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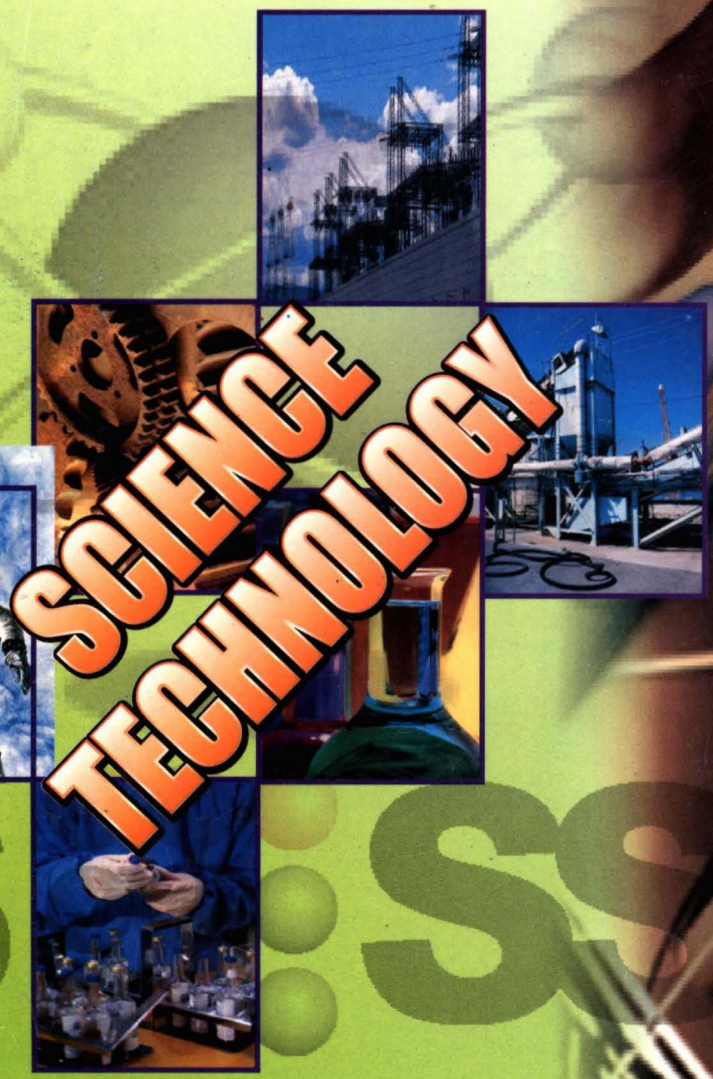
# Globalising Knowledge and Information

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# Interactive 3D Multimedia Learning Tool in Biology – Skeleton (MLTB-S)

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ABSTRACT

*Nowadays, as biology has been taught at schools for years, the teachers have been facing a problem on how to get the students to fully understand the human biology. Of course a student can explain what a skull is, based on the books that he or she has read, but does he or she truly know what a skull looks like. Has he or she touched one? Examine it closely. And not only that, the current method of teaching biology is too static and boring. The teachers teach, and the students listen to it. There has to be some way to change this. The learning tool that has been developed here is called "Interactive 3D Multimedia Learning Tool in Biology – Skeleton", took the advantages from the full-grown potential of Multimedia and 3D Animations. The main goal of this CD-ROM platform product is as a tool that will be able to teach the users what skeleton system is, its functions and know exactly how the bones look like in a very dynamic and interactive method.*

**Keywords**: *Biology, multimedia, learning, animation, software*

## Introduction

A new approach of learning and teaching concept with computer-controlled, makes the media of delivery and reception information different from tradtional media. Based on the changes of the learning style, interactive with multimedia elements was developed to fullfill the requirements of learning using computer as a interface (Kamsin & Lim 2005).

> *'Interactive 3D Multimedia Learning Tool in Biology – Skeletal' is a software that helps form 4 and 5 biology students understanding the names, the locations, the shapes, and the functions of each bone in the human body. The navigation starts with the main page. And from there, the students can choose different modules of the system to navigate, either to start studying, or taking quizzes to test their understanding of the subject.*

'Interactive 3D Multimedia Learning Tool in Biology – Skeletal' is basically an educational system designed to allow students to learn about the human skeleton system in an interesting and interactive way. This software has a lot of multimedia elements that can help the students to grasp the subject easier. Pictures of the bones is shown for the students to know roughly how the bone looks like while reading the description in the same window. And if the student wants to 'look' at the bones a little bit closer and get a dash of interactivity by 'spinning' the bone around, the students can open the interactive 3D model of the bone and manipulate the 3D model of the bone however the student wanted.

### Objectives

The objectives for this system are to:

i. *Provide an easy reference to users*
This system provides a comprehensive and easy to use reference, as this system will be broken into smaller and systemized subchapters.

ii. *Provide audio explanation on each subchapter*
This function helps the users to understand any subchapter, as it also adds the multimedia elements. The users can just listen to the audio explanation if they don't feel like reading the text.

iii. *Provide a 3D representative of the human skeleton system*
This system includes 3D representative of the complete set of human skeleton systems throughout the body. It will be modeled as accurate as possible to the real thing. The individual skeletal sub-system will also be individually modeled, such as the skull and the spine. This way, the users will have a better understanding of how the various systems look like and how they connect together.

iv. *Provide an interactive environment for the user*
The system provides interactivity for the user to manipulate the elements in the system. The users can play, pause or stop the audio explanations. They can also scroll through the text explanations. Hypertexts and hypertext are used within this system to add the level of interactivity.

## Literature Review

By the late 1960s, psychological theory and research had undergone a pervasive shift away from behaviorism to an emphasis on cognitive processes and their effects in instruction and learning. As a result of this shift, cognitive science developed as a new field of psychology to explore issues such as perception, memory, attention, problem solving and the application of cognitive processes to instructional design (Saettler 1990).

The latest cognitive theory of multimedia learning draws on dual coding theory, cognitive load theory, and constructivist learning theory. It is based on the following assumptions: (a) working memory includes independent auditory and visual working memories (Baddeley 1986); (b) each working memory store has a limited capacity, consistent with Sweller's (Sweller 1980 (43 Sweller 1994), (Chandler & Sweller 1992) cognitive load theory; (c) humans have separate systems for representing verbal and non-verbal information, consistent with Paivio's (Paivio 1986) dual-code theory; (d) meaningful learning occurs when a learner selects relevant information in each store, organizes the information in each store into a coherent representation, and makes connections between corresponding representations in each store (Mayer 1997).

And in the Dual-code theory, it provides theoretical support of the use of verbal (such as text) and nonverbal (such as animation) codes in lesson presentations. Studies performed by Mayer and Anderson (Mayer & Anderson 1992) and Mayer and Sims (Mayer & Sims 1994) confirm the dual-code theory. Their studies reveal that computer animation and oral narration are most effective when they occur contiguously in time or space. Other studies have also verified positive learning effects in certain circumstances where computer animation is used in courseware (Park & Gittelman 1992); (Rieber 1989); (Baek & Layne 1988), (Baggett 1984).

In the MLTB – Skeleton system, researchers implemented the Dual-code theory into use as how the information is to be conveyed to the users. Dual coding theory proposes that memory consists of two separate but interrelated codes for processing information—one verbal and the other visual. The verbal and visual systems can be activated independently, but there are interconnections between the two systems that allow dual coding of information. The interconnectedness of the two systems permits cueing from one system to the other, which in turn facilitates the interpretation of our environment (Rieber 1994), (Simpson 1995).

As explained above, even though the school is fully equipped with technologies, it will still not bring out the effectiveness teaching and learning to the teachers and students, unless some useful middleware or third parties between the technologies and the students, such as software, qualified teachers, multimedia elements, join in the lesson. CAL and E-learning are one of the tools to increase the effectiveness of teaching and learning with the use of technologies (Kamsin & Lim 2005).

This is a new tool for learning material. This tool effectively attracts the students' interest in learning. The multimedia presents the visual and animated information for the students. The learning course can be presented in video clip, games, quizzes and some other interesting format to make students become more interested in the topic or subject. In this way, the students are more motivated to learn without any forcing from teachers or parents. If every student studies in this environment, it will increase the studying interest and the result of the students. They are willing to spend more time playing with the computer with the software. Students are not easily influenced by the negative activities from outside (Kamsin & Lim 2005).

Mayer and Moreno's (Mayer & Moreno 1998) study showed that students who learn with concurrent narration and animations outperform those who learn with concurrent on-screen text and animations. It also showed that students who learn with concurrent narration and animations (physical integration of on-screen text and visual materials) outperform those who learn with concurrent on-screen text and animations.

Hayes and Billy have done a survey of how comprehensive is learning with multimedia applied. "Based on a survey of the prior instructional experiences of instructional staff working in a laboratory setting, we determined that student learning was often enhanced when topics were explained using diagrams, models and other visual aids. The potential educational value of using well-designed computer-based, interactive multimedia modules was perceived as one way to complement traditional laboratory teaching methods" (16 Hayes & Billy).

## System Design

System design is one of the steps moving towards the implementation phase. The design of each component is essential to produce a completely well-designed system (Kamsin & Lim 2005). The MLTB-Skeleton is a stand alone system which is able to operate within the Windows environment. It contains a lot of multimedia elements as the main feature, such as image, audio, video and animation. This system is an interactive multimedia courseware in

itself. The use of all those multimedia elements is also the reason on why the FDSS was not developed as an online system. Because, by implementing it online, not only will it require a high bandwidth, it will also increase the time needed to play the multimedia files like the audio and video file, therefore reducing the effectiveness of MLTB-Skeleton.

The MLTB-Skeleton operation is based on a simple and straightforward workflow. This will enable user to use this system with ease and also avoid any trouble which might arise with the use of the system, such as navigation disorientation. The basic process of the MLTB-Skeleton is shown in the diagram below. This diagram summarizes the processes which will be done by the MLTB-Skeleton.

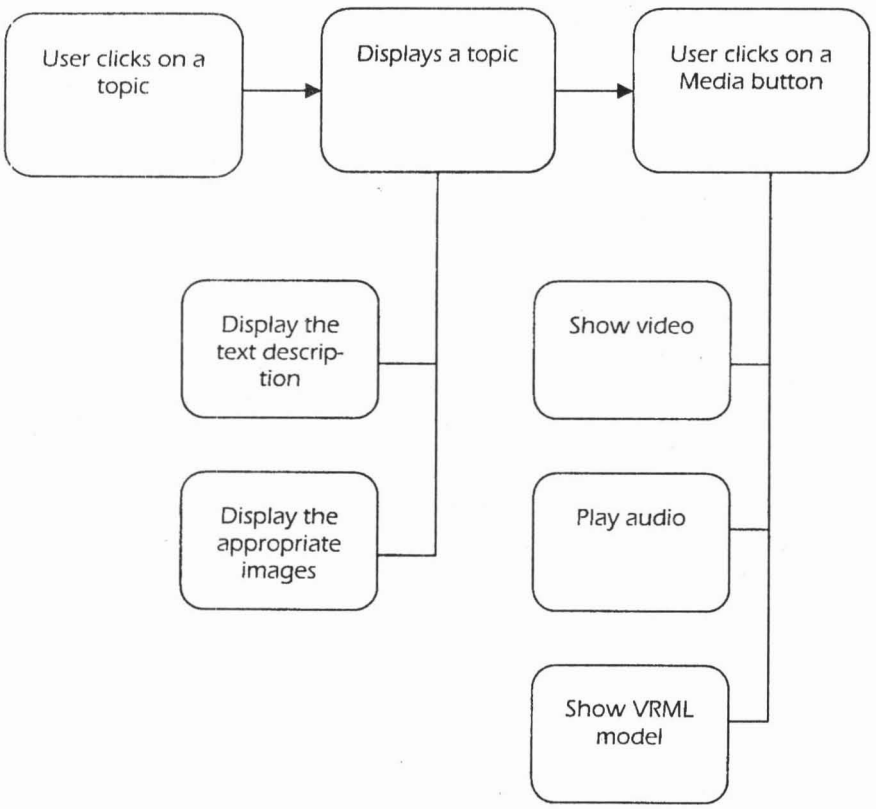


Fig. 1: The Basic Workflow of MLTB-Skeleton

The MLTB-Skeleton does not apply any use of database. This is because all the data used in are quite small in number, thus they are stored in their specific folder (i.e. audio files stored in the 'Audio' folder, etc). The system will then open these media files when the users called (clicked on a button) for them. The system can only call a file, and the users cannot store anything in this system.

In the MLTB-Skeleton, there are 3 modules that are presented

1 The functions of the skeleton system module
2 The human skeleton library module
3 Test module

In this skeleton system module, the functions of the skeleton system will be presented. It will range from the 'What Bones Are Made Of' to 'The Functions of Tendons'. This module will be presented as a selectable list of topics that the users can click to bring the user to the page of the topic that the users have selected.

The human skeleton library module shows the users what the different types of bones look like. In this module, an image of a complete human skeletal system will be displayed to the users. And when the users slick on a bone, it will take the users to the menu of the chosen bone. In this page, there will be a brief description of the said bone, and

also the users can view the interactive 3D model of the bone by the video provided the screen.

In the tests module, the users will be tested on their knowledge of the skeleton system. The users will be presented with a number of objective questions that the users have to answer. In the end of the test, the result of the test will be displayed, and if there are any wrong answers given by the users, the correct one will be displayed too.

## Discussion

The interface is the front end of the system that the users can interact to get the information contained or use the functions available in the system. And to that end, the interface must be easy to use, simple and hassle free and this system has achieved just that. The interface implemented is intuitive, which means the users can know exactly what each button will do, and what output does the buttons provide. And the interface is so straight forward that the users won't even need a user manual to go through every module of the system and use every functions of the system from start till end.

Naturally, the information contained in any learning tool must be highly informative, highly educational and relevant to the title. One of the objectives of the system is to be as simple as possible, yet informative and the researchers have acquired the right balance of information content and the simplicity of it. This basically means, the content is summarized and arranged so that the users will not be overwhelmed by the amount of information contained in the system. But yet they will definitely gain some valuable knowledge regarding the skeleton system and achieve its objectives.

As the topic of this system is the "Interactive 3D Multimedia Learning Tool in Biology - Skeleton" the 3D element of the system simply cannot be under emphasized. A lot of considerations on how to effectively use the robust elements of 3D have been thoroughly analyzed in the system analysis, and researchers decided on modeling the whole skeleton system, modeling the bones one by one. Although researchers didn't model the whole exact 206 bones, which will take a ridiculously huge amount of time and effort. So, researchers simply ignored the bones which are redundant, such as the phalanges of both the hands and feet, tarsal and metatarsal bone, the ribs and some of the vertebras.

The page navigation or the structure of the modules, and how they are connected to one another is also one of the strong points of this system. The page follows the tree structure, with one page can be traced linearly to the root, which is the Main Page. This will make it easier for the users to know which page they are viewing and not getting lost while viewing through the system

## Conclusion

As overall, this learning tool brings an innovative approach into learning about the human skeletal system. By integrating all the multimedia elements, it is able to provide a better understanding on the human skeletal system. Additionally, it can change or improve the way people think about the human skeleton system from something dull, static and boring to the one that purely interesting. Biology is undoubtedly the most important field of science.

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