

## BORANG PENGESAHAN STATUS TESIS\*

JUDUL : FORM 5 BIOLOGY SUBJECT CONTENT: 3D ANIMATION OF  
TRANSPIRATION IN PLANTS

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FORM 5 BIOLOGY SUBJECT CONTENT: 3D ANIMATION  
OF TRANSPIRATION IN PLANTS

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This report is submitted in partial fulfilment of the requirements for the  
Bachelor of Computer Science (Interactive Media)

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2012

## DECLARATION

I hereby declare that this project report entitled  
**FORM 5 BIOLOGY SUBJECT CONTENT: 3D ANIMATION**  
**TRANSPIRATION IN PLANTS**

is written by me and is my own effort and that no part has been plagiarized  
without citations.

  
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## **DEDICATION**

Specially dedicated to my beloved mother, father and family,

For my supervisor, Mdm. Badariah bt. Mat Sah,

(UTeM)

And lastly to my beloved friends and who have encouraged, guided and inspired me  
throughout my journey in education

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## ABSTRACT

This is a comprehensive study of the use of multimedia elements as a new approach of teaching and learning. The main objective of this project is to develop a 3D animation as a new alternative for students to understand about transpiration in plants which is a subtopic from one of the chapters in form 5 Biology syllabuses and evaluate the effectiveness of learning using multimedia elements rather than just reading books. This animation is aimed for students who are in Sijil Pelajaran Malaysia (SPM) levels. For current time, they are still using traditional approach which is using textbook for learning. In textbooks, there are diagrams but it is static. Something like water is a fluid thing and it is always moving. To help students to have better understanding about processes, this project is proposed. Hopefully, this animation can help the students understand the information clearly and learn easily. The methodology that was used to develop the animation is Multimedia Production Process which consists of three stages starting from Pre-Production, Production and Post-Production. Multimedia elements such as text, audio, video, graphics and animation were used in the 3D animation. In this project, the hardware and software requirements also will be explained. Once the project has been developed, a testing will be conducted to get feedback from the target user.

## ABSTRAK

Ini merupakan sebuah kajian tentang penggunaan elemen-elemen multimedia sebagai pendekatan yang baru bagi tujuan pengajaran dan pembelajaran. Objektif utama dalam projek ini ialah membangunkan sebuah animasi 3D sebagai suatu alternative baru kepada pelajar sekolah untuk memahami tentang transpirasi yang berlaku kepada tumbuhan dan ia merupakan salah satu daripada bab-bab yang terdapat di dalam matapelajaran Biology tingkatan 5. Objektif lain ialah untuk menilai tahap keberkesanan daripada pembelajaran dengan menggunakan penggunaan elemen-elemen multimedia daripada hanya membaca buku teks. Animasi 3D ini ditujukan kepada pelajar-pelajar yang akan mengambil Sijil Pelajaran Malaysia (SPM). Pada masa kini, pelajar-pelajar sekolah masih menggunakan cara tradisional iaitu belajar dengan menggunakan buku teks. Di dalam buku teks, terdapat beberapa rajah tetapi ianya statik. Partikel-partikel seperti air ialah cecair dan ia merupakan suatu partikel yang bergerak. Untuk membantu pelajar-pelajar memahami dengan lebih baik tentang proses-proses yang berlaku, projek ini telah diusulkan. Mudah-mudahan, animasi ini dapat membantu pelajar-pelajar memahami lebih baik tentang informasi-informasi yang diberikan dan juga belajar dengan mudah. Metodologi yang diguna untuk membangunkan animasi 3D ini ialah “Multimedia Production Process” yang mengandungi tiga peringkat bermula dengan “Pre-Production”, “Production” dan “Post-Production”. Elemen-elemen multimedia seperti teks, audio, video, grafik dan animasi telah digunakan di dalam animasi 3D ini. Dalam membangunkan projek ini, keperluan perkakasan dan perisian juga akan diterangkan. Setelah projek telah siap dibangunkan, pengujian akan dijalankan untuk mendapat maklum balas daripada target pengguna.

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**LIST OF ABBREVIATIONS**

PSM	-	Projek Sarjana Muda
MPP	-	Multimedia Production Process
FPS	-	Frame Per Second
SPM	-	Sijil Pelajaran Malaysia
CD	-	Compact Disc
DVD	-	Digital Versatile/Video Disc
KPM	-	Kementerian Pelajaran Malaysia

## CHAPTER I

### INTRODUCTION

#### 1.1 Project Background

Like animals, plants also lose water. Most of the water is lost through a process called transpiration. It is replaced by the absorption of water from soil in the roots. Transpiration is the loss of water vapour from a living plant due to evaporation. A large tree can absorb water at a rate of 1 dm min. However, only 1% of this water is used by its cells for photosynthesis and for turgidity. The remaining 99% evaporates from the leaves and is lost to the atmosphere through transpiration. In most plant, about 90% of transpiration takes place through stomata. Transpiration also takes place through lenticels.

Transpiration helps in the absorption and transport of water and mineral ions from the roots to different parts of the shoots. The continuous stream of flowing water from the roots to the leaves is called transpiration stream. Water is needed not only for photosynthesis but also to prevent wilting of the plant. On a hot and sunny day, transpiration produces a cooling effect in the plant.

Basically, transpiration is one of the chapter in Biology subject learnt by secondary students (Form 5). In this chapter students will learn about translocation and transpiration. In delivering the information, we will be using animation as its new alternative to replace text book.

Animation is the rapid display of a sequence image of 2 Dimension (2D) or 3 Dimension (3D) artwork or model positions to create an illusion of movement. For this proposed project, will be using 3D animation as it looks more realistic than 2D. In developing 3D animation has its constraint such as it took long time to develop the models and also for rendering.

This animation that will be developed will be focusing on Transpiration only. This 3D animation will take a visual and meaning-based approach that is much easier for students to understand. The characters used in this animation are leaf, plastic bag, cells and many more. The viewers would be able to see how the characters are moving to make them understand about how transpiration happens. By watching this 3D animation, viewers are able to understand better than just reading because the animation helps to visualise the transpiration process using multimedia elements. For the animation, principle of animation and multimedia elements that will be applied such as audio, video, image and text will be put into studies in details.

## **1.2 Problem Statement**

Reading books only gives few percents of understanding compared to watching videos. For teachers, using outdated materials such as text books makes teaching much more difficult. In text books, there are diagrams but they are static. Something like transpiration process is better to be presented using animation because the process involves the process of water flowing through a plant. Teenagers nowadays prefer to watch videos rather than reading books because they find that it is very interesting when they can see the visualization of what they are learning. Multimedia elements help to deliver information clearly and easily in learning. Therefore, this project is developed to try and use another way of teaching, which is 3D animation in order to teach students about transpiration in plants and to see if it is really effective.

### **1.3 Objective**

The objectives of this project are:

1. To develop an animation as a new alternative for students to understand about transpiration in plants.
2. To demonstrate the actual process of transpiration in plants.
3. To evaluate the effectiveness of learning using multimedia elements rather than just reading books.

### **1.4 Scopes**

The scopes in developing this project are:

#### **1. User**

Target user for this animation application is all the viewers who is in Sijil Pelajaran Malaysia (SPM) level and taking Biology subject.

#### **2. Module / Function**

- i. Introduction.
- ii. The process of transpiration.
- iii. Movement of water from the soil to the leaves.
- iv. Types of transpiration.
- v. Conclusion

## **1.5 Project Significance**

This Form 5 Biology Subject Content: 3D animation of Transpiration in Plants is developed for students, especially for those in the SPM level to make them understand how the process is happening. From this animation, the viewers can gain information about what is transpiration, the process and types of transpiration. The content is developed with 3D character using Autodesk Maya 2010 which will make the viewer get the informations in an attractive way.

3D animation is suitable for chosen topic, Transpiration in Plants because it can captures attention, and the information which is presented as a moving image is retained by the viewer for a longer time and greater accuracy and students can easily capture the information. This idea can be used and developed better to give contribution in management education and increase students interest in learning.

## **1.6 Conclusion**

This chapter explains the overview of the proposed project which is 3D animation of transpiration in plants. Animation is important as the students can see how the transpiration in plants happens.

Project background, had explained about transpiration and types of it, current scenario and solution of the problem that arise. Problem statement discusses about what is happening currently and from that, objective for this project can be stated. The scope of this project is also stated based on target users and module.

In the following chapter, will discuss about literature review that will be carried out to conduct research related to transpiration in plants is presented.

## **CHAPTER II**

### **LITERATURE REVIEW AND PROJECT METHODOLOGY**

#### **2.1 Introduction**

This chapter reviews literatures and previous projects that have been done by others that have connection with the title of this project. These literature reviews will be compared to strengthen the chosen title. The comparisons are made based on the chosen domain. In this chapter we will describe about the literature review and project methodology that will be used for this project. A literature review is a process of reading, analyzing, evaluating, and summarizing scholarly materials about a specific topic which usually compiled in a report or they may serve as part of research article or thesis.

A methodology will consist of phases, themselves consisting of sub-phases, which will guide the systems developers in their choice of techniques that might be appropriate at each stage of the project and also help them plan, manage, control and evaluate research [1]. Many types of this can be approaches on multimedia methodology project such as the analysis which will be explained further in Chapter 3, pre-production, production and post-production. Therefore, the appropriate methodology project can helps to manage and to maintain the project development.

This chapter also discusses about the project methodology which is to use all available approaches, techniques and tools to be used in achieving the predetermined objectives. In term of the project methodology, the listing of hardware and software specifications that will be used in developing this project will be explained.

## 2.2 Domain

Animation is designed as a simulation of movement created by displaying a series of pictures or frames [2]. It starts with drawing independent pictures and putting them together in a frame to form the illusion of continuous motion. 3D means that the picture is drawn with help of three coordinates of geometry. These are designated as x (horizontal), y (vertical) and z (depth). The basic different between 2D and 3D can be illustrated by drawing a rectangle (2D) and a cube (3D). 3D presents the object from every possible direction like in real life.

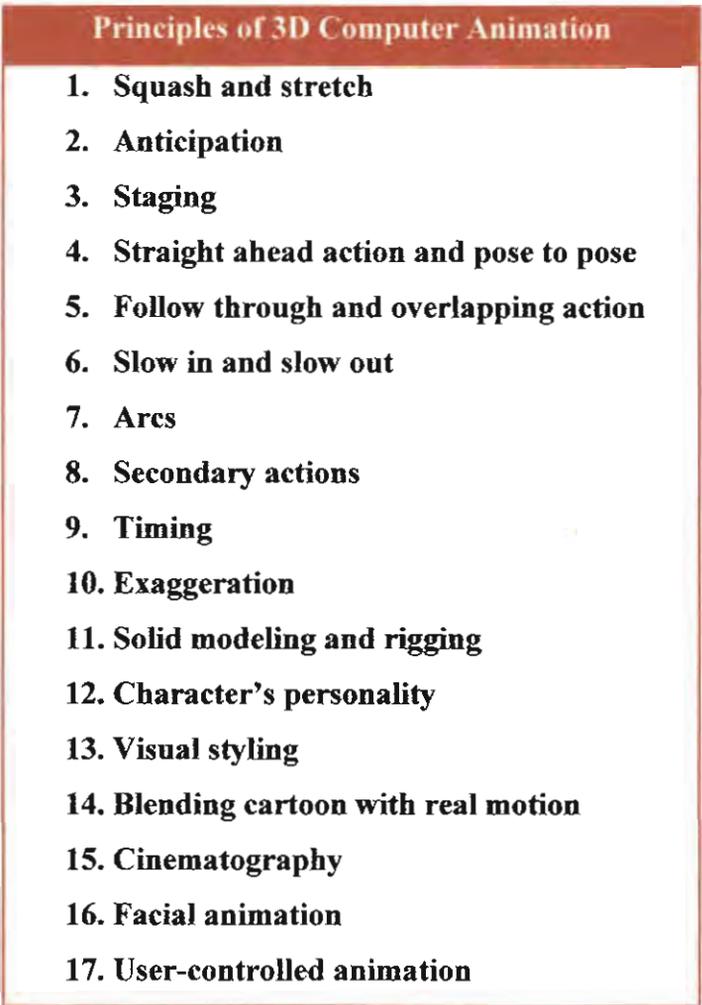
In early days animation was restricted to only hand drawings. But with the advanced technology, animation has its new face that is known as 2D and 3D animation. 3D animation is better than 2D animation because it adds more vigour and vivacity to animation.

Domain for this project is 3D animations. Some of the computer animation techniques used to create sequence of still images are based on the techniques of traditional cell animation, but most are unique computer based simulations of 3D worlds and character in motions. 3D is something that has *width, height and depth*. Our physical environment is 3D and we move around in 3D every day.

Humans are able to perceive the spatial relationship between objects just by looking at them because we have *3D perception*, also known as *depth perception*. As we look around, the retina in each eye forms a two-dimensional image of our surroundings and our brain processes these two images into a 3D visual experience [3].

3D animation involves digital modelling of characters. Various steps are involved in 3D animation which are character sketching, character modelling, scene building, texturing, lighting, camera setup, rendering, editing and mixing. With these, greater use of multimedia elements through 3D animation can be developed.

For this 3D animation, some of the principles of animation will be applied. There are twelve principles of animation. The twelve principles are mostly about five things: acting the performance, directing the performance, representing reality (through drawing, modelling and rendering), interpreting real world physics, and editing a sequence of actions.

- 
- Principles of 3D Computer Animation**
- 1. Squash and stretch**
  - 2. Anticipation**
  - 3. Staging**
  - 4. Straight ahead action and pose to pose**
  - 5. Follow through and overlapping action**
  - 6. Slow in and slow out**
  - 7. Arcs**
  - 8. Secondary actions**
  - 9. Timing**
  - 10. Exaggeration**
  - 11. Solid modeling and rigging**
  - 12. Character's personality**
  - 13. Visual styling**
  - 14. Blending cartoon with real motion**
  - 15. Cinematography**
  - 16. Facial animation**
  - 17. User-controlled animation**

**Figure 2.1 : Expanded and New Principles of Animation**

This project will produce an animation that is standalone and use Digital Versatile/Video Disc (DVD) as delivery medium. DVD is a small, portable and round medium made of moulded polymer for electronically recording, storing, and playing back audio, video, text, and other multimedia data in digital form. This project is using DVD as delivery medium because it will make it easy to distribute it to schools rather than transferring all the files by using other storage devices such as thumb drive. Other than that, using DVD needs a specific player or software to watch it. When it comes to cost, DVD is more expensive than Compact Disc (CD) because DVD has a very big storage space reaching until 8.75GB. I choose to use DVD because this is a standalone animation which may take much space to be stored. At the end of the project, all of the content and the complete animation needs to be burn to the DVD and distribute to schools.

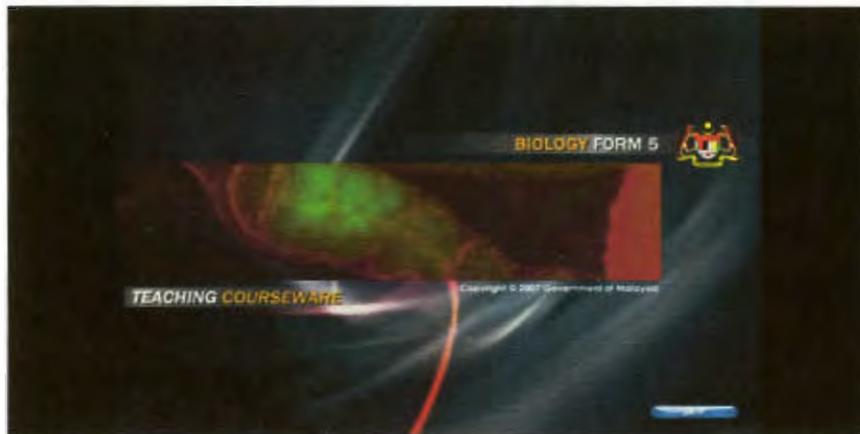
### **2.3 Existing System**

The existing system that will be reviewed in this chapter are 3D animations short video which is Biology Form 5 : Teaching Courseware, a short animation of Transpiration in Plants and a Form 4 Biology textbook. These related content are using different approaches to develop and demonstrate the same topic, so that target user can get the info easily. These existing system will be used as a reference and guide in order to develop a better quality of 3D animation.

#### **i. Biology Form 5 : Teaching Courseware**

*Biology Form 5 : Teaching Courseware* is an interactive animations produced by Ministry of Education, Government of Malaysia [4]. It is called interactive animations because user need to respond to the animation and then it will give feedbacks. The medium used to deliver the courseware is CD, where it has 25 lessons. Each lessons is based on the textbook. While students are watching the animation, they can refer to textbook. The animation was delivered with its exercises so that students can practice with the teachers. *Biology Form 5 : Teaching Courseware* is well-used by teachers in some school. In this courseware, the chapters are taken from the textbook. The

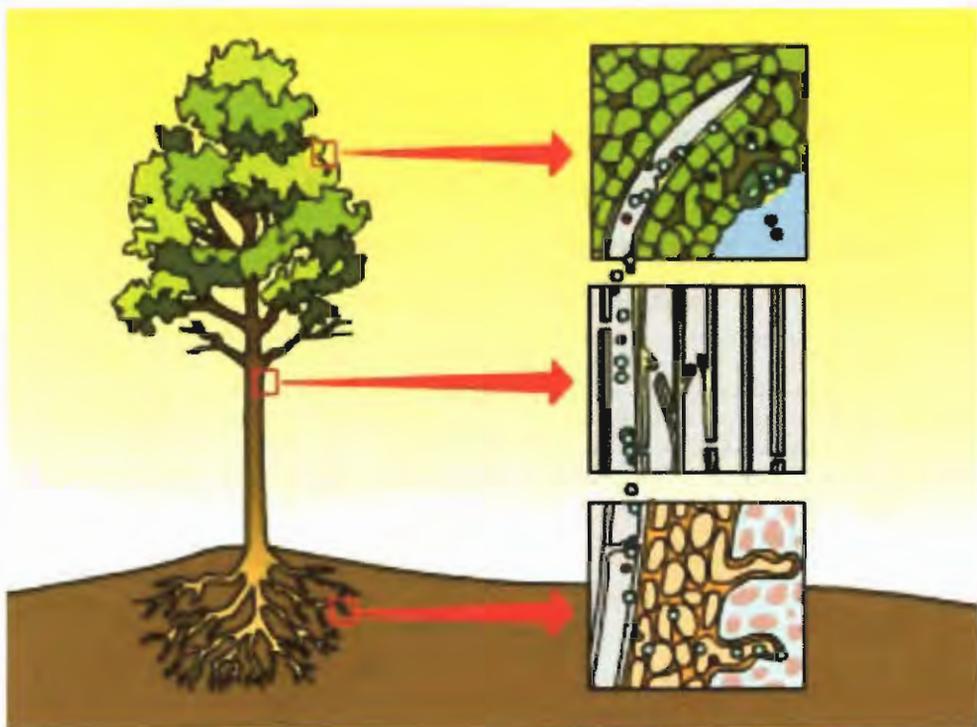
interactive part is that, user can choose which chapter they want to view. In this courseware, exercises are provided for the students to practice and they can also view their marks.



**Figure 2.2 : Biology Form 5 : Teaching Courseware**

## ii. **Transpiration in Plants (Short Animation)**

Transpiration in plants is a short video animation produced by Pearson Education .Inc [5]. 2D animation does not look real as it only has 2 dimension which is x-axis and y- axis. In this animation not, all subtopics of transpiration were covered as it only covered about the movement of water from the roots to the leaves. This animation has lack of information of transpiration, for example, the importance of transpiration and types of transpiration. In addition, this is not a courseware as it does not have any interactivity in the animation. Students only be able to watch the animation. Also, there was no any camera movement as it only shows one scene.



**Figure 2.3 : Transpiration in Plants**

**iii. Form 5 Biology Textbook**

The textbook was released by Kementerian Pelajaran Malaysia (KPM) only for Form 5 students who are taking Biology subject [6]. This textbook provides the details of certain topics. In detail, for *Chapter 1 : The Transport of Organic Substances and Water in Plants*, there are diagrams but it is static. For example, there is a diagram about the movement of water from roots to the leaves, when it comes to movement, it should be presented as an animation as it can show how the water is moving rather than just a picture which is static. The static picture could not visualize the process of flow water inside the plant.

### 2.3.1 Comparison of Existing System

Table 2.1 : Comparison of three existing system

<b>Comparisons</b>	<b>Biology Form 5 : Teaching Courseware</b>	<b>Transpiration in Plants (Short Animation)</b>	<b>Form 5 Biology Textbook</b>
<b>Medium</b>	CD	Website	Book
<b>Approach</b>	Courseware	Animation	Text-based
<b>Linear/Non-Linear</b>	Non-Linear	Linear	Linear

## 2.4 Project Methodology

Basically, methodology is a set or system of methods, principle and rules for regulating a given discipline, as in the arts or sciences. It shows the techniques used in a particular research study, or the techniques used to accomplish a particular project. Having a clear methodology is very important especially in the science field. Clearly outlined directions and procedures tend to increase consistency, and to create task which can be repeated elsewhere. This is why the methodology used in scientific research is always described, so that others can replicate the research themselves or identify errors in the methods that will be used which may have created skewed results.

Method that is being used in developing this 3D animation is Multimedia Production Process. There are six phases involve in the production of multimedia project. The six phases involved can be categorised into 3 main stages which are Pre-Production, Production and Post-Production.