

3D INTERACTIVE COURSEWARE FOR EDUCATION:
ANATOMY OF HUMAN BRAIN

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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.

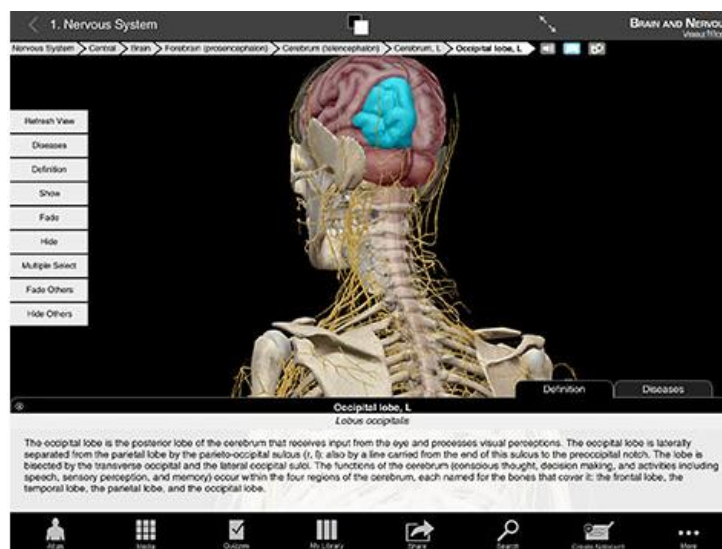


Figure 1.1: Brain and Nervous Anatomy Atlas

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.

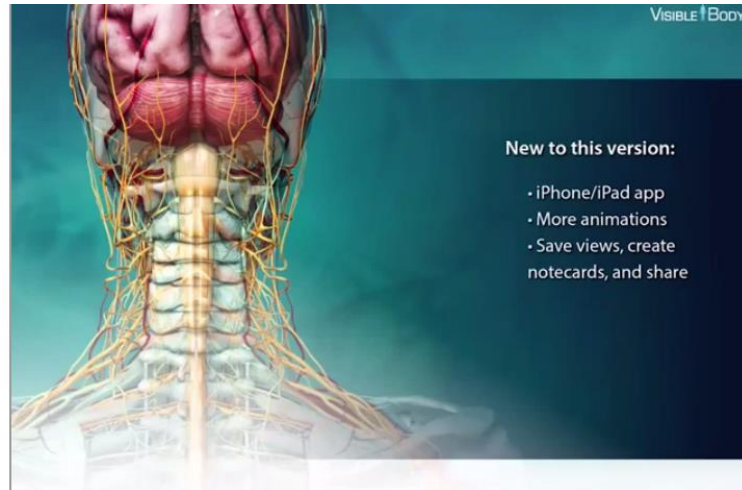


Figure 1.2: Purchase additional 3D model in Brain and Nervous Anatomy Atlas

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.

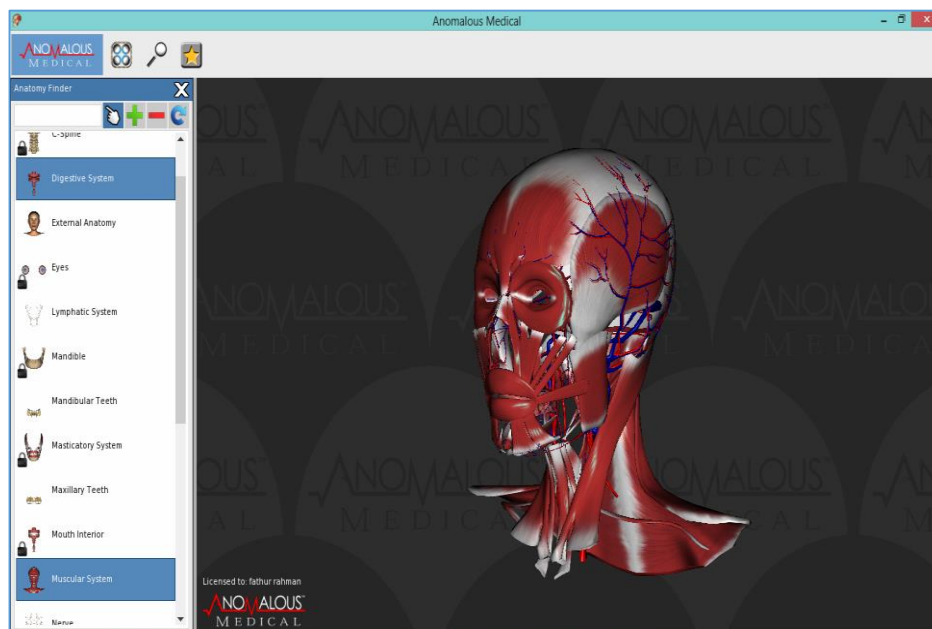


Figure 1.4: Anomalous Medical

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.

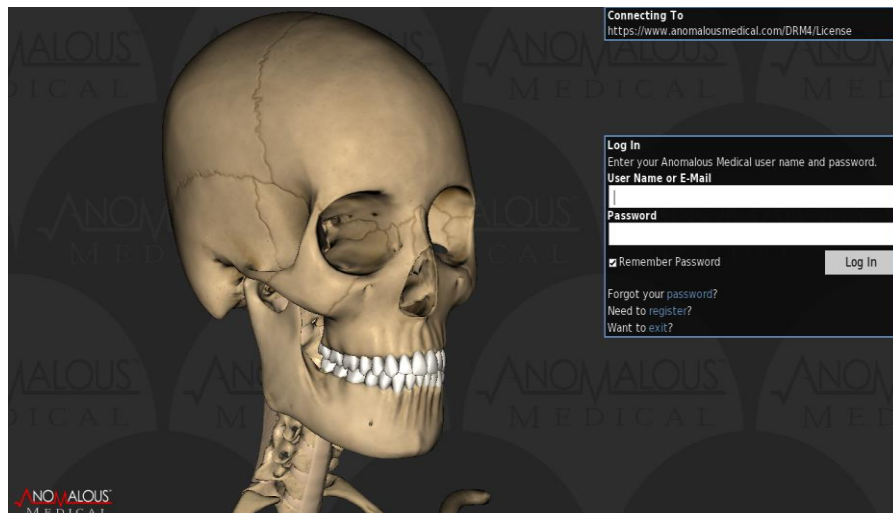


Figure 1.5: User login in Anomalous Medical

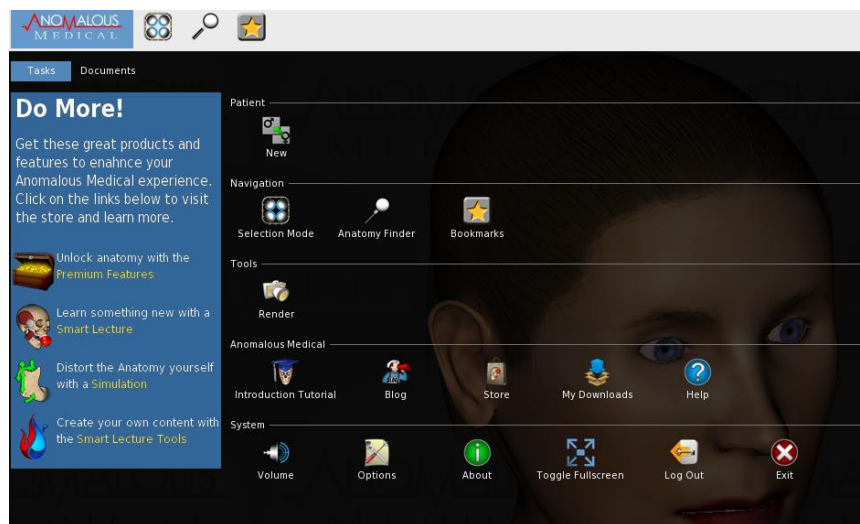


Figure 1.6: Purchase additional features in Anomalous Medical

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.

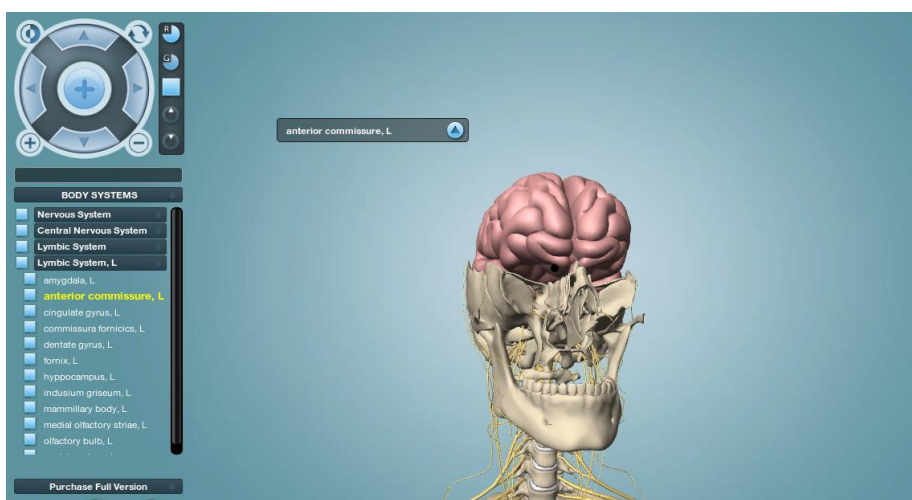


Figure 1.8: Unity Web Player for online version of Anatronica - 3D Interactive Anatomy

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

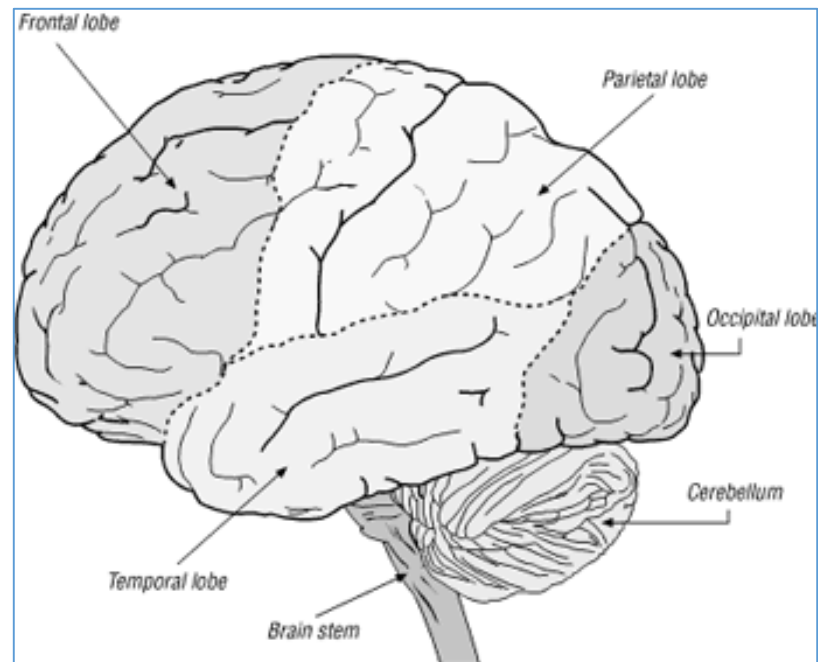


Figure 1.9: External Structure of Human Brain

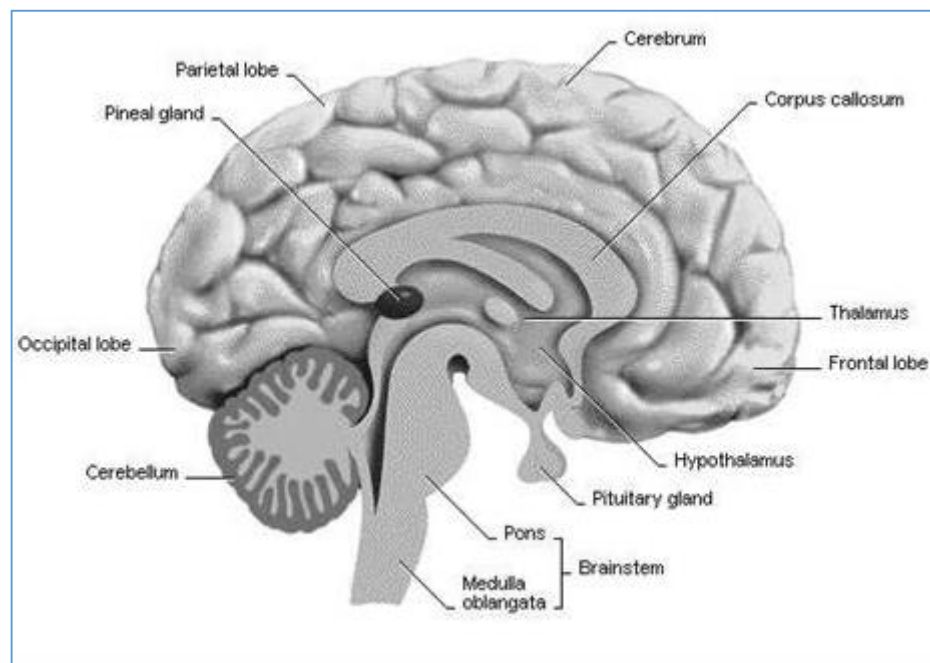


Figure 2.0: Internal Structure of Human Brain

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.