edutainment system, close-ended questions and open-ended questions.

2. WORK TO BE DONE

1. Set the video into public mode.
2. Spilt questions in the questionnaire into several parts which are the overall system usability and features, evaluation on each modules and open-ended question.

3. PROBLEMS ENCOUNTERED

1. The video cannot be seen as it set the mode of private.
2. Spilt questions in the questionnaire into several parts which are the overall system usability and features, evaluation on each modules and open-ended question.

4. SELF EVALUATION OF THE PROGRESS

1. Set the video into public mode.
2. Spilt questions in the questionnaire into several parts which are the overall system usability and features, evaluation on each modules and open-ended question.

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FINAL YEAR PROJECT WEEKLY REPORT

(Project I / <u>Project II</u>)

Trimester, Year: Trimester 2, Year 4	**Study week no.:** Week 11
Student Name & ID: Phan Kar Yu, 1600300	
Supervisor: Ts. Dr. Lee Chen Kang	
Project Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

1. Set the video into public mode.
2. Spilt questions in the questionnaire into several parts which are the overall system usability and features, evaluation on each modules and open-ended question.
3. Corrected some questions in the questionnaire.

2. WORK TO BE DONE

1. Change some questions in the questionnaire so that user can choose more than one answers.
2. Distribute the online questionnaire to collect the data.
3. Do the chapter 5 of testing, results and discussions in fyp2 report.
4. Do the chapter 6 of overview in fyp2 report.
5. Write list of table and list of figures of chapter 4, 5 and 6 in the fyp2 report.

3. PROBLEMS ENCOUNTERED

1. Some of the questions in the questionnaire can let the user to choose more than one answers.

4. SELF EVALUATION OF THE PROGRESS

1. Change some questions in the questionnaire so that user can choose more than one answers.

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FINAL YEAR PROJECT WEEKLY REPORT

(Project I / <u>Project II</u>)

Trimester, Year: Trimester 2, Year 4	**Study week no.:** Week 12
Student Name & ID: Phan Kar Yu, 1600300	
Supervisor: Ts. Dr. Lee Chen Kang	
Project Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

1. Changed some questions in the questionnaire so that user can choose more than one answers.
2. Distributed the online questionnaire to 78 respondents and analyzed the results from the collected data.
3. Done the chapter 5 of testing, results and discussions in the fyp2 report.
4. Done the chapter 6 of overview in the fyp2 report.
5. Wrote list of table and list of figures of chapter 4, 5 and 6 in the fyp2 report.

2. WORK TO BE DONE

1. Correct the 6.2 of research findings which analyzed the results collected from the 5.4 of results and discussions to see got achieve the objectives of the multimedia courseware development.

3. PROBLEMS ENCOUNTERED

1. Temporary no problems encountered.

4. SELF EVALUATION OF THE PROGRESS

1. Checking on the fyp2 report.

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FINAL YEAR PROJECT WEEKLY REPORT

(Project I / <u>Project II</u>)

Trimester, Year: Trimester 2, Year 4	**Study week no.:** Week 13
Student Name & ID: Phan Kar Yu, 1600300	
Supervisor: Ts. Dr. Lee Chen Kang	
Project Title: Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

1. Done the correction of the 6.2 of research findings which analyzed the results collected from the 5.4 of results and discussions to see got achieve the objectives of the multimedia courseware development.
2. Changed the fyp1 checklist to fyp2 checklist.
3. Submitted the fyp2 report to Turnitin.
4. Updated the poster to fyp2 contents by replacing the user requirements gathering graphs to users testing graphs.
5. Already put the user testing sample questionnaire in appendix.
6. Added the front cover, signed report status declaration form and title page into the fyp2 report.

2. WORK TO BE DONE

1. Update the table contents.
2. Update the poster contents by change the user requirement gathering to user testing and change the technologies involved to system display.
3. Delete the fyp1 weekly log and correct the fyp2 work done.
4. Put the Turnitin originality report into the plagiarism check result in fyp2 report.

3. PROBLEMS ENCOUNTERED

1. Did not update the table contents.
2. Did not update the poster contents by change the user requirement gathering to user testing and did not change the technologies involved to system display.
3. Did not delete the fyp1 weekly log.
4. The fyp2 work done repeat the same things in every week.
5. Did not put the Turnitin originality report into the fyp2 report.

4. SELF EVALUATION OF THE PROGRESS

1. Update the table contents.
2. Update the poster contents by change the user requirement gathering to user testing and change the technologies involved to system display.
3. Delete the fyp1 weekly log and correct the fyp2 work done.
4. Put the Turnitin originality report into the plagiarism check result in fyp2 report.

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_____*Phan*_____

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Plagiarism Result Checked

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Full Name(s) of Candidate(s)	Phan Kar Yu
ID Number(s)	1600300
Programme / Course	Bachelor of Information Systems (Hons) Information Systems Engineering
Title of Final Year Project	Computer Aided Instruction (CAI) for Biology Curriculum (Learner Centered Approach)

Similarity	**Supervisor's Comments** **(Compulsory if parameters of originality exceeds the limits approved by UTAR)**
Overall similarity index:___5_____ % **Similarity by source** Internet Sources: _____4_____% Publications: _____3_____ % Student Papers: _____0_____ %	
Number of individual sources listed of more than 3% similarity: _____0_____	

Parameters of originality required and limits approved by UTAR are as Follows:
  (i)   Overall similarity index is 20% and below, and
  (ii) Matching of individual sources listed must be less than 3% each, and
  (iii) Matching texts in continuous block must not exceed 8 words
Note: Parameters (i) – (ii) shall exclude quotes, bibliography and text matches which are less than 8 words.

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

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

Lee Chen Kang

_____   _____

Signature of Supervisor   Signature of Co-Supervisor

Name: __Dr. Lee Chen Kang_____   Name: _____

Date: _____10/9/2020_____   Date: _____

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF INFORMATION & COMMUNICATION TECHNOLOGY (KAMPAR CAMPUS)

CHECKLIST FOR FYP2 THESIS SUBMISSION

Student Id	1600300
Student Name	Phan Kar Yu
Supervisor Name	Ts. Dr. Lee Chen Kang

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

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

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