

3D INTERACTIVE COURSEWARE FOR EDUCATION:
ANATOMY OF HUMAN BRAIN

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3D INTERACTIVE COURSEWARE FOR EDUCATION:
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requirements for the award of the degree of
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ABSTRACT

3D Interactive courseware for education (Anatomy of Human Brain) is an educational courseware that will provide information about human brain structures, the functions and the interaction towards senses. This could help the user to gain knowledge on human brain related topics and help them to seek information. Plus, there are problems that have been discovered that is lead to this courseware creation which is most of the people is still using traditional methods of seeking information, difficulties to explore the brain directly, the human brain has too many parts to remember and understand, and the waste of paper. The objectives of this project are to study about the human brain, to develop interactive courseware that includes 3D models, and to test the effectiveness and functionality of this courseware. Besides, the methodology that will be used is ADDIE model. The courseware could provide an accurate look at the anatomy of the most important organ in human body. 3D interactive courseware for education would be an outstanding experience of learning for users. Quiz also included in this courseware for users to attempt and evaluate their understanding on human brain.

ABSTRAK

Perisian 3D Interaktif untuk pendidikan (Anatomi Otak Manusia) adalah sebuah perisian kursus pendidikan yang akan menyediakan maklumat mengenai struktur otak manusia, fungsi dan interaksi terhadap deria. Ini boleh membantu pengguna untuk mendapatkan pengetahuan mengenai topik-topik yang berkaitan otak manusia dan membantu mereka untuk mendapatkan maklumat. Selain itu, terdapat masalah yang telah ditemui yang membawa kepada penciptaan perisian ini iaitu sebahagian besar orang masih menggunakan kaedah tradisional dalam mencari maklumat, kesukaran untuk meneroka otak secara langsung, otak manusia mempunyai terlalu banyak bahagian untuk diingati dan difahami, dan pembaziran kertas. Objektif projek ini adalah untuk mengkaji tentang otak manusia, untuk membangunkan perisian kursus interaktif yang merangkumi model 3D, dan untuk menguji keberkesanan dan fungsi perisian ini. Selain itu, kaedah yang akan digunakan ialah model ADDIE. Perisian ini boleh memberikan sudut pandangan yang tepat terhadap anatomi organ yang paling penting dalam badan manusia. Perisian interaktif 3D untuk pendidikan akan menjadi sebuah pengalaman pembelajaran yang luarbiasa untuk pengguna. Kuiz juga akan dimasukkan dalam perisian ini bagi pengguna untuk mencuba dan menilai pemahaman mereka terhadap otak manusia.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Nowadays, the world is too dependent on machines and technologies in daily life. The technology has affected society and its surroundings in a number of ways. Various forms of technologies have been created to enable people to do any task or work, such as The Information Technology. The use of modern information technology in education helps students to form a creative and productive approach, which is sure to give them a lot of benefits for their future profession or a process of self-education. The advantages of the technology also very helpful for teachers and students to maximize their efforts in teaching and learning.

There are many ways to improve the field of education. For example, interactive courseware system. By this system, teachers are no longer to be the only reference sources in teaching and learning. It is able to be used by teachers and learners for different learning activities which involve specific computer tools and facilities.

The brain is the most complex organ in human body consist of external and internal part. In every part of structure in human brain involves different activities. Generally, there are five sense organs that involve in brain activities which is sight,

smell, taste, touch, and hearing. There is so much information about the human brain that we can study. However, there are problems that have been discovered which is most of the people is still using traditional methods to seeking information, difficulties to explore the brain directly, human brain has too many part to remember and understand, and paper waste.

The motivation of this project is to implement the 3D interactive courseware as the resources in teaching and learning. The aim of this courseware is to give information about the human brain to public, especially for those who in the education field. The information given will relate to the human brain structure, the functions, and human senses. This project also will develop a human brain in the 3D model.

1.2 Problem Statement

Several problem has been discovered that lead to the creation of this educational courseware. One of the problem is most of people especially the students are still using the traditional method to seeking information about the human brain. Usually, they only use books and materials from the internet. Uninteresting lessons in schools also can lead the students to boredom.

Besides, the brain is the most complex organ in the human body. The brain is divided into two parts which is internal and external brain. In every part of it has a few more other components. Plus, each component has a different function and a different name. It is too many parts of the brain for students to remember and understand. Of course, there will be students who are not interested to learn because it is too much for them. Therefore, the interactive courseware using the 3D model can be used as an alternative to attract them to learn.

Furthermore, most of people are not able to explore the structure of the human brain and its functions in detail. It is very difficult for them to get a chance to see it directly because it is so limited and privacy, especially when they are not a members in medical fields. What they can do is just by looking through the pictures and videos.

Millions of tons of paper every day produced for daily use such as documentation in the office and at school. Many trees have been cut down to produce paper. Unfortunately, the papermaking process is not a clean one. According to the U.S. Toxic Release Inventory report published by the U.S. Environmental Protection Agency (EPA), pulp and paper mills are among the worst polluters to air, water and land of any industry in the country. The Worldwatch Institute offers similar statistics for the rest of the world. Each year millions of pounds of highly toxic chemicals such as toluene, methanol, chlorine dioxide, hydrochloric acid and formaldehyde are released into the air and water from papermaking plants around the world. Therefore, the interactive courseware system at least can help to minimize the waste of paper.

1.3 Objective

- i. To study and collecting information about the human brain.
- ii. To develop educational courseware that includes Object2VR technique.
- iii. To test functionality of this courseware.

1.4 Scope

- i. The target users for 3D interactive courseware is medical students, physiology students, teachers, and any user who seeking information about the human brain. The 3D models, video animation and quiz are included in this courseware. Through this courseware, the user should be able to learn and understand about the structure and how the human brain works.
- ii. This courseware is developed as a stand-alone application which is does not require any special software other than the operating system itself to work.
- iii. The text of information about human brain will be in full English. The English language is the most widely used languages in the world which will allow users from all over the world to get the information about the human brain.
- iv. The activities of human brain will cover on three senses organs; sight, smell, and hearing.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The main purpose of this chapter is to study about the courseware system, analysis and comparison of existing system, and human brain.

2.2 Courseware system

Courseware is a combination of the words 'course' with software. The courseware system is a computer program that is widely used as one of the new technologies in any knowledge area. Usually, it is used as a tutoring system for students to learn about something without intervention from the teacher or lecturer. Students also can access the courseware regardless of time or in any place. It is very helpful in disseminating important information to students.

2.3 Existing system

2.3.1 Brain and Nervous Anatomy Atlas

Brain and Nervous Anatomy Atlas by Visible Body is an interactive reference and study guide on the human nervous system. The application includes an Atlas section with 1,000+ structures in the human nervous system, a Media section with 14 animations and illustrations, and a Quiz section with over 100 questions to help review nervous structures.

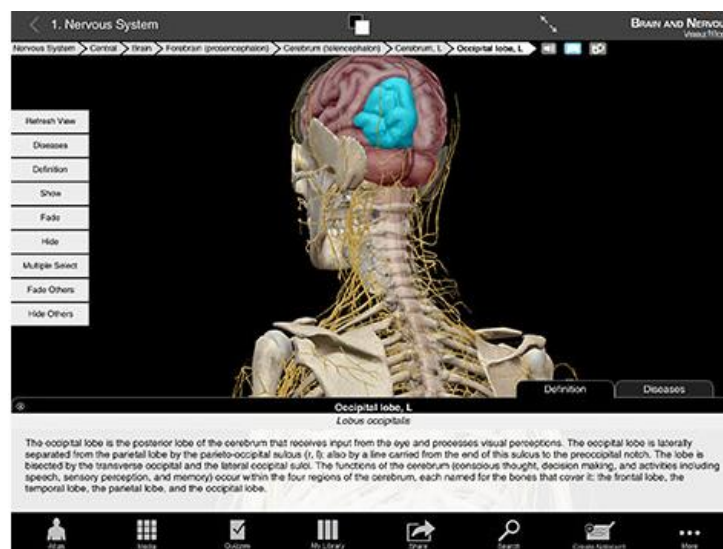


Figure 1.1: Brain and Nervous Anatomy Atlas

Problems in the Brain and Nervous Anatomy Atlas

This application provided limited 3D model of the human body and other features for the first time installation. The users need to purchase an additional pack of the 3D anatomical models and their features to explore more about the human body.

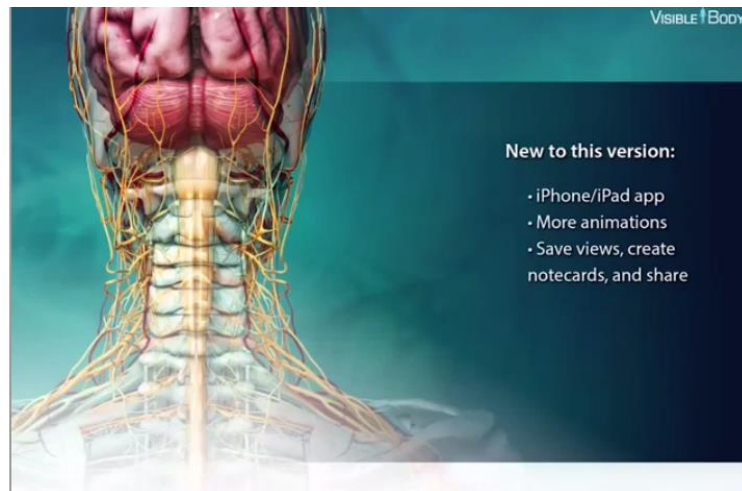


Figure 1.2: Purchase additional 3D model in Brain and Nervous Anatomy Atlas

Besides, the navigation of 3D model also quite difficult to control for the first time used and need more time to understand it. Sometimes, the users may get confused with the function of each button in this application.



Figure 1.3: Navigation in Brain and Nervous Anatomy Atlas

2.3.2 Anomalous Medical

Anomalous Medical which is developed by Anomalous Medical, LCC is a 3D anatomy education software program. This application is designed to help the medical professionals to save time, communicate with patients, and enhance the image of their practice. This 3D Anatomy software combines the knowledge of medical experts in 3D interactive anatomy simulation. Using this application, we are able to discover the part of the human body in detail.

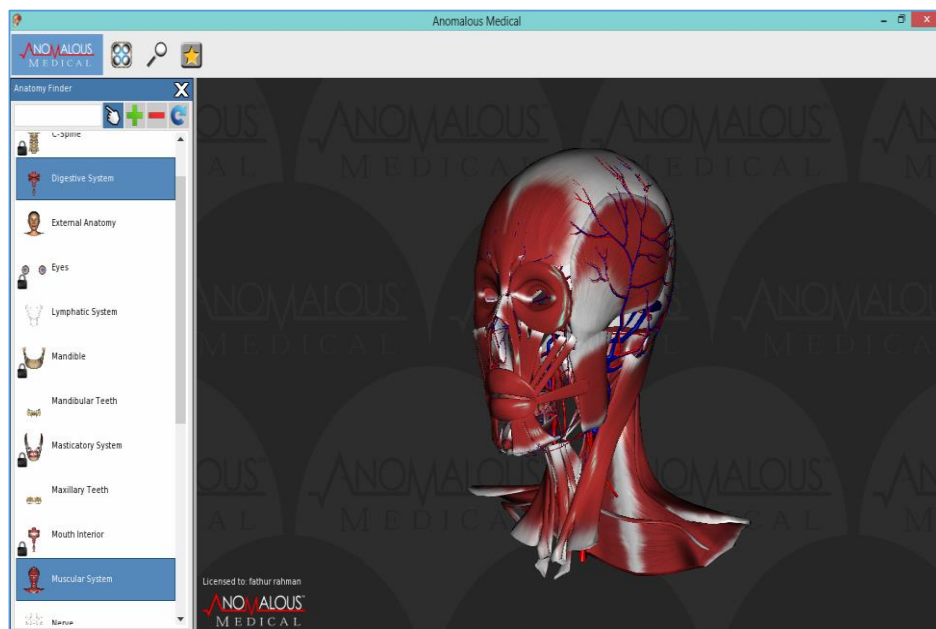


Figure 1.4: Anomalous Medical

Problems in the Anomalous Medical

As the first step to use this application, the users must login to open it. The users need to do this because this application provides some online features. It is might be for updating their features or any technical issues that they need to resolve.

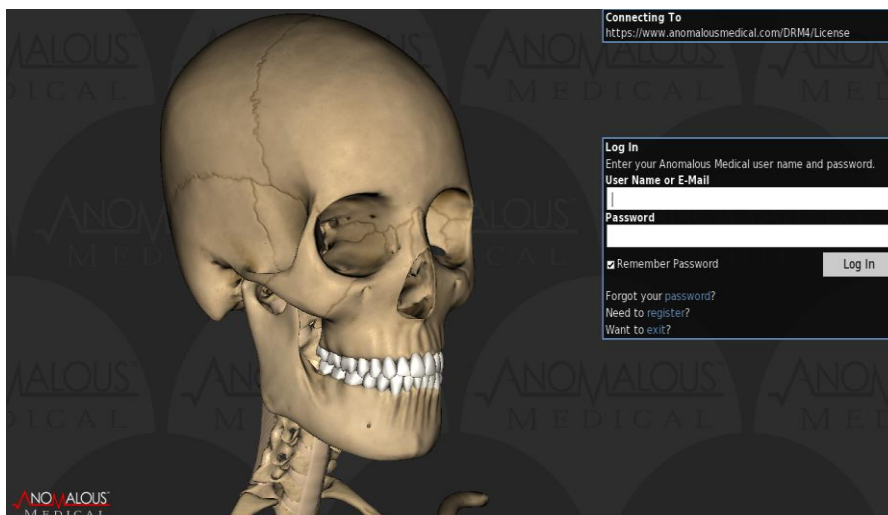


Figure 1.5: User login in Anomalous Medical

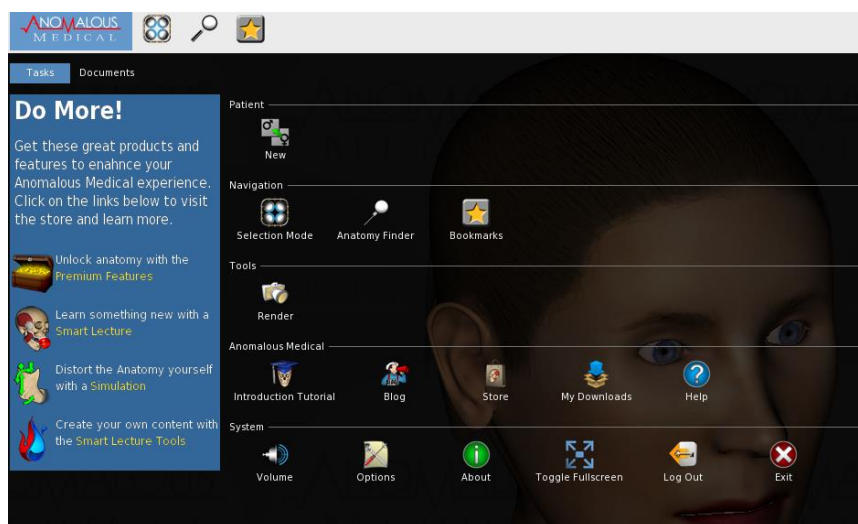


Figure 1.6: Purchase additional features in Anomalous Medical

This application also provides limited 3D model of the human body. The users need to purchase at their online store to get more additional product of 3D model and its features. However, this system does not include information about the part of the human body. Furthermore, this application may need navigation tools which is more user friendly and easy to control the movement of the 3D model.

2.3.3 Anatomica - 3D Interactive Anatomy

Anatronica - 3D Interactive Anatomy developed by Goodwill Enterprise Development is a free interactive 3D anatomy study aid and featuring an advanced 3D interface. It is suitable for students, teachers and everybody who is interested in human anatomy and also available for desktop and mobile. In this application, the dynamic search tool are provided to find and locate objects from thousands of anatomical structures. Furthermore, it is also included an information of every part of the human body from Wikipedia and Grays anatomy.



Figure 1.7: Anatomica - 3D Interactive Anatomy mobile version

Problems in the Anatronica - 3D Interactive Anatomy

This application provided a demo apps installation for google chrome browser. But, there is some problem that happened to open this application which is only load in a 2 inches strip at the top of the windows.

In order to run an online version of Anatronica Interactive 3D Anatomy Unity3D plug-in is needed. High graphics may cause the system need more time loading. The navigation tools also quite difficult to control.

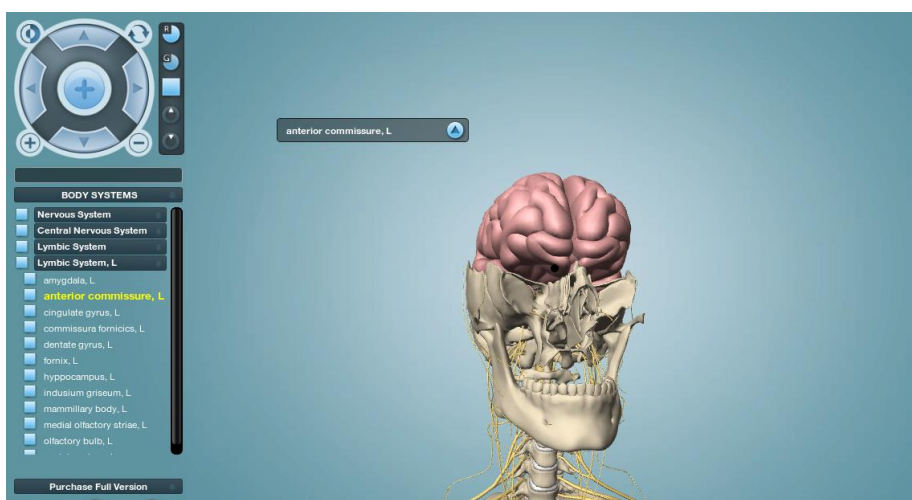


Figure 1.8: Unity Web Player for online version of Anatronica - 3D Interactive Anatomy

2.4 Comparison between existing systems

Table 1.1: Literature review comparison table

	Brain and Nervous Anatomy Atlas	Anomalous Medical	Anatronica - 3D Interactive Anatomy
Targeted user	i. students	i. medical professionals	i. Students, teachers any users who interested.
Internet connection	i. No internet connection required after download.	i. No internet connection required after download. But must register it first.	i. Always connect to the internet.
Cost	i. Free installation ii. Pay for additional features.	i. Free Installation ii. Pay for additional features.	i. Pay by type of application that provided.
Application for	i. Ipad.	i. PC / Laptop.	i. Internet browser. ii. Desktop/Mobile.
User control	i. View 3D model without navigation tool. ii. Single page of interface.	i. View 3D model with simple navigation tool. ii. Single page of interface.	i. View 3D model with navigation tool. ii. Single page of interface.
Functionality	i. Explore 3D model of human nervous system. ii. Provide information of human nervous system iii. Includes animations, and Quiz.	i. Explore 3D model of human upper body ii. No information provided	i. Explore 3D model of full human body. ii. Provide information for every part of human body

Based on the problems and comparison between the existing systems, this project will be implemented a new technique which is called Object2VR to view the 3D model. By using this technique, it will solve several problems in the previous existing system. It will be focusing on one part of the human body which is the human brain. In addition, the detailed information about the human brain will be provided. This courseware also includes navigation tools to move the 3D model. The interface design also will be made in the simple form, attractive and easy to understand. Furthermore, it will be built as a standalone courseware and not charge too much cost for users.

2.5 Human Brain

Human brain can be considered as the most complex organ in the human body. The brain is a part of the central nervous system (CNS). It receives information from other parts of the body via the spinal cord and the peripheral nervous system and uses this information to control the body. The human brain has the same basic structure as the other mammal brains, but it is larger than any other brains based on their body size. There are many components in the human brain that work together to maintain basic life processes. The main component of human brain is the cerebrum, the cerebellum, and the brain stem. The cerebrum is the largest part of the human brain that controls activity and thought. While, the cerebellum controls posture, balance, and coordination. Plus, the brain stem is the part at the base of the brain that connects the spinal cord with the hemispheres of the brain.

2.5.1 Structure of Human Brain

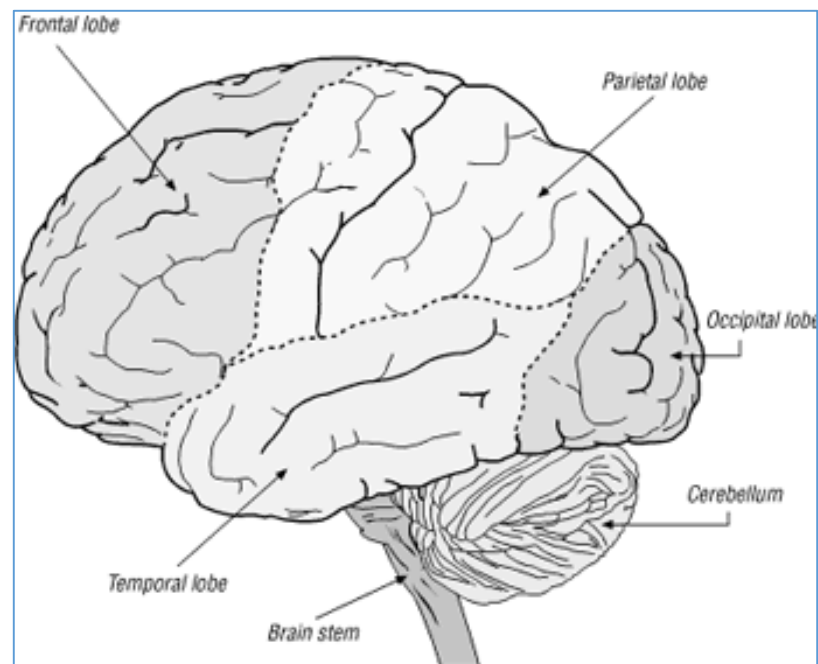


Figure 1.9: External Structure of Human Brain

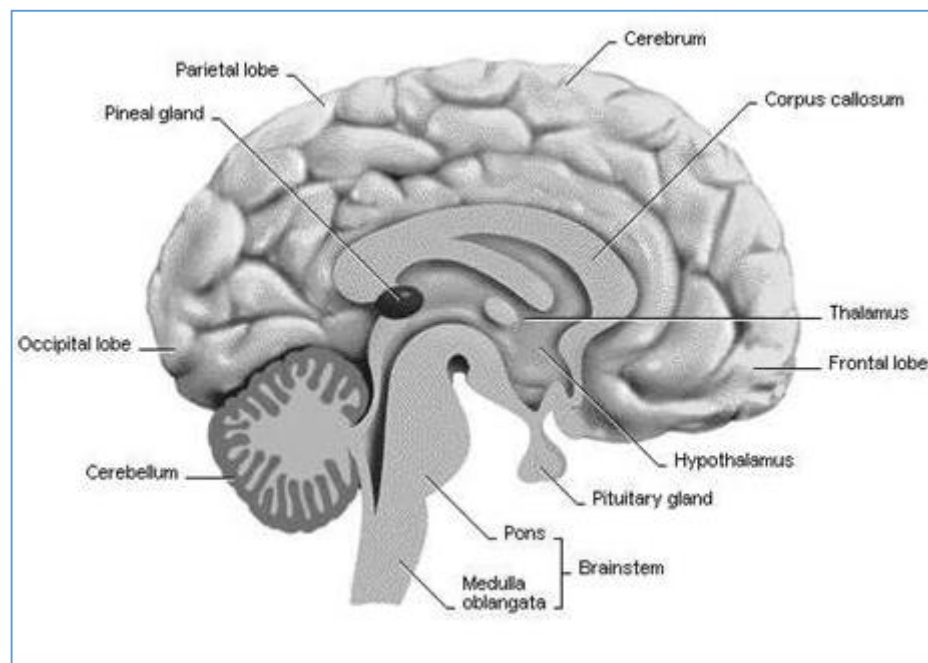


Figure 2.0: Internal Structure of Human Brain

2.5.2 Function of Human Brain

Table 1.2: Human brain function info table

Structure	Function
1. Frontal lobe	i. Affects emotion, limbic system, personality, judgment, intellect, morality, language planning, consciousness, motor cortex, abstract thought, voluntary movement, olfaction, attention span, short-term memory, perseverance, impulse control.
2. Parietal lobe	i. The major association area and effects sensory functions, motor functions, pain, temperature, somatosensory, pressure, position, tactile recognition, perceptual functions, taste, abstract reasoning, body image, spatial relations, proprioception, right-left discrimination and the ability to read and create maps
3. Occipital lobe	i. Affects vision. The optic tract integrates visual stimuli with other cortical areas
4. Temporal lobe	i. The major memory processor and affects hearing, receptive language, the sense of smell, understanding speech (Wernicke's), emotional memory (limbic area), awareness and discrimination of sound.
5. Cerebellum	i. Coordinates movement and muscles; controls balance, muscle tension, equilibrium, posture, and the ability to identify muscle overuse.
6. Diencephalon: i. Thalamus ii. Hypothalamus	i. The thalamus is the cerebral cortex relay center, affects emotive expression, integrates sensory (sight, hearing, touch and taste) input with emotional responses, regulates and maintains consciousness, is the collection of pathways.

	<p>ii. The Hypothalamus is the Autonomic Nervous System (ANS) integration center, affects visceral reflexes; regulates thirst, temperature, sleep, appetite cycles, fat metabolism and sexual responses; monitors hormones, blood pressure, “flight or fight” response, and emotions. It is part of the limbic system. The pituitary gland (“master gland”) is situated at the base of the hypothalamus.</p>
<p>7. Epithalamus : i. (Pineal Gland)</p>	<p>i. Called the “third eye”; sensitive to variations in environmental light; located behind the thalamus; connects with the thalamus, hypothalamus, basal nuclei, and medial temporal lobe; produces melatonin; controls body rhythms, may affect onset of puberty; stimulates the immune system, is an active endocrine gland</p>
<p>8. Limbic System: i. Olfactory System ii. Amygdala iii. Hippocampus</p>	<p>The limbic system is the older part of cortex, includes parts of temporal frontal, and parietal lobes plus subcortical associations, olfactory pathways anatomically close to limbic system, responsible for emotions, attitudes, motivation, drive, social bonding, influences sexual activity, influences biological rhythms, integrates recent memory.</p> <p>i. Olfactory system is an old and primitive system; olfactory pathways anatomically close to limbic system, smell directly processed; responsible for emotional tone; influences sexual activity, influences biological rhythms, integrates recent memory.</p> <p>ii. Amygdala is located within the basal ganglia; includes parts of temporal, frontal, and parietal lobes; “heart of the limbic system”; regulates heartbeat, visceral activity, emotional response,</p>

	<p>and mood; FEAR processor; initiates “Fight or Flight” response; controls autonomic nervous system; integrates cognitive and sensory input to decipher potential impact of an event. Visual, auditory and somatosensory areas provide input to the amygdale.</p> <p>iii. The hippocampus is critical in organizing long-term/declarative memory; necessary for storing new memories as they occur.</p>
<p>9. Brain Stem:</p> <p>i. Midbrain</p> <p>ii. Pons</p> <p>iii. Medulla</p>	<p>i. The mid brain is the cerebral hemisphere nerve pathway; affects body posture, equilibrium, the Autonomic Nervous System (ANS), blood pressure, body temperature, emotional influences, and consciousness; help regulate appetite and hormones. It is home to nuclei of cranial nerve III and IV.</p> <p>ii. Pons is the central bridge between descending tracts from the midbrain to the lower centers and ascending tracts from the medulla and the spinal cord. It affect respiration, chewing, taste, arousal, wakefulness, and alertness. It is home to the nuclei of cranial nerves V Trigeminal, VI Abducens, VII Facial, and VIII Vestibulocochlear.</p> <p>iii. Medulla is the life-sustaining control center; controls heart, respiratory, and vasomotor functions; affect the ability to cough, gag, swallow, vomit, and digest; hot to cranial nerves VIII Vestibulocochlear, IX Glossopharyngeal, X Vagus, XI Accessory, and XII Hypoglossal.</p>

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter will cover about the methodology that will be used through this project. After considering the various matters in this project, the ADDIE model will be used as the methodology.

3.2 The ADDIE model- Instructional Design

The word “ADDIE” is stands for Analyze, Design, Develop, Implement, and Evaluate. The ADDIE model is an instructional Systems Design model that will guide the designer or developer through the process of developing effective educational courses and materials for the users.

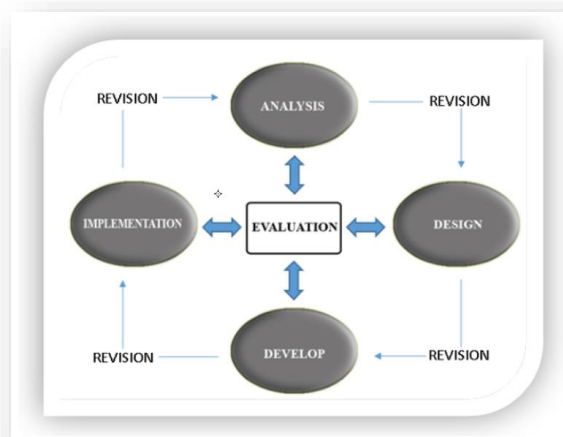


Figure 2.1: ADDIE model – Instructional Design

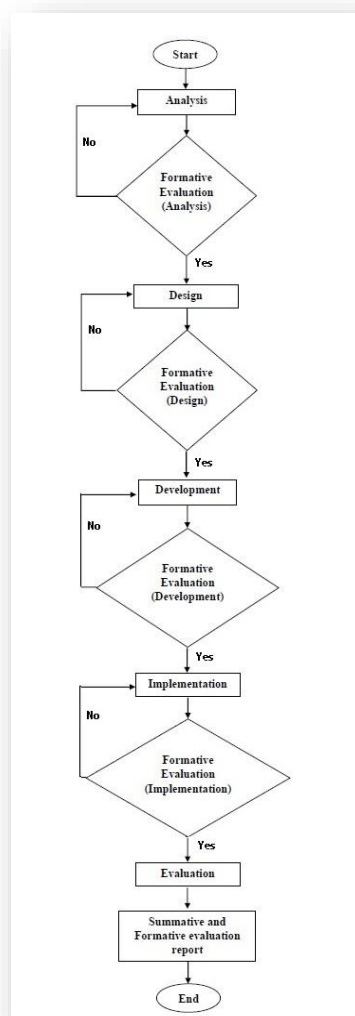


Figure 2.2: Flowchart of ADDIE model

3.2.1 Analysis Phase

The analysis phase is the first and the most important step in the process. This is the step where we gathered all the information needed through this project.

First of foremost, we identified the title which is 3D Interactive Courseware: Anatomy of Human Brain. This title is picked because of several problems that has been discovered. First, the people are still using traditional methods as their resources such as printed materials, power point slides, internet, mobile applications, educational software and multimedia courseware. Second, there are very limited ways to explore the human brain structure in details. Third, there are people who have a blood-phobia which is extremely afraid of blood, physical injury and others that related to it.

The target users for this 3D interactive courseware are any users either they are medical students, teachers, lecturers, or anyone who is seeking the information about human brain structure or all related issues to improvise their knowledge.

Besides, the objectives of this project is to study about human brain, develop educational courseware that includes 3D and test an effectiveness and functionality of the 3D interactive Courseware. This courseware will be contains the 3D model of human brain with labels, detailed view of its structures. It is also included the information on the interaction towards senses and every part of human brain; external and internal brain. Quiz related to human brain will be applied to test the understanding of the users.

Based on the analysis, there are no 3D Human Brain Anatomy courseware available which supports technology. Therefore, 3D interactive courseware that created would be a revolutionary technology in educating the users on human brain anatomy related knowledge.

3.2.1.1 User Requirement

The method that will be used to define the user requirement is using questionnaire and interview. All of the questions asked are focused on the users' understanding about the human brain, and the interactive courseware system. This research will be consist of three parts which is participants, data collection method and data analysis.

i. Participants:

A survey conducted was participated by 20 users from various backgrounds. The set of questionnaire consists of 10 questions that has to be answered by the user.

ii. Data Collection method:

The purpose of using the data collection method is to detect a problem and create solutions.

iii. Data Analysis:

All data collected by questionnaire will be analyzed and presenting in percentages and graphs.

3.2.1.2 User Responses

There are two techniques in the evaluation phase, namely summative evaluation and formative evaluation. The formative evaluation conducted to identify the effectiveness and efficiency of the 3D Interactive courseware for Anatomy of human brain. Based on the constructive response or feedback provided by the users, appropriate adjustments will be applied for the courseware. The summative evaluation will be conducted to identify the overall 3D Interactive courseware for Anatomy of human brain's effectiveness measured upon the courseware completion. The user feedbacks via survey and questionnaire collected and the contain accuracy, methods and effectiveness of the courseware will be validated. There 20 participants responded for both evaluation processes and the responses were collected and recorded in charts

3D Interactive Courseware For Education: Anatomy of Human Brain

* Required

Name: *

Name requested for informational and statistical purpose only

Your Gender: *

Male

Female

Level of your computer literacy? *

Beginner

Intermediate

Expert

What is your field of study? *

Please answer the following question.

	Yes	No
Do you know what is Hippocampus?	<input type="radio"/>	<input type="radio"/>
Do you understand the structure of human brain and its functions properly?	<input type="radio"/>	<input type="radio"/>
Do you have a blood phobia?	<input type="radio"/>	<input type="radio"/>
Teachers or lectures are using an interactive multimedia applications or similar tools as part of teaching and learning	<input type="radio"/>	<input type="radio"/>
Do you familiar with 3D interactive courseware?	<input type="radio"/>	<input type="radio"/>
Do you think it's interesting to have 3D interactive courseware to learn about human brain?	<input type="radio"/>	<input type="radio"/>

Never submit passwords through Google Forms

Figure 2.3: Questionnaire

3.2.1.3 Questionnaire result

From the questionnaires result, a conclusion can be made. In figure 2.1 shows that almost all respondents doesn't know the Hippocampus which is one of the part of human brain. We can assume that all the respondents is lacked of information about human brain structure. In Figure 2.2 is states that almost all the respondents doesn't understand the structure and its functions of human brain. Next in figure 2.3, there are five of twenty respondents that has a blood phobia. From figure 2.4, most of them agreed that the teachers or lecturers are using an interactive multimedia application in teaching and learning. It means that the technology is widely used by everyone to get information. However, in figure 2.5 only 60% of them are familiar with the 3D interactive courseware which is proved that the application that include 3D model are still not widely used as one of a sources in teaching and learning. Last but not least, in figure 2.6 almost all respondents shows their interest to have 3D interactive courseware to learn about human brain.

With the result data collected, then, solutions will be made to overcome the problems and improvise the existing systems. Feedback from respondents about their knowledge about human brain and courseware system is one of the processes in the analysis phase to make sure why this project should be implemented.

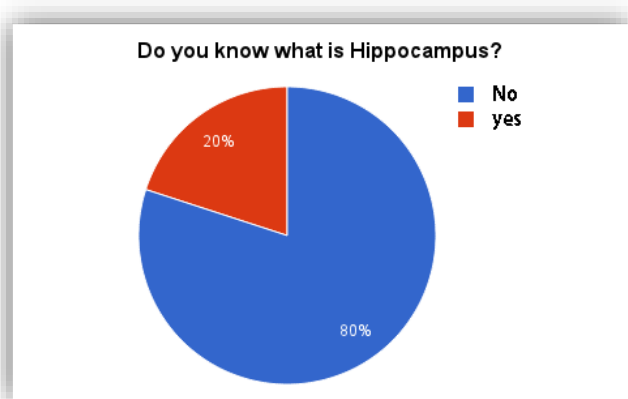


Figure 2.4: Hippocampus (Part of Human Brain)

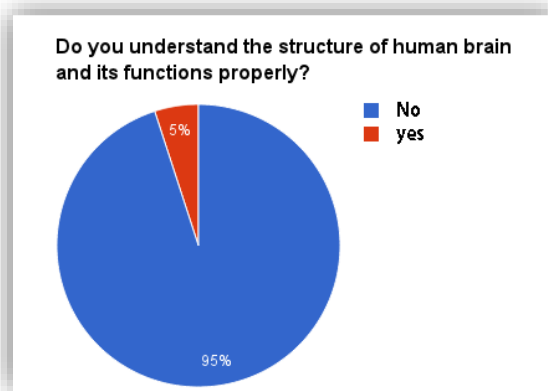


Figure 2.5: Structure of Human Brain and Its Function

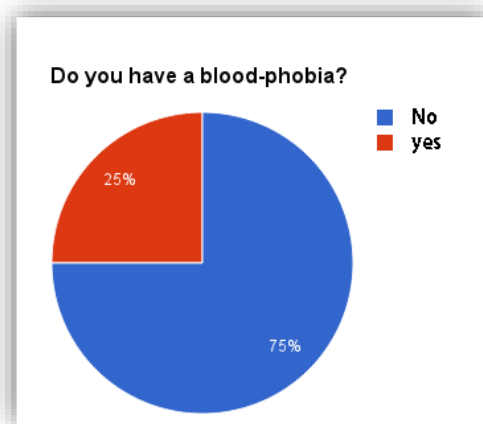


Figure 2.6: Blood-Phobia

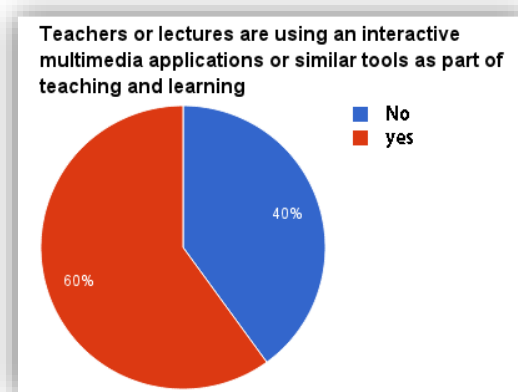


Figure 2.7: Learning materials

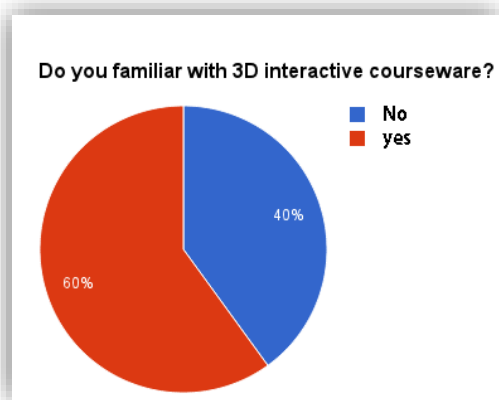


Figure 2.8: Familiar to 3D interactive courseware

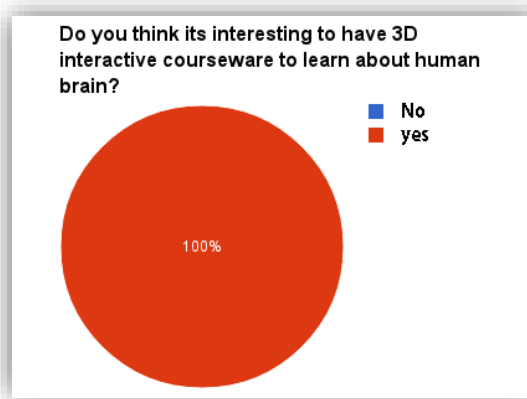


Figure 2.9: Users interest

3.2.1.4 Software and Hardware Requirement

Table 1.3: Software Requirement

Software	Purpose
1. Autodesk Maya	3D modeling and rendering.
2. Object2VR	To generate 360 degree image.
3. Microsoft Word / PowerPoint	For project based documentation
4. Adobe Flash Professional CS6	To develop a courseware.
5. Adobe Photoshop	Edit or create image textures.
6. Adobe After Effect	Create video

Table 1.4: Hardware requirement

Hardware	Specification	Purpose
1. Acer Aspire 4755g	i. Intel i5-2410M 2.3GHz with turbo boost up to 2.9Ghz ii. NVIDIA Geforce iii. Ram 8 GB iv. 14.0 HD LED LCD	For documentation and development
2. Apple iMac (Desktop)	i. 21.5 inch ii. Mac OS	For developing models using high standard software. For example, rendering process of images.
3. External Hardisk / Pen drive	i. 1 TB / ii. 4GB	Backup data and file

3.2.1.5 The Interaction of Human Brain towards Senses

1. Sight

2.

The eye is the organ of vision. It has a complex structure consisting of a transparent lens that focuses light on the retina. The retina is covered with two basic types of light-sensitive cells—rods and cones. The cone cells are sensitive to color and are located in the part of the retina called the fovea, where the light is focused by the lens. The rod cells are not sensitive to color, but have greater sensitivity to light than the cone cells. These cells are located around the fovea and are responsible for peripheral vision and night vision. The eye is connected to the brain through the optic nerve. The point of this connection is called the "blind spot" because it is insensitive to light. The brain combines the input of our two eyes into a single three-dimensional image. In addition, even though the image on the retina is upside-down because of the focusing action of the lens, the brain compensates and provides the right-side-up perception.

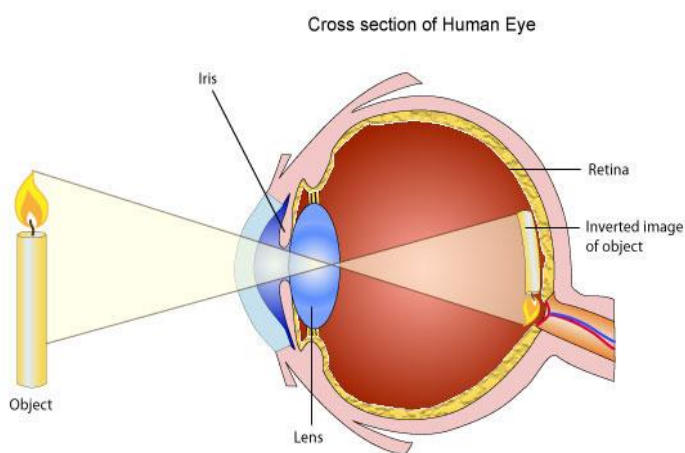


Figure 3.0: Human Sense of Sight

3. Smell

The nose is the organ responsible for the sense of smell. The cavity of the nose is lined with mucous membranes that have smell receptors connected to the olfactory nerve. The smells themselves consist of vapors of various substances. The smell receptors interact with the molecules of these vapors and transmit the sensations to the brain. The nose also has a structure called the vomeronasal organ whose function has

not been determined, but which is suspected of being sensitive to pheromones that influence the reproductive cycle. The smell receptors are sensitive to seven types of sensations that can be characterized as camphor, musk, flower, mint, ether, acrid, or putrid.

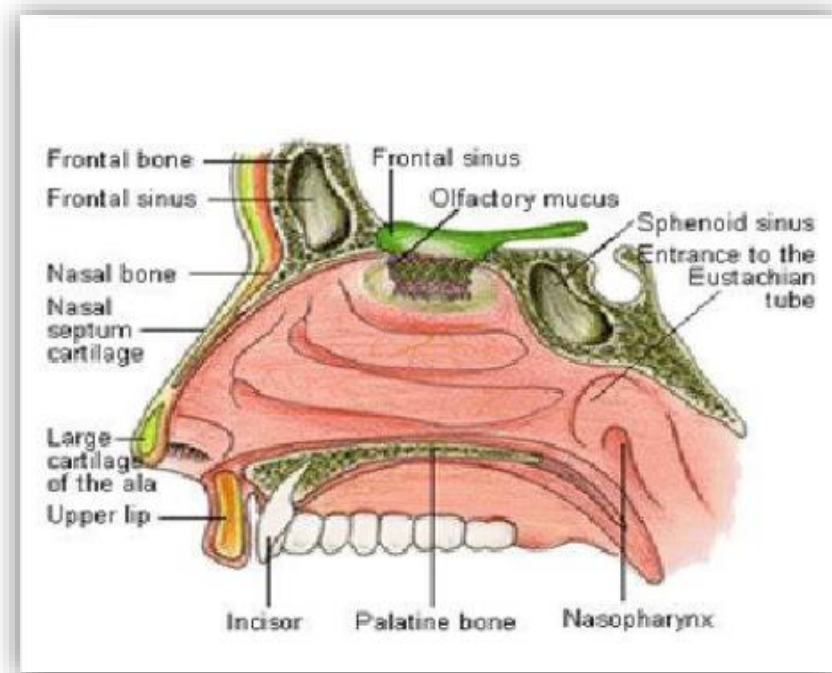


Figure 3.1: Human Sense of Smell

4. **Hearing**

The ear is the organ of hearing. The outer ear protrudes away from the head and is shaped like a cup to direct sounds toward the tympanic membrane, which transmits vibrations to the inner ear through a series of small bones in the middle ear called the malleus, incus and stapes. The inner ear, or cochlea, is a spiral-shaped chamber covered internally by nerve fibers that react to the vibrations and transmit impulses to the brain via the auditory nerve. The brain combines the input of our two ears to determine the direction and distance of sounds.

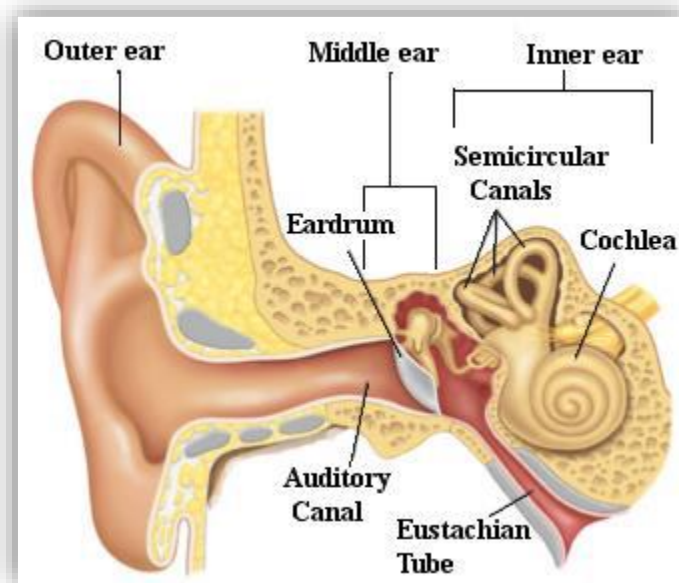


Figure 3.2: Human Sense of Hearing

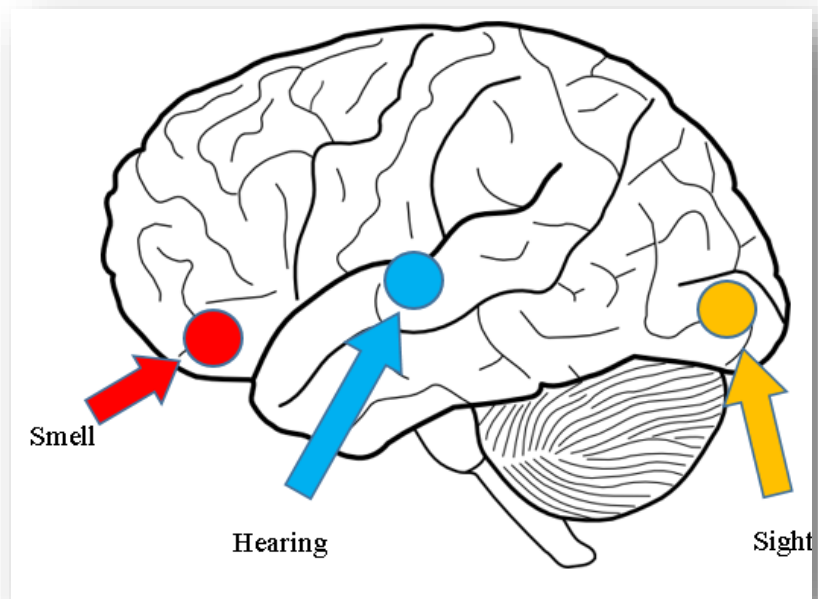


Figure 3.3: The connection between human brain and senses

3.2.2 Design Phase

The second phase in the ADDIE Model is Design phase which is to insure the systematic development of the courseware. This phase will deals with learning objectives of the courseware, assessment evaluation for quiz included, contents based on human brain anatomy and any related topics. The details of the storyboard that are attached in this report will help the designers to organize the system. Also, Gantt chart that are made will help the designers and developers to avoid any delaying and runs the project according to the timeline.

When the designing phase starts, some available application will be used to design the interface of the system to get the initial overview and design to this project. Thus, the 3D interactive courseware which will be developed using Adobe Flash Professional CS6 that would have an attractive interface design with high quality 3D models and construction of navigational interfaces to courseware.

The interactive courseware is consist of the multimedia navigation menu which is most appropriate navigation menu identified for a learning environment. A Multimedia menu also included a home button, back and next buttons and other related buttons which are not only look attractive but will be user friendly.

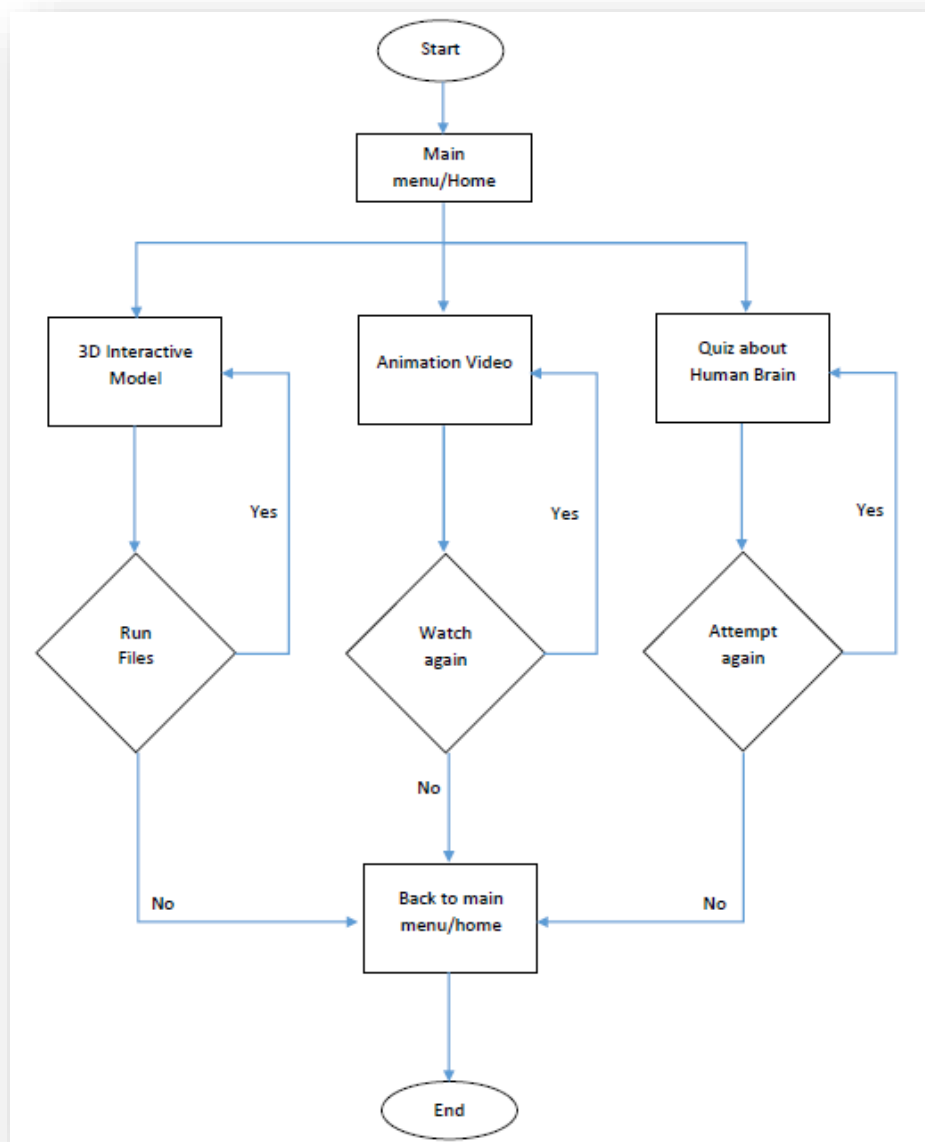


Figure 3.4: Flowchart of the courseware

3.2.2.1 Storyboard

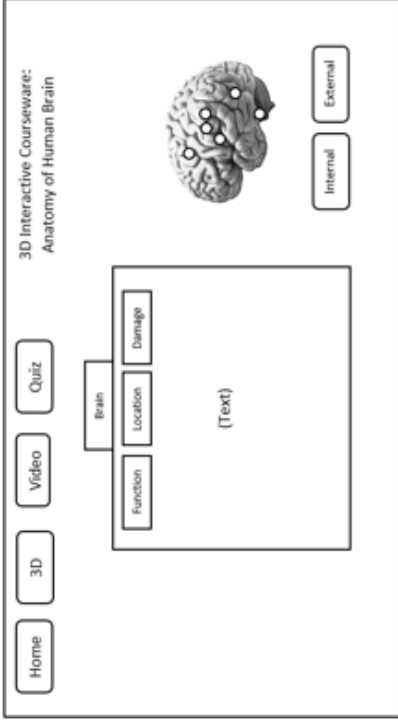
<p>Project title: 3D Interactive Courseware: Anatomy of Human Brain Screen title: Home page (Content 1) Resolution: 1024x768 4:3 Links From: - Links To: 3D, Video, Quiz, and External pages</p>	<p>Producer: Muhammad Fathurrahman Bin Rizal Date: 25 November 2014</p>
	<p>Screen description: The home page (content 1) contains the introduction of the human brain, and information about the part of external brain.</p> <p>Navigation: From home page to other pages. Graphics: Button (Customs designed) and Pictures. Animations: - Audio: - Video: - Functionality: - Introduction of Human Brain - shows the information about the part of external human Brain. Interactivity: - Click the button (menu, internal, and the part of human brain button). - Sliding text of information Hyperlinks: -</p>

Figure 3.5: Storyboard 1 (Home page Content 1)

<p>Project title: 3D Interactive Courseware: Anatomy of Human Brain</p> <p>Screen title: Home page (Content 2)</p> <p>Resolution: 1024x768 4:3</p> <p>Links From: -</p> <p>Links To: 3D, Video, Quiz, and Internal pages</p>	<p>Producer: Muhammad Fathurrahman Bin Rizal</p> <p>Date: 25 November 2014</p>
<p style="text-align: center;">3D Interactive Courseware: Anatomy of Human Brain</p>	
<p>Navigation: From home page to other pages.</p> <p>Graphics: Button (Customs designed) and Pictures.</p> <p>Animations: -</p> <p>Audio: -</p> <p>Video: -</p> <p>Functionality: - Introduction of Human Brain - shows the information about the part of internal human Brain.</p> <p>Interactivity: - Click the button (menu, external, and the part of human brain button.) - Sliding text of information</p> <p>Hyperlinks:-</p>	<p>Screen description:</p> <p>The home page (content 2) contains the introduction of the human brain, and information about the part of internal brain.</p>

Figure 3.6: Storyboard 2 (Home page Content 2)

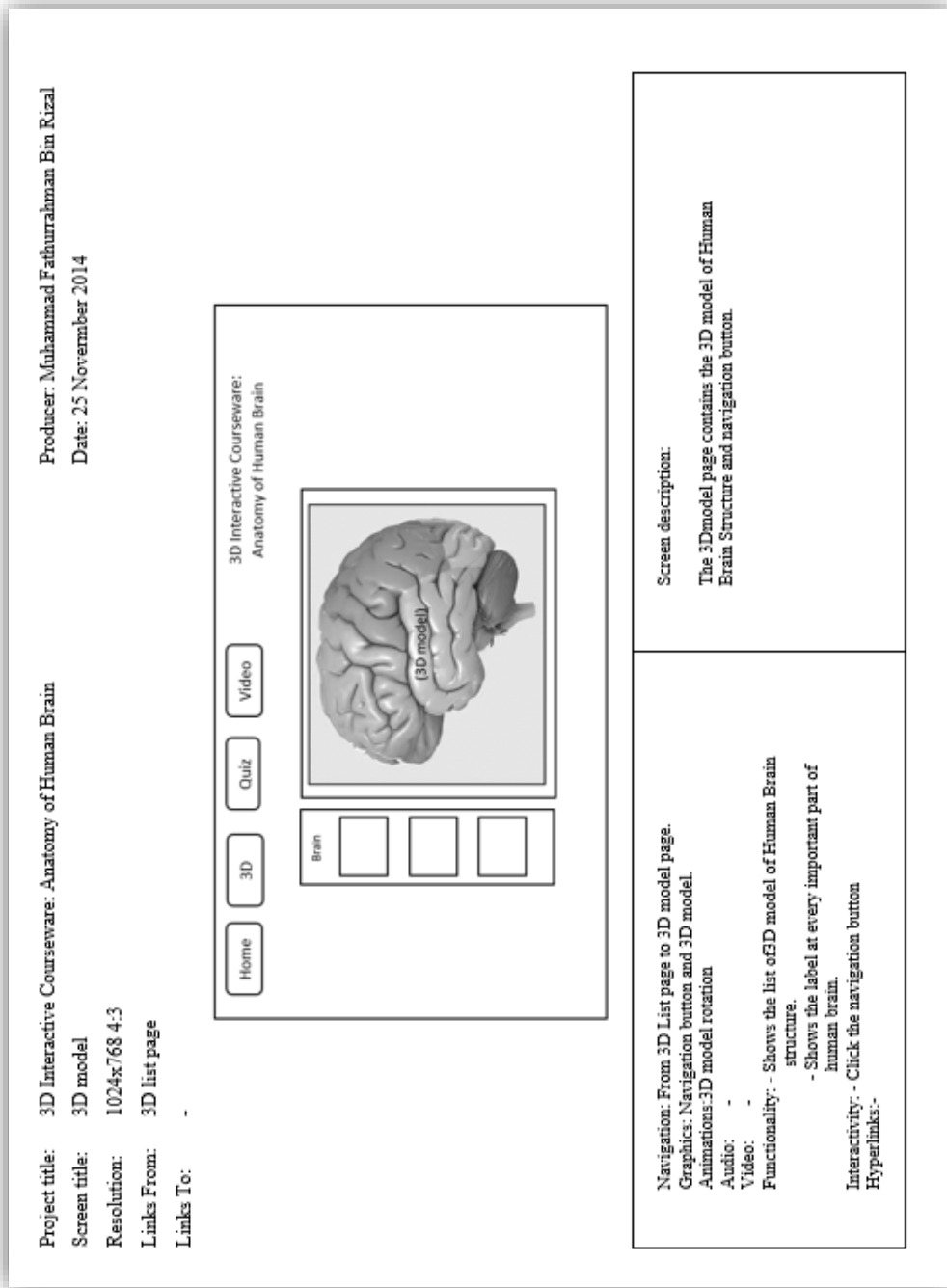


Figure 3.7: Storyboard 3 (3D model)

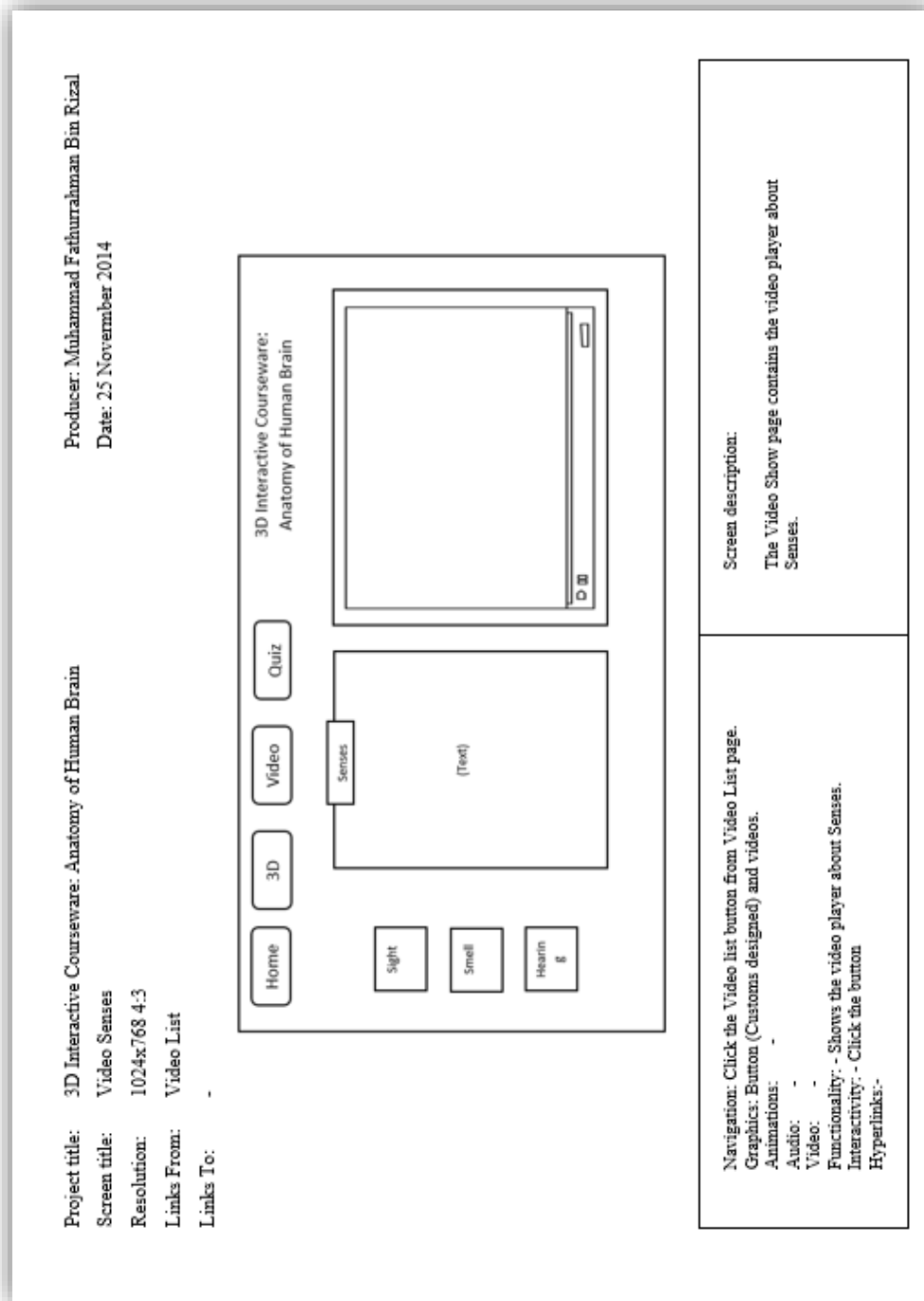


Figure 3.8: Storyboard 4 (Senses Video)

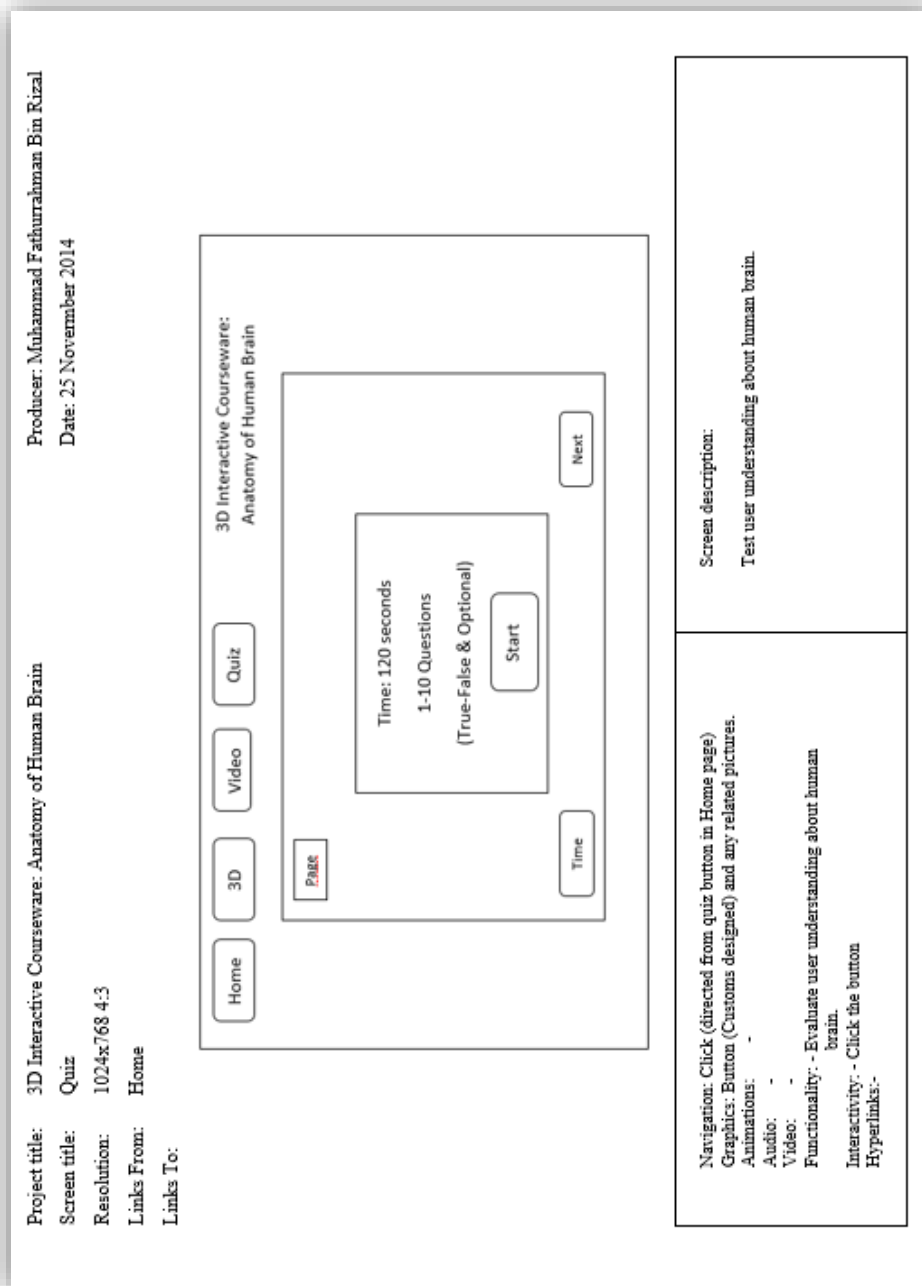


Figure 3.9: Storyboard 5 (Quiz)

3.2.2.2 Human Brain design

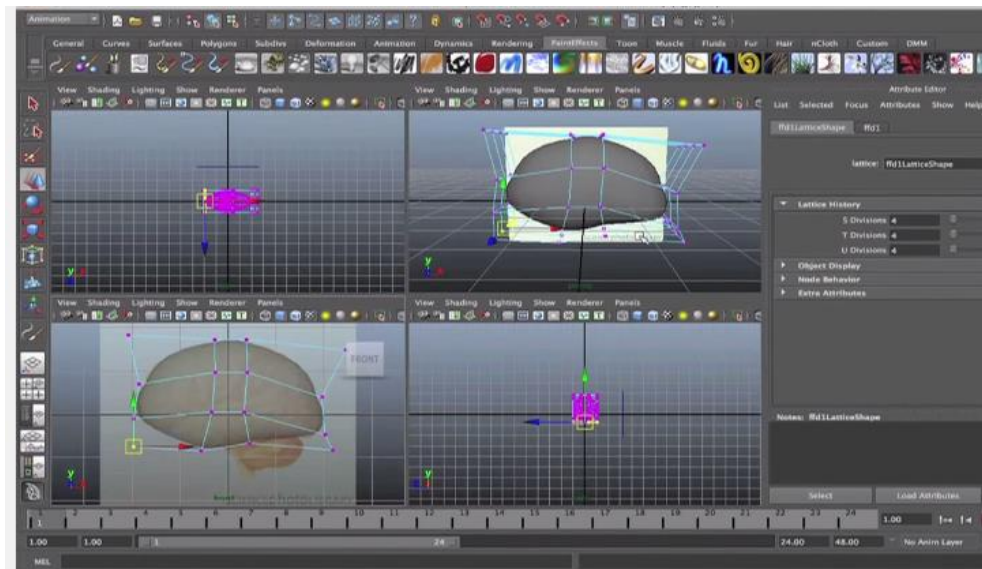


Figure 4.0: Human brain design in Autodesk Maya (Rough skecth 1)

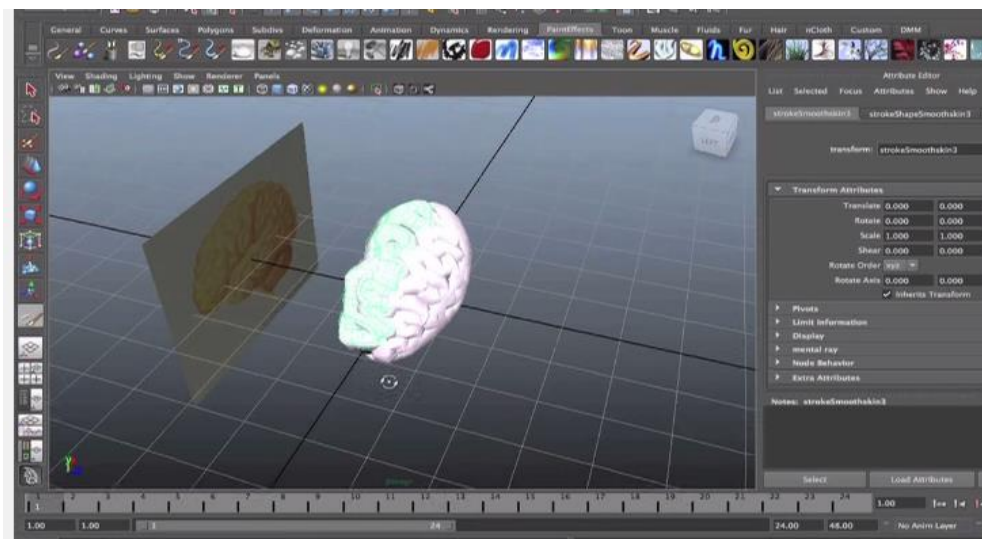


Figure 4.1: Human brain design in Autodesk Maya (Rough skecth 2)

3D Interactive Courseware For Anatomy Of Human Brain			
System Evaluation Form			
What describes yourself better? I'm a...			
<input type="radio"/> Student <input type="radio"/> Teacher/Lecturer <input type="radio"/> Public			
	Strongly agree	Agree	Not Agree
Ease of use			
1. Icon are meaningful.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Buttons are clearly highlighted.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Exit or main menu is clearly provided.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. User interface layout help navigation easier.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Good interactive control such as navigation tool.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Help/User guide button is available	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Attractiveness			
1. Screen background is attractive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Graphics enhance the instructional effect	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Videos enhance the instructional effect	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Animated illustration is good	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
User control			
1. User can skip video or animation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Screen layout is consistent	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Button can function properly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Information			
1. No typographical errors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Information collected is accurate.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. The content help to achieve the objectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Clearly understand the text given.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Please write if any further improvement needed on the system.			

Figure 4.2: Sample evaluation in Design Phase

3.2.3 Development Phase

The following phase next to design phase is the development phase where the instructional designers and developers create and assemble the content assets that were identified and created in the design phase.

The developers or programmer will develop the 3D interactive courseware with the information about human brain. As the final step in this phase, the testers will perform debugging procedures to identify the errors that can be found in the courseware. This project will be reviewed, revised and modified according to the feedback received during development phase level evaluation conducted.

Adobe Flash Professional CS6 and Autodesk Maya are the software that will be used for the development of this courseware.

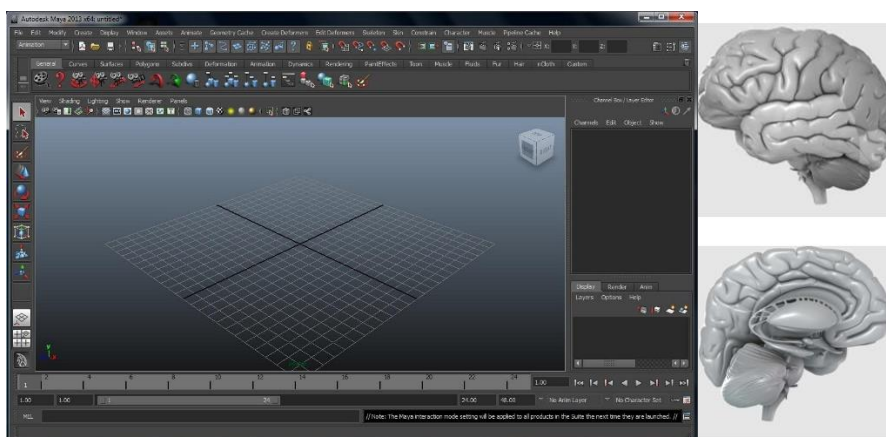


Figure 4.3 : Human Brain 3D Model Development

3.2.4 Implementation phase

In this implementation phase, a procedure user guidance or user manual will be developed for training any users who are interested in learning human brain and related issues. Upon the completion of the implementation phase, the developer needs to provide proper documentation, devices (software or hardware), and other materials that are required to run the system. For example, Adobe Flash Professional CS6 and Autodesk Maya were used to develop 3D courseware.

3.2.5 Evaluation phase

Evaluation phase is ongoing activities that are conducted throughout all the phases. This phase consists of two types of techniques, which are formative evaluation and summative evaluation. The evaluation will be done based on user satisfaction.

A set of questionnaires consisting of close-ended and open-ended questions is distributed online to obtain feedback and opinion on the courseware from users. The questionnaire is focused on human brain and the 3D interactive courseware system. The survey conducted will be participated by at least 20 participants from various backgrounds. The beta version of the courseware also will be given to the participants to be tested and evaluated before they complete the feedback form. They will determine whether the courseware works or not.

In analysis phase, we will analyse the problem, objective, scope, existing system, user requirements and any related data required. In design phase, we ask about the user satisfaction on the courseware design. During development, we will know what activities are required that will bring the best performance of the courseware. In implementation phase, we will investigate the users' skills and knowledge to perform the required tasks.

CHAPTER 4

IMPLEMENTATION

4.1 Adobe Flash CS6 Professional

This application is implemented using Adobe Flash CS6 Professional which allows the development of any stand-alone application for both windows OS and Mac. This tool is used to develop the application and it comes out with a variety of packages depending on what is going to be developed. Basically, in order to develop a project, Adobe Flash must use its own programming language which is known as ActionScript (AS) and ActionScript 3.0 (AS3) is used for the development of this courseware. The reason AS 3 is used for this project is to develop the courseware with a simple yet effective way of creating courseware.

4.1.1 ActionScript 3.0



Figure 4.4: Main menu button

Main menu

1. Home page button
2. 3D page button
3. Senses page button
4. Quiz page button

```

homebtn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene);
function fl_ClickToGoToScene(event:MouseEvent):void
{
    MovieClip(this.root).gotoAndStop(1, "external");
}
stop();

tridibtn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_2);
function fl_ClickToGoToScene_2(event:MouseEvent):void
{
    MovieClip(this.root).gotoAndStop(1, "3dscene");
}
stop();

videobtn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_3);
function fl_ClickToGoToScene_3(event:MouseEvent):void
{
    MovieClip(this.root).gotoAndStop(1, "videoscene");
}
stop();

quizbtn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToScene_4);
function fl_ClickToGoToScene_4(event:MouseEvent):void
{
    MovieClip(this.root).gotoAndStop(1, "quizscene");
}

```

Figure 4.5: Main menu button code

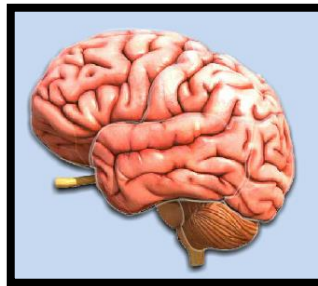


Figure 4.6: Brain part (exterior)

Brain part Exterior button description:

1. Frontal lobe button
2. Temporal lobe button
3. Parietal lobe button
4. Occipital lobe button
5. Cerebellum button
6. Interior brain button


```

frontallobebtn.addEventListener(MouseEvent.CLICK, f1_ClickToGoToAndStopAtFrame);
function f1_ClickToGoToAndStopAtFrame(event:MouseEvent):void
{
    gotoAndStop(5);
}

parietallobebtn.addEventListener(MouseEvent.CLICK, f1_ClickToGoToAndStopAtFrame_2);
function f1_ClickToGoToAndStopAtFrame_2(event:MouseEvent):void
{
    gotoAndStop(10);
}

temporallobebtn.addEventListener(MouseEvent.CLICK, f1_ClickToGoToAndStopAtFrame_3);
function f1_ClickToGoToAndStopAtFrame_3(event:MouseEvent):void
{
    gotoAndStop(15);
}

occipitallobebtn.addEventListener(MouseEvent.CLICK, f1_ClickToGoToAndStopAtFrame_4);
function f1_ClickToGoToAndStopAtFrame_4(event:MouseEvent):void
{
    gotoAndStop(20);
}

cerebellumbtn.addEventListener(MouseEvent.CLICK, f1_ClickToGoToAndStopAtFrame_5);

```

Figure 4.7: Brain exterior part button code

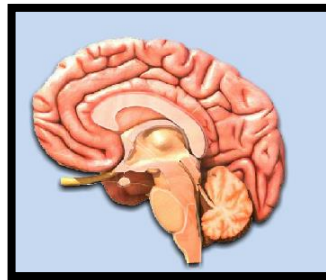


Figure 4.8: Brain part (Interior)

Brain part interior button description:

1. Corpus callosum button
2. Thalamus button
3. Pituitary gland button
4. Pons button
5. Medulla oblongata button
6. Hypothalamus button
7. Pineal gland button
8. Interior brain button

```

//Brain Button
corpusbtn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToAndStopAtFrame_6);
function fl_ClickToGoToAndStopAtFrame_6(event:MouseEvent):void
{
    gotoAndStop(5);
}

thalamusbtn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToAndStopAtFrame_7);
function fl_ClickToGoToAndStopAtFrame_7(event:MouseEvent):void
{
    gotoAndStop(10);
}

pituitaryglandbtn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToAndStopAtFrame_8);
function fl_ClickToGoToAndStopAtFrame_8(event:MouseEvent):void
{
    gotoAndStop(15);
}

ponsbtn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToAndStopAtFrame_9);
function fl_ClickToGoToAndStopAtFrame_9(event:MouseEvent):void
{
    gotoAndStop(20);
}

medullabtn.addEventListener(MouseEvent.CLICK, fl_ClickToGoToAndStopAtFrame_10);

```

Figure 4.9: Brain interior button code

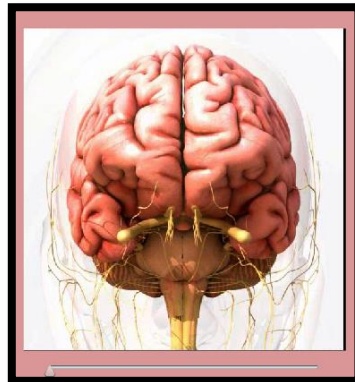


Figure 5.0: 3D Slider button

Brain part button description:

1. Whole brain button
2. Half brain button
3. Inner brain button
4. Slider button

```

import fl.controls.Slider;
import fl.events.SliderEvent;
import fl.controls.Label;
|
trace(wholebrain.totalFrames);

aSlider.maximum = wholebrain.totalFrames;
aSlider.liveDragging=true;

aSlider.addEventListener(Event.CHANGE,mcHandler);

function mcHandler(e:Event){
// wholebrain.frameTxt.text = aSlider.value;

//trace("aSlider.value: "+aSlider.value);
wholebrain.gotoAndStop(aSlider.value);
}

```

Figure 5.1: Slider button code

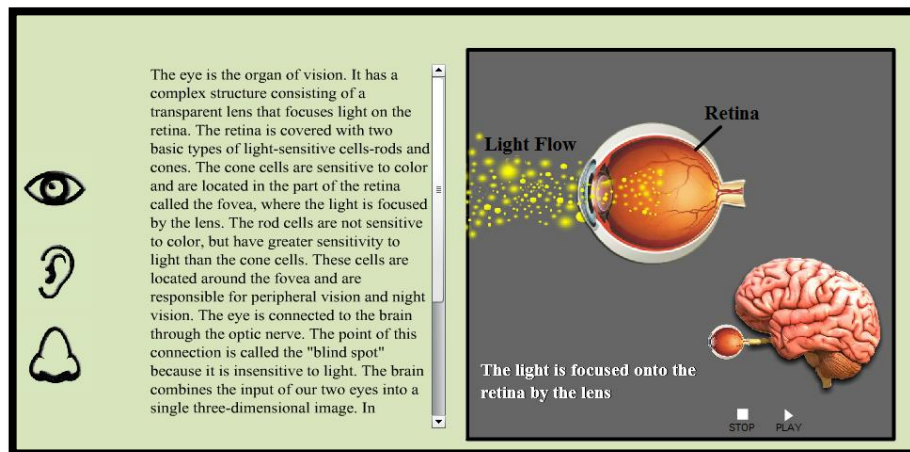


Figure 5.2.: Senses part

Senses part button description:

1. Sight button
2. Hearing button
3. Smell button
4. Stop button
5. Play button

```

stop_btn.addEventListener(MouseEvent.CLICK, f1_ClickToGoToAndStopAtFrame_12);

function f1_ClickToGoToAndStopAtFrame_12(event:MouseEvent):void
{
    stop();
}

play_btn.addEventListener(MouseEvent.CLICK, f1_ClickToGoToAndPlayFromFrame_2);

function f1_ClickToGoToAndPlayFromFrame_2(event:MouseEvent):void
{
    play();
}

```

Figure 5.3: Play and Stop animation button

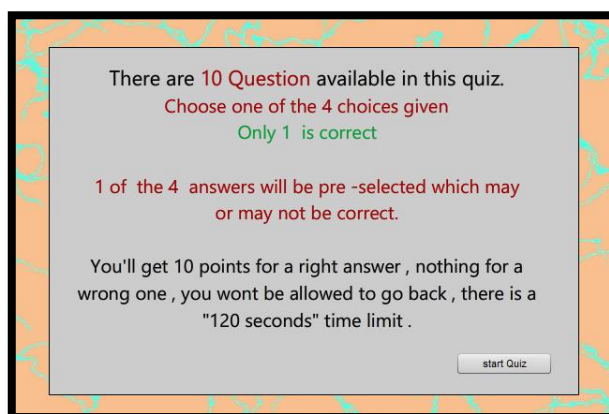


Figure 5.4: Start Quiz button

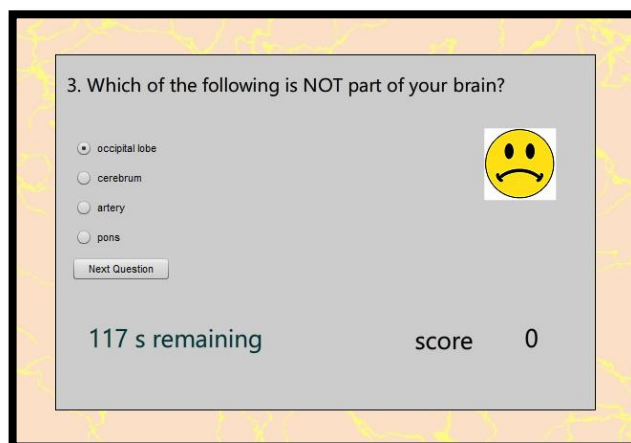


Figure 5.5: Quiz question

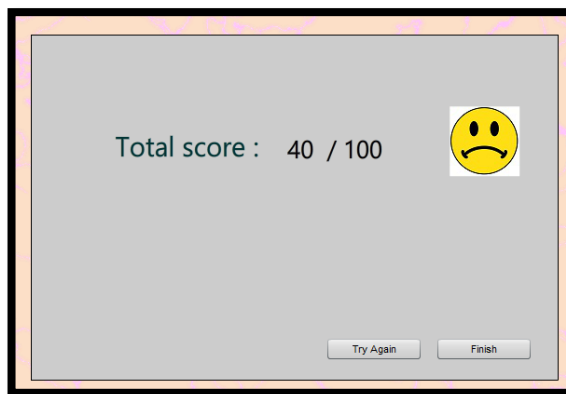


Figure 5.6: Quiz score (end)

Quiz part button description:

1. Start Quiz button
2. Try again button
3. Finish button
4. Answer Radio button

```
// using the import directive to import the required classes

import fl.controls.RadioButtonGroup;
import flash.events.MouseEvent;
import flash.events.TimerEvent;
import flash.utils.Timer;

// starting out with a score of 0

var myscore = 0; score.text = myscore+"";
// creating a new instance of the radioButtonGroup Class
var mygroup1:RadioButtonGroup = new RadioButtonGroup("group1");
a1.group = a2.group = a3.group = a4.group = mygroup1;

b1.addEventListener(MouseEvent.CLICK, quizHandler1)
function quizHandler1(event:MouseEvent):void{
if(mygroup1.selection.label=="Cerebrum"){myscore+=10; nextFrame(); smiley.visible=true;}
else{ nextFrame(); smiley.visible=false;}
}

// firing a 30 second timer
var myTimer:Timer = new Timer(1000);
myTimer.addEventListener(TimerEvent.TIMER, countdownHandler);
function countdownHandler(event:TimerEvent):void{
countdown.text = 120-myTimer.currentCount+" s remaining";
if(myTimer.currentCount==120){gotoAndStop(12)}
}
myTimer.start();}
```

Figure 5.7: Quiz code

4.2 Autodesk Maya

Autodesk Maya 2013 is used to develop the 3d models included in this courseware. The models were animated to rotate 360 degree and rendered into 24 frames of sequence of picture.

4.3 Adobe Photoshop

Photoshop is used to design the interfaces for the courseware. The textures for 3D models is also designed in Photoshop. For this courseware Photoshop version CS6 was utilized.

4.4 Object2VR

Object2VR used to create the interactive 3d models using sequence of picture consist of several Frames

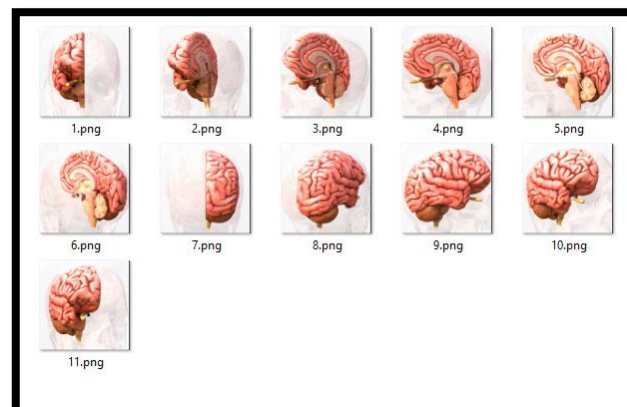


Figure 5.8: 3D model rendering frame

CHAPTER 5

RESULT

5.1 Results

As planned, this project should come out with the final results that related to all chapters within this report. Thus, the final results for this project are supposed to be an educational courseware about human brain. The interface of this courseware are shown as follow:

5.1.1 Home page interface

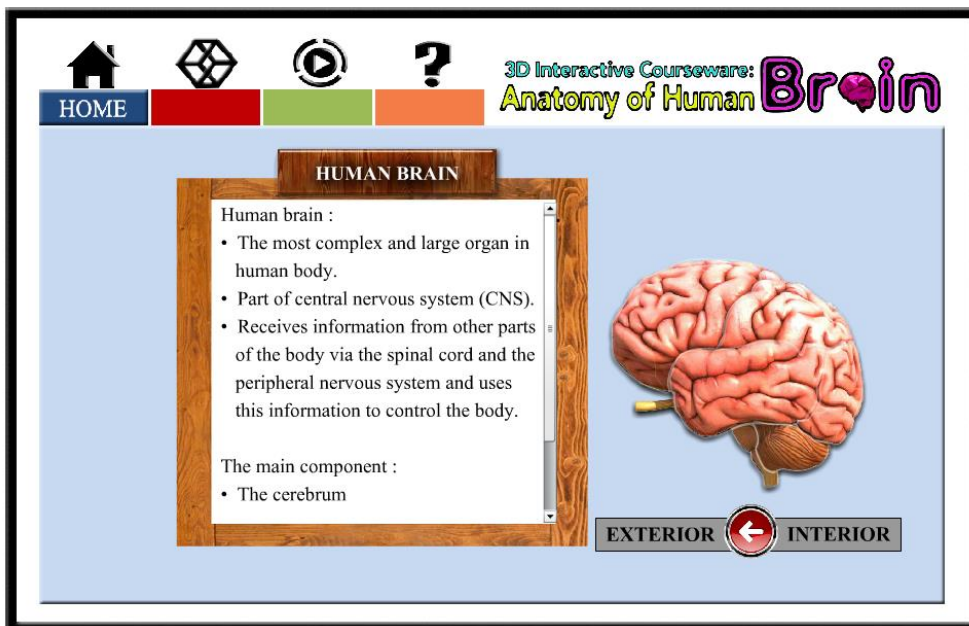


Figure 5.9: Homepage (Exterior) interface

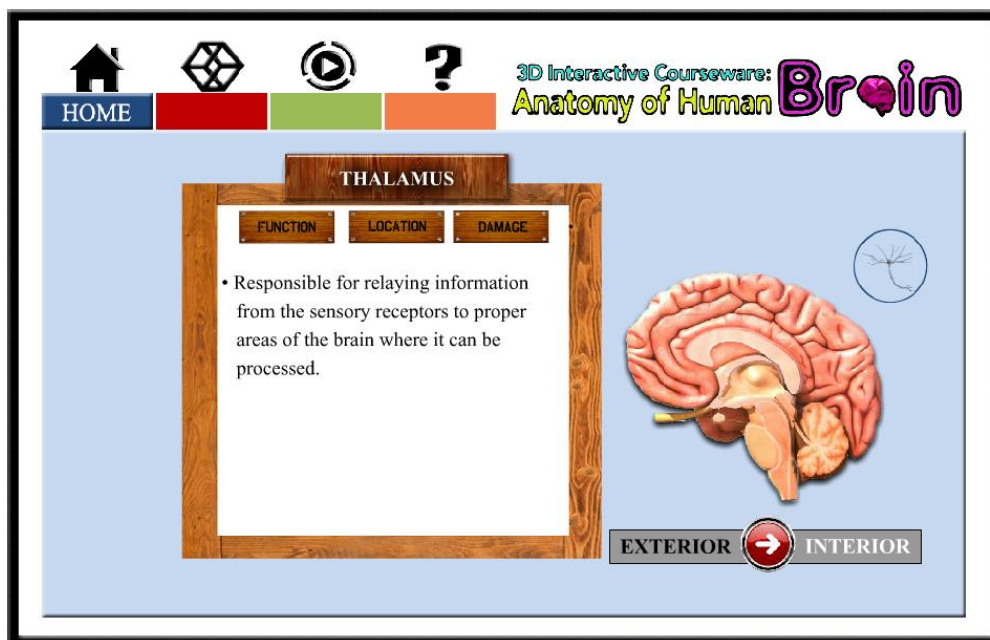


Figure 6.0: Home page (Interior) interface

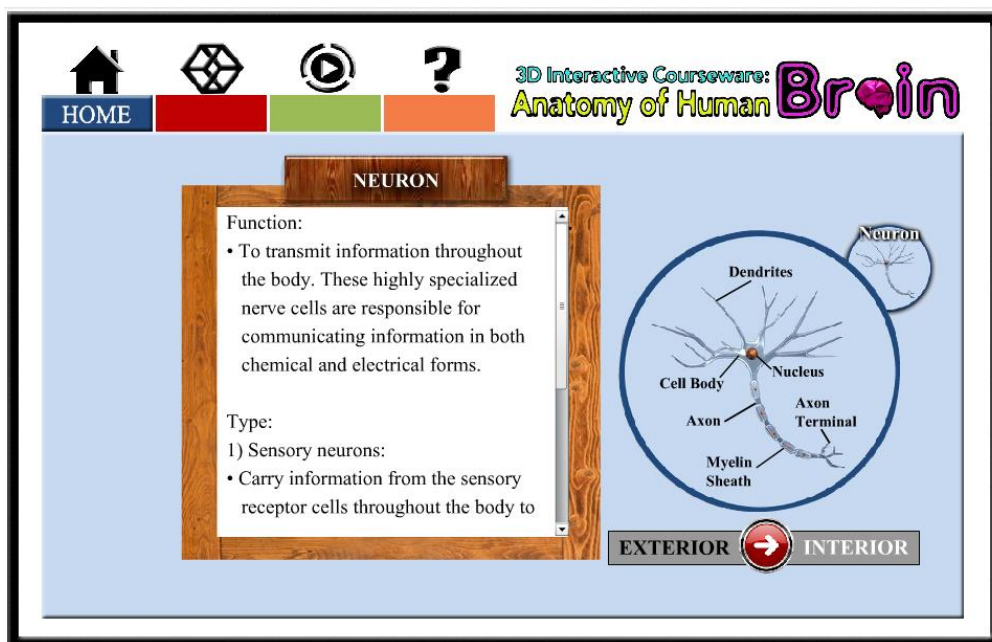


Figure 6.1: Home page (Interior-Neurons) interface

Interface description:

The home page interface contains the introduction of the human brain, and information about the part of exterior and interior brain. Buttons are including Main menu, brain part, exterior and interior.

5.1.2 3-Dimension page interface

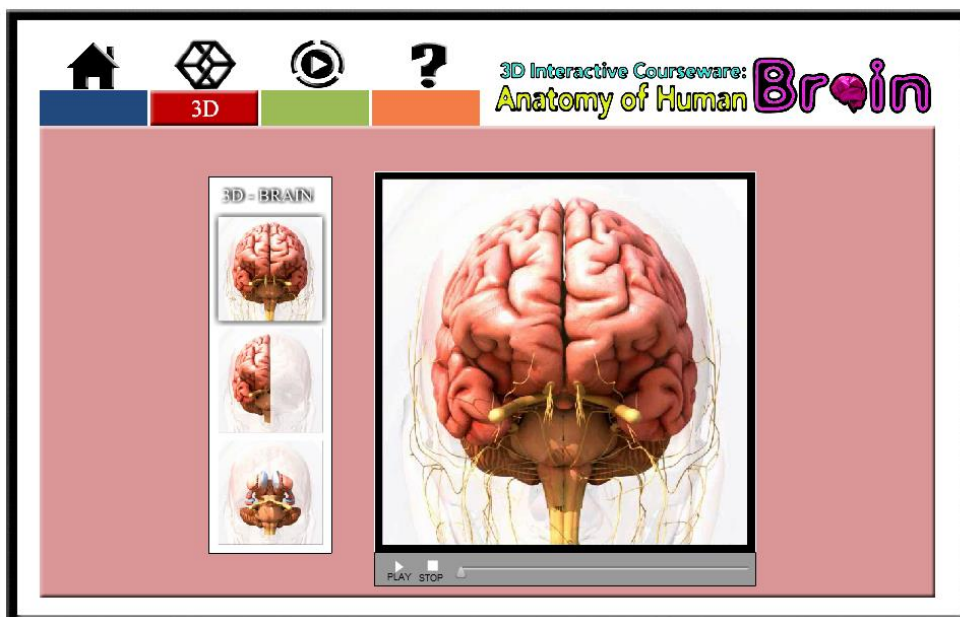


Figure 6.2: 3D page (whole brain) interface

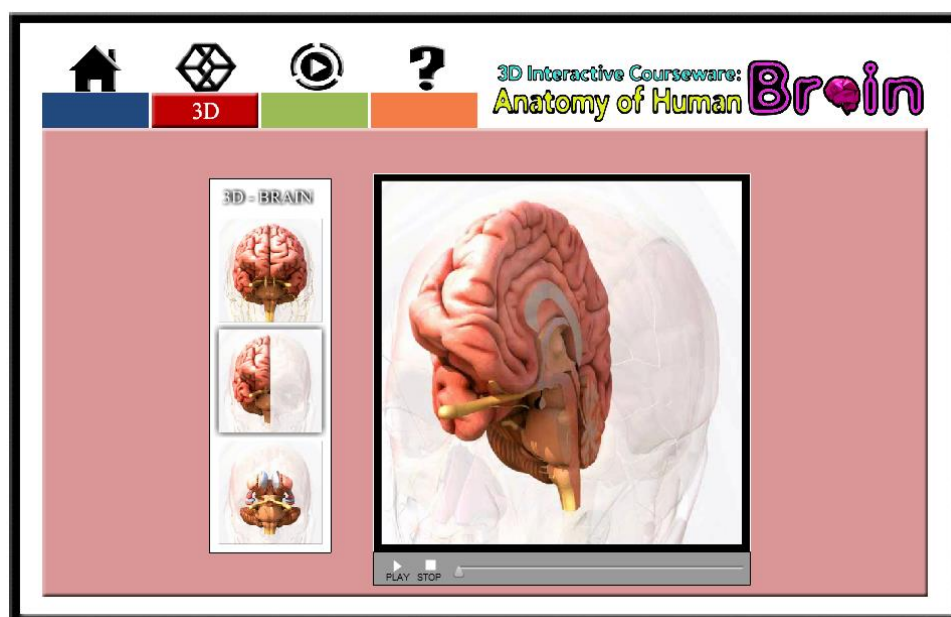


Figure 6.3: 3D page (half brain) interface

Interface description:

The 3D page interface contains the 3D model of human brain which viewed using Object2VR technique. Buttons are including Main menu, slider, play and stop, Whole brain, half brain, and interior brain.

5.1.3 Senses page interface

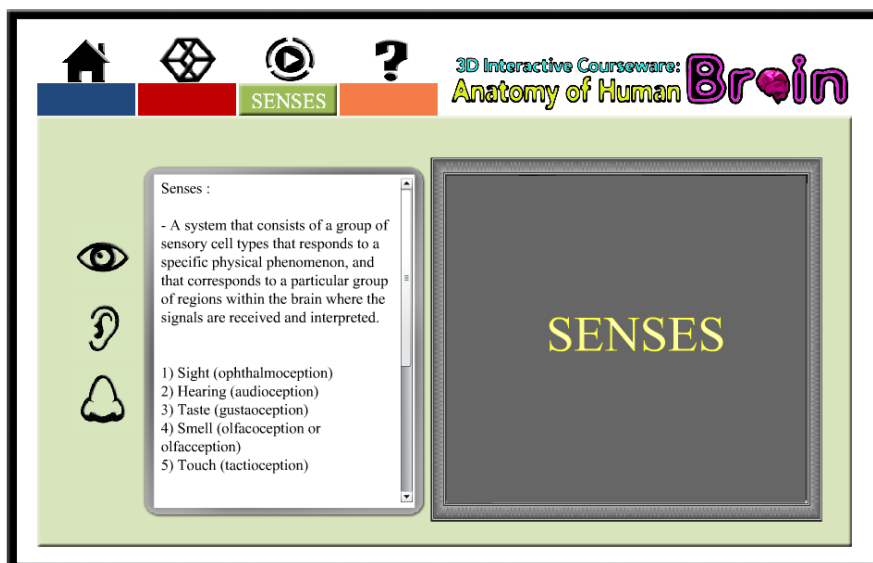


Figure 6.4: Senses page interface

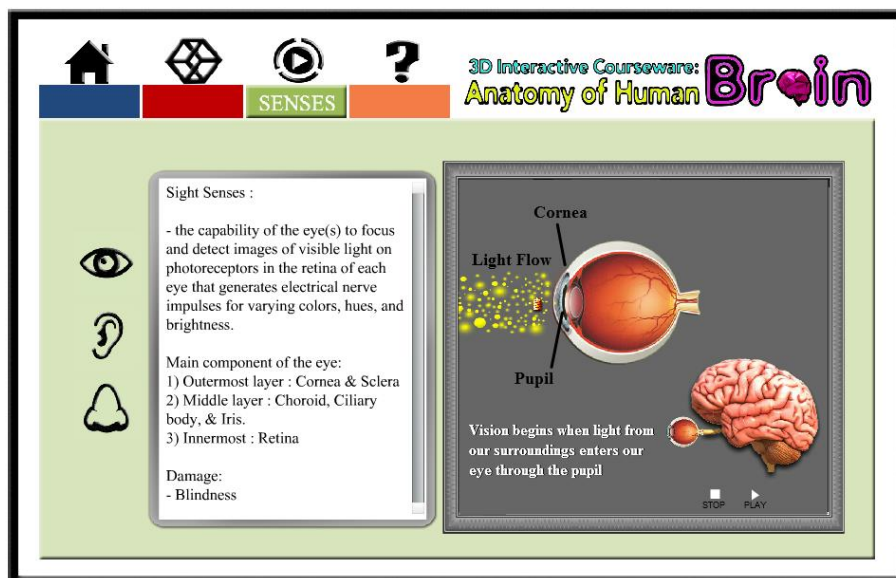


Figure 6.5: Senses page (Sight) interface

Interface description:

The Senses Video Animation page interface contains the animation and the information about the senses. Buttons are including Main menu, Sight, Hearing, Smell, play and stop.

5.1.4 Quiz page interface

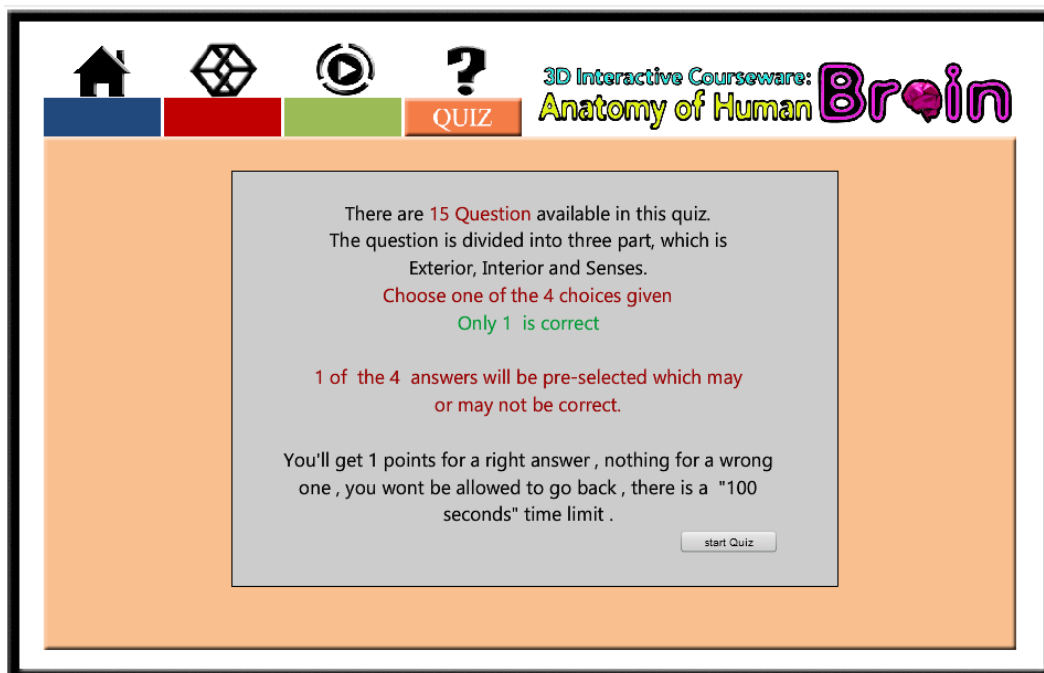


Figure 6.6: Quiz page (Start Quiz)

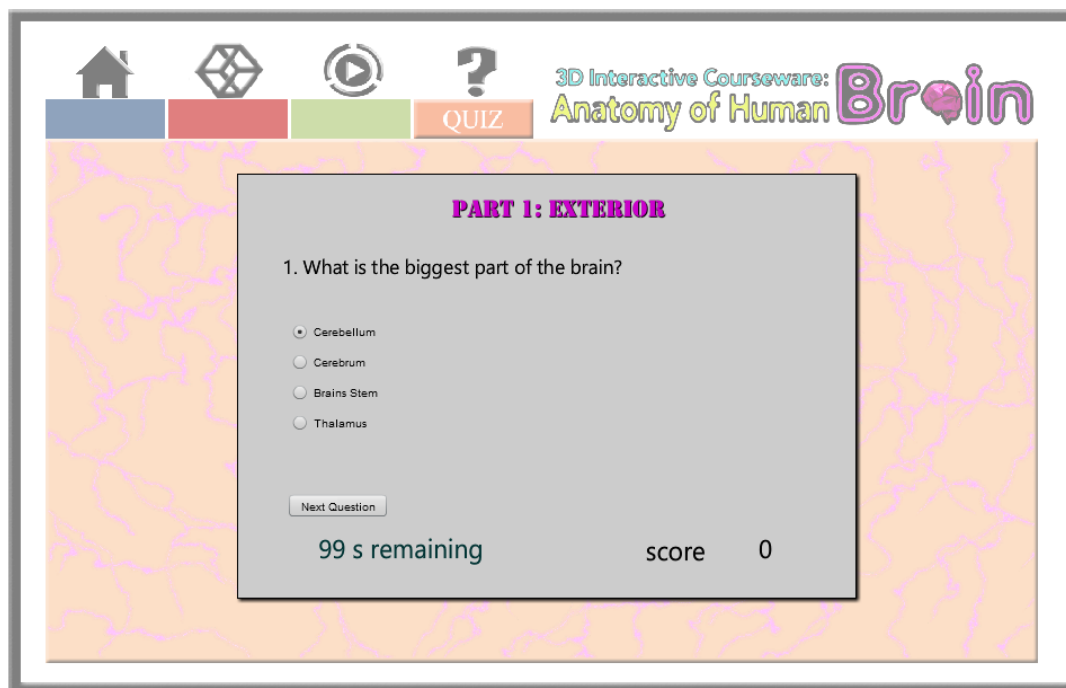


Figure 6.7: Quiz page (Question)

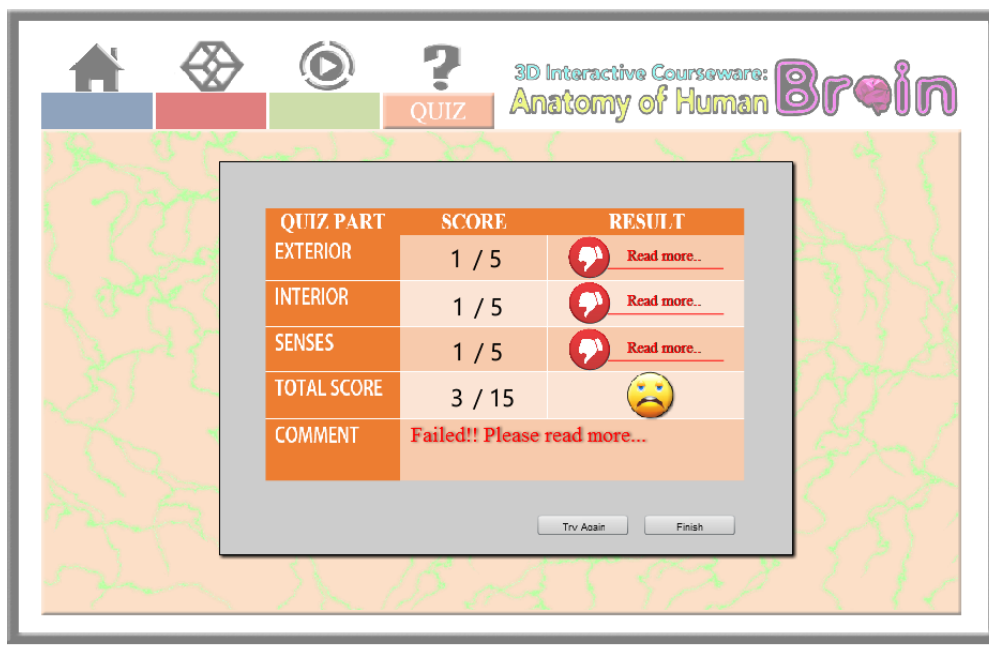


Figure 6.8: Quiz page (end)

Interface description:

The Senses Video Animation page interface contains the quiz about human brain and senses. Buttons are including Main menu, start quiz, answers radio button, next, try again and finish.

5.2 Testing and Evaluation

As parts of the completing phase of the development of this project, there should be a testing and evaluation session where this testing had been conducted randomly to the end users. This session is done in order to get the feedback from the users about how the courseware works and does it fulfill the main objectives of this project. Hence, the testing and evaluation session has been conducted and the responses were recorded for future improvement or enhancements.

3D Interactive Courseware For Anatomy of Human Brain

What describes yourself better? I'm a...

Student
 Teacher/Lecturer
 Public

Ease of use

	Strongly Agree	Agree	Not Agree
Icon are meaningful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Buttons are clearly highlighted.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Main menu is clearly provided	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
User interface layout help navigation easier.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Good interactive control such as navigation tool.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Help/User guide button is available	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Attractiveness

	Strongly Agree	Agree	Not Agree
Screen background is attractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Graphics enhance the instructional effect	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Animated illustration is good	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

User Control

	Strongly Agree	Agree	Not Agree
User can skip video or animation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Screen layout is consistent	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Button can function properly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Information

	Strongly Agree	Agree	Not Agree
No typographical errors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The content help to achieve the objectives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information collected is accurate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clearly understand the text given.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please write any further improvement needed on the system.

[Submit](#)

Never submit passwords through Google Forms.

Figure 6.9: Post Evaluation Questionnaire

Evaluation Results:

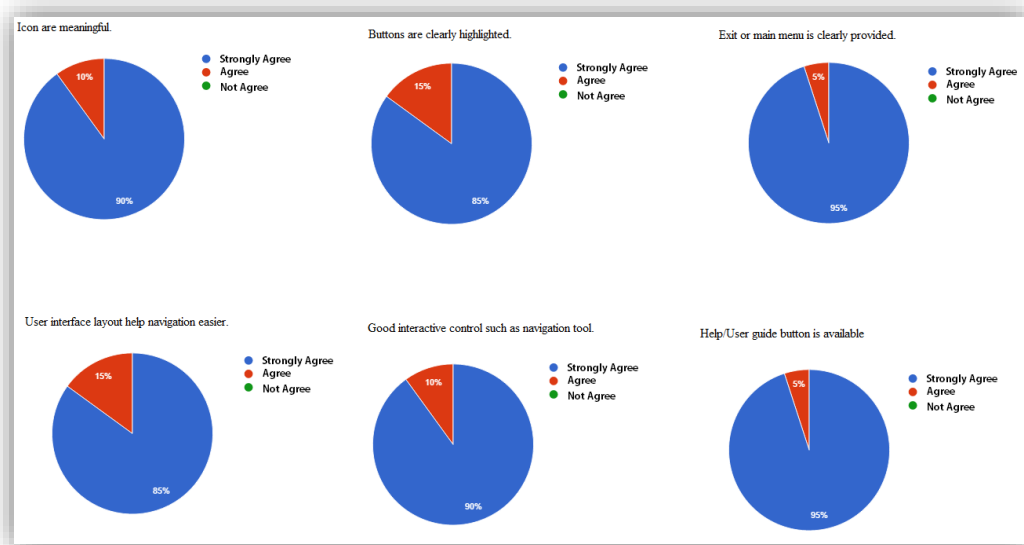


Figure 7.0: Ease of Use

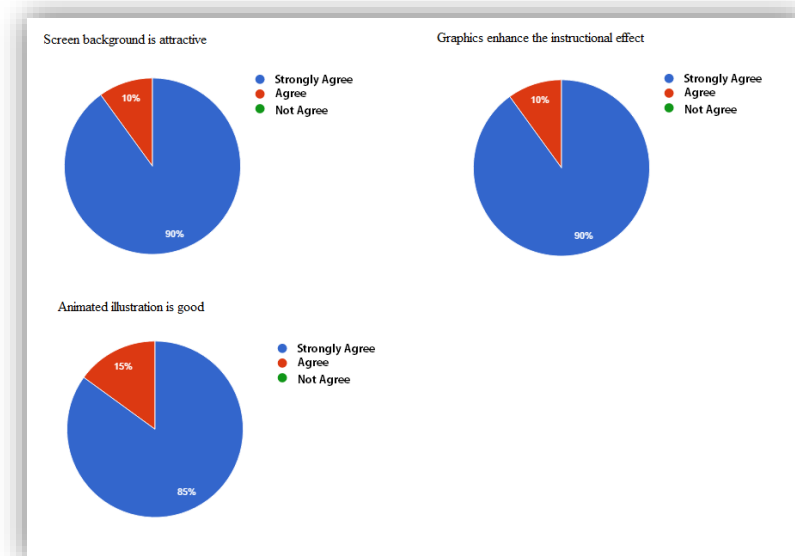


Figure 7.1: Attractiveness

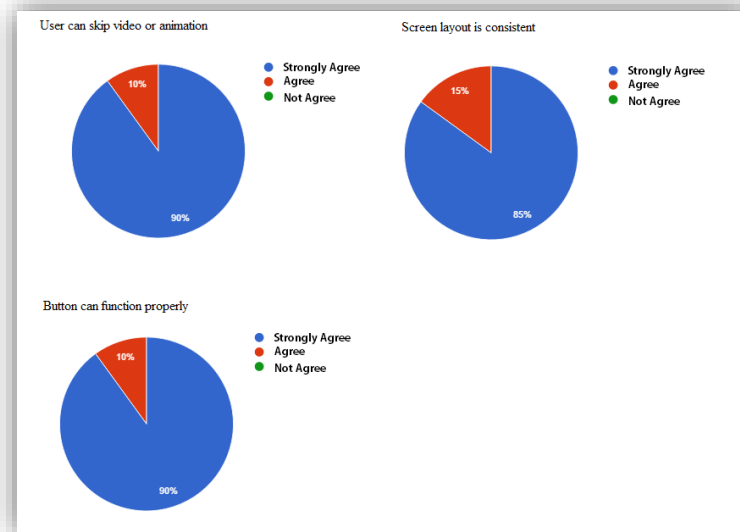


Figure 7.2: User control

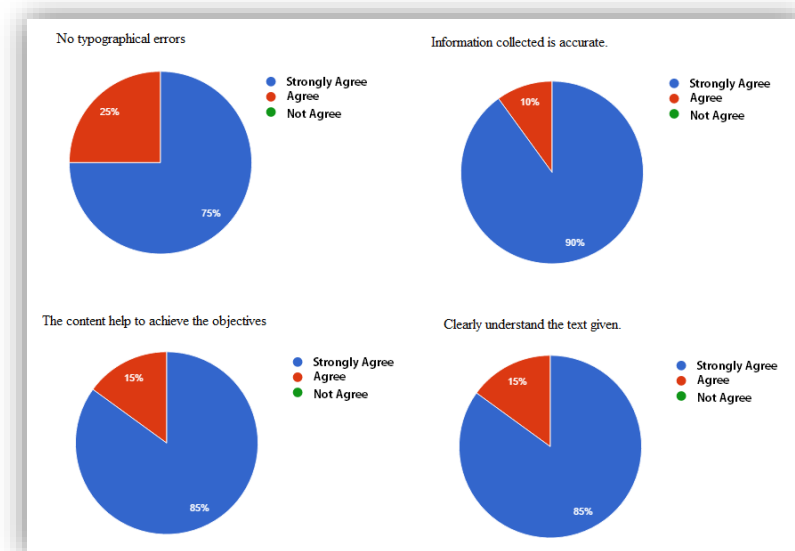


Figure 7.3: Information

5.3 Conclusion

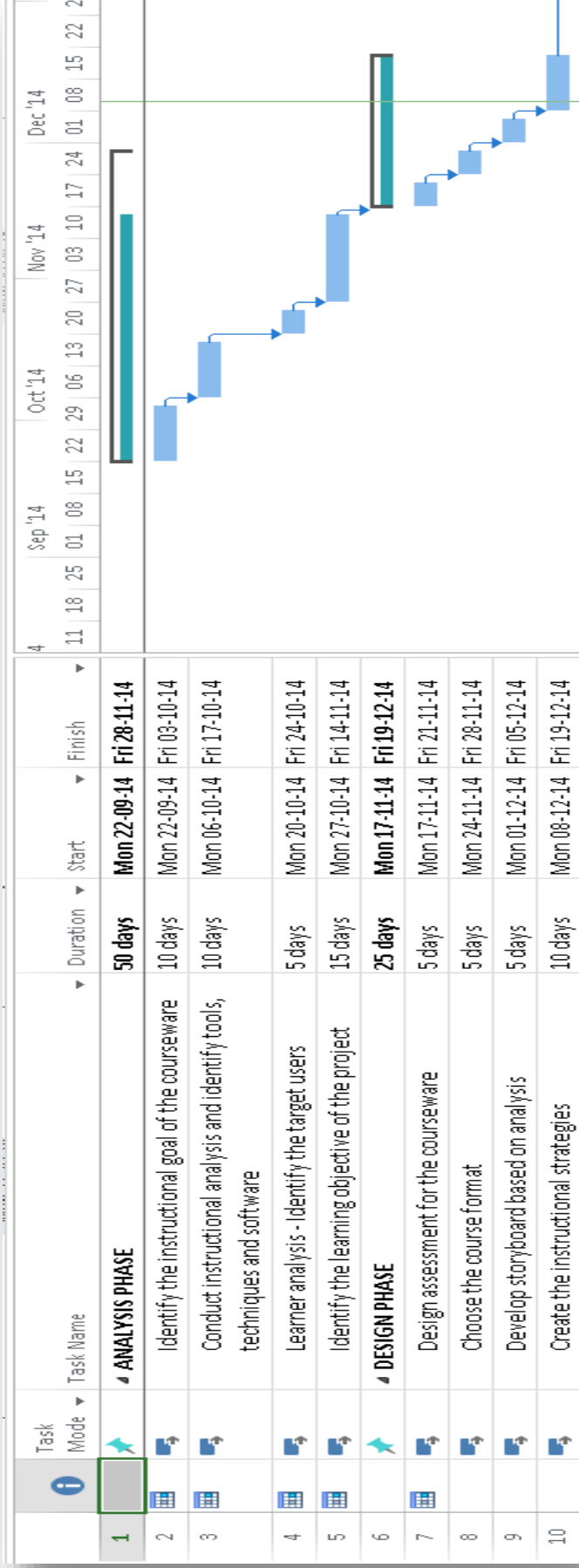
As a conclusion, 3d Interactive courseware for anatomy of human brain has been successfully developed using Adobe Flash CS6 Professional as the development tools for this project. This application has fulfilled the user requirements and the objectives that have been decided at the early stage of this project. In the other hand, the aim is to allow user to study and explore the human brain. However, this courseware still have some weakness and limitations that should be improved and upgrade in the future. As a result, it is a hope that this courseware would help to improve the educational field in Malaysia.

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APPENDIX A
GANTT CHART

PSM 1



PSM 2

	Task Mode	Task Name	Duration	Start	Finish
10		Create the Instructional strategies	10 days	Mon 08-12-14	Fri 19-12-14
11		DEVELOPMENT PHASE	19 days	Tue 17-02-15	Fri 13-03-15
12		Create (sample) prototype of the interactive courseware material consists of human brain anatomy syllabuses	5 days	Mon 16-02-15	Fri 20-02-15
13		Collect the courseware material consists of human brain anatomy syllabuses	5 days	Mon 23-02-15	Fri 27-02-15
14		Develop 3D courseware based on syllabus	10 days	Mon 02-03-15	Fri 13-03-15
15		IMPLEMENTATION PHASE	45 days	Mon 09-03-15	Fri 08-05-15
16		Prepare training materials and train the users	10 days	Mon 09-03-15	Fri 20-03-15
17		Arrange the learning space with proper tools and knowledge based on anatomy	10 days	Mon 23-03-15	Fri 03-04-15
18		Test the functionality of the interactive courseware	10 days	Mon 06-04-15	Fri 17-04-15
19		Identify the appropriate prerequisites for the human brain anatom and implement accordingly on the courseware	15 days	Mon 20-04-15	Fri 08-05-15
20		EVALUATION PHASE	15 days	Mon 11-05-15	Fri 29-05-15
21		Formative evaluation - Evaluate the phase using the questionnaire to ensure the accuracy of the information collected	10 days	Mon 11-05-15	Fri 22-05-15
22		Summative evaluation - Evaluate entire project or courseware to determine the success of the objectives identified	5 days	Mon 25-05-15	Fri 29-05-15

