

CERTIFICATION OF APPROVAL

**Animation Courseware as a Learning Aid for Student of C Language  
Research on "The Suitability of Multimedia Component Combinations  
Towards Effective Learning"**

By

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## CERTIFICATION OF ORIGINALITY

This is certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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## ABSTRACT

This research is developed in conjunction with the development of **Animation Courseware as a Learning Aid for Student of C Language**. The title of this research "*The Suitability of Multimedia Component Combinations Towards Effective Learning*" derived from the development of Graphical User Interface (GUI), in which merging the concept of Computer-based Learning (CBL) into the current educational trend. The development of this animation courseware would give a new dimension in developing educational software since it is planned to use animations. This animations environment is a better way in learning especially when the target subject is programming-based and the target users are among the students.

The primary objective is to introduce C Language lesson in multimedia learning applications and the scope is specified in the range of the multimedia components, the user interface design and the interactive multimedia learning application. The author has narrowed the scope to just the chapter of functions due to the time constraint.

In order to develop this animation courseware, there are some research methodologies being used. The main resources during the development of this animation courseware would be the lecturer of multimedia as well as the lecturer of c programming.

This courseware would be a system that is fully required these days due to its fulfillment in interactive needs today. Living in a fast lane in the world today, this is very precious indeed. For people that are in the run, manual old-fashioned approach in big fuzz. Therefore, learning interactively can save time thus having understood the same as attending conventional classes, sometimes more.

## **ACKNOWLEDGEMENT**

### **AL-FATIHAH, 'THE OPENING'**

**In the name of Allah, the Beneficent, the Merciful.**

**Praise be to Allah, Lord of the Worlds,**

**The Beneficent, the Merciful.**

**Owner of the Day of Judgment,**

**Thee (alone) we worship; Thee (alone) we ask for help.**

**Show us the straight path,**

**The path of those whom Thou have favored;**

**Not (the path) of those who earn Thine anger nor those who go astray.**

One of the great pleasures of writing such a report is acknowledging the efforts of the many people whose names may not appear on the cover, but whose hard work, cooperation, friendship and understanding were crucial to the production of this report as well as the courseware itself. In the name of God, the Compassionate, the Merciful, I would like to thank him for giving me the strength, skill, knowledge, patience and good health in order to produce this report and courseware.

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Thanks again to all. Welcome to the exciting world of programming using multimedia applications. I hope you enjoy your look at leading-edge computer applications development.

May God bless you all.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background of Study

This research is done to study "*The Suitability of Multimedia Component Combinations Towards Effective Learning*". Since the popularity of the E-Learning and Computer Based Training (CBT) is on the rise, the author would like to explore what are the contents of the multimedia elements that are being much preferred by the user. Due to this fact, the author has developed 'Interactive Web Tutorial for C Language', an **animation courseware** that provides tools to learn C Language (Example of Chapter: *Functions*).

The fact that all the developers used the same development process in the process of developing their applications had contributed to our interest of finding which of them contains the best multimedia elements that can help the users to fully utilize the interactive multimedia applications. In other words, we believe that although there are many types of interactive multimedia applications available in the market, there are only a few that can be categorized as good and the thing that makes them good is what actually we want to discover in this research (in term of multimedia elements being used).

Generally, this research explained the details of the research methodologies and results that had been carried out. The data gathered from the survey which use questionnaire as the method of data gathering. All the data will be formed in a graphical interface to produce a comparison between the courseware and other sources of multimedia applications.

## 1.2 Problem Statement

Basically, the development of multimedia application for learning purposes is similar to other multimedia application. The difference lies in the fact that multimedia learning application require more understandings or details on how to get the best approach of delivering the ‘message’ or simply the learning materials.

Today, virtually all new major operating systems are written in C and/or C++. Over the past two decades, C has become available for most computers and is generally considered to be hardware independent [12]. Thus, a strong fundamental of C would be essential in industry. Students would be encouraged to learn C using this new courseware as it would be more interesting and less boredom. Looking ahead, our industry clients appreciated the availability of C-literate graduates who could work immediately on substantial projects, rather than first having to go through costly and time-consuming training programs. Due to these facts, the author could see the essential of having a new way of learning C programming and has choosing the multimedia application as a medium of application.

The consideration should also apply to what multimedia elements should be used in order to deliver the learning materials to the user. Currently, the text-based applications are popularly available but the question lies in the fact that how good is the use of text or other multimedia elements as medium of learning in the learning process. As being observed nowadays, the text-based learning applications are currently being exchanged by graphics or images based applications. This problem can be considered as critical, since the learning process requires heavy consideration on the medium being used. If the wrong mediums are used, that what the user might get the wrong or false information or knowledge.

The animation representation of this courseware would overcome some limitations on the text representation. In text representation, it is hard to produce clear picture of the whole ideas. This is because in text representation, it only consists of a bundle of letters, which only tells about the idea without clearly showing the imagination. It may leads to the

imaginary problems. Meanwhile, in animation images, there is an additional advantage, which will clearly show the whole ideas of the picture. Therefore the environment would be livelier because of its enhanced features (movement of pictures). With the usage of animation figures, the courseware would be more intuitive and effective method to learn the C Language. However, it is needed to say that text is not bad at all instead by implementing animation with text in developing this courseware would enhance the learning with its detailed imagination.

### **1.3 Objectives**

- 1) To introduce C Language in multimedia learning applications.
- 2) To prove that integration of multimedia component into multimedia application is preferable, to the user, in comparison with text based application.
- 3) To determine the effect of multimedia components in learning situations.
- 4) Proving the concept of multimedia components preferences.
- 5) To clarify the best multimedia component combinations towards effective learning.
- 6) To prove that programming (C Language) and multimedia can be integrated in learning process and produced quality information.
- 7) To determine the effect of animation courseware to the users in C Language lessons.
- 8) To prove that having animation elements will have a positive impact in multimedia applications usage.

## 1.4 Scope

The scope of the research is divided into four parts:

### 1) The topic covered

- The author has decided to narrow the scope to the Functions chapter only. By doing this, the author could concentrate more on developing the efficient and effective presentation of multimedia rather than widening the scope to more than one chapter. Furthermore, the time constraint also being one of the factors for the author to only focusing on single chapter. Based on the rationality, the author sees that the period of 14 weeks is only suitable for a development of one chapter only.

### 2) The multimedia components

- Theoretically, it is derived that multimedia has increasingly popular in learning. Most students, educators, software developers, programmers and other educational related fields, integrate multimedia components into their learning process. Books publisher also attempting to integrate multimedia learning through selling Compact Disc with their books. This trend has been increasingly accepted worldwide that learning has significantly enhanced through multimedia learning. The components are audio, animation and text. Although video is also one of the multimedia components, the author sees that there is no relevancy of using that element in developing a courseware of C Programming lessons.

### 3) The user interface design

- In computer-based learning, user interface is generally what you see in your screen or monitor. Some would describe user interface as the computer navigation. User interface usually is the residing area of multimedia components. The design of user interface generally

consists of a single or combinations of multimedia components. It is rather important for the interface designer to carefully select the appropriate combination, for a bad design sometimes could cause misleading the user.

#### 4) The interactive multimedia learning application

- An interactive application is a software application that requires users to participate in the learning process, by giving responses and inputs as requested. Through this process the user will be able to memorize all the material conveyed and taught. Interactive application also requires the user to focus on certain aspect of the contents. This is exclusively true for interactive learning application since the contents also being accepted as the learning material, which are essential in individual learning process.

#### 5) The impact of animation courseware towards the learning process of C Language.

- The author would run a research to examine the impact of the additional elements of multimedia which is animation to the level of knowledge of the users. A set of quizzes would be given to the users to measure their level of understanding. Here, the author has decided to make some assumptions and limitations which are :
  - i) All users are not familiar with C language at all (foundation students).
  - ii) All users are currently using the software of [http://www.iota-six.com.uk/c/20\\_funct.htm](http://www.iota-six.com.uk/c/20_funct.htm) as their source of studying C Language.
  - iii) All users will be given a new product which is 'Interactive Web Tutorial for C Language' as their treatment.

## CHAPTER 2

### LITERATURE REVIEW

#### **2.1 Multimedia and Animation Representation**

Multimedia derived from the word multiple media and according to Walter Goralski multimedia refers to “the integration of two or more different information media within a computer system”. In the development of this animation courseware, the author will assimilate the usage of text, animations and audio in order to attract the users, which are the students of C Language. The pedagogical strength of multimedia is that it uses the natural information-processing abilities that we already possess as humans. Our eyes and ears, in conjunction with our brain, form a formidable system for transforming these multimedia attributes into information. These are the best aspects in implementing multimedia in developing the animation programming courseware where it would attract the users in exploring and to stay tune on the courseware itself (it is understood that programming is a boring subject to many people, thus, this courseware could help to maintain the ability of focusing towards the programming education). A great quote stated that "a picture is worth a thousand words" often understates the case especially with regard to moving images (animation), as our eyes are highly adapted by evolution to detecting and interpreting movement.

Apparently, one advantage of multimedia courseware over the text-based variety is that the application will look better and more interactive. If the courseware only includes a few images at least this gives relief from screens of text and stimulates the eye, even if the images have little pedagogical value. This has resulted the implementation of the animation courseware where the lesson will be delivered with the usage of moving images rather than text based information. For example, a courseware describing the value brought forward would be much more interactive and interesting if it includes moving images of enhanced texts showing the movement of the value itself rather than if it merely used a thousands of text.

The idea to convey the C Language lesson by using animation representation is due to the fact that it could be much more attractive and lively for the students. The animation representation of this courseware would overcome some limitations on the text-based illustration. With the usage of animation figures, the courseware would be more intuitive and effective method to learn the C Language.

In this animation environment, the students can see exactly where the values and the characters go and also what will be the output in that particular process of programming.

## **2.2 Multimedia and C Language Programming**

Multimedia is a form of communication that attempts to engage multiple senses. By engaging the senses, the developer able to create a unique experience for the user and to stimulate emotional reactions. This form of communication invites the user to take action or react and therefore, to become contributor or participant in the communication process. Multimedia consists of the magical compound of sound, video, animation, text and graphics. Multimedia is the combination of engaged sense, your thinking, hands, eyes and ears.

Through multimedia, students can be encouraged to build meaning and develop understanding. Given aural tools with which to explore, expand, clarify, and modify their understandings, the technology can be cast in the role of support system for students as they develop and share their interpretations.

Recent advances in CD-ROM and multimedia technology have marked a new departure in the advancement of interactive computer technologies. The ability to be able to integrate text, static and animated graphics, video, sound and music into a coherent whole, has already had an impact on other learning aids such as books and video.



In the world of school education, Interactive Web Tutorial for C Language Programming is adjusting to adapt in the current multimedia environment. As the Programming emphasizes learning through all five senses, which tend to be similar to the multimedia environment, it will help the student to not just listening, watching, or reading but learn at their own, individual pace and according to their own choice of activities from hundreds of possibilities.

Recent surveys have yielded a statistic on the behavior of human being in learning situation, people retain 20% of what they see, 40% of what they see and hear and 75% of what they see, hear and do. This result proved that multimedia and Interactive Web Tutorial for C Language is the best approach as it emphasizes learning through all five senses. In addition, nowadays 91% of parents have turned to use computer to teach their children for education purposes [1].

Studies shown that children who interacted with computer game derived significance gains in motivation in their activity and motivation in learning about brain [2]. In the comprehension area, children who interacted with computer understood 90% of the content compared with 70% and 69% for the traditional lecture and control groups, respectively. These results suggest that the computer interaction is far superior to traditional ways of teaching students about complex matter such as the brain.

### **2.3 Multimedia-Based Application Versus Text-Based Application**

In discussing the issue of learning, the materials delivered could affect the learning process. Learning material characteristics include the medium, physical structure, psychological structure, conceptual difficulty and sequence [3]. The multimedia elements are actually being defined as the medium of learning or in other words, the transformation from the learning materials to the learning process. Thus, the consideration, with respect to the user interface design of interactive multimedia learning applications should lies on the medium of learning materials.

Many researchers are getting into more understandings of the fitness of multimedia elements as a medium for learning materials, but their opinions come out to be unmatchable. Although their opinions differ [4], limited evidence suggests that some media are better than others at communicating certain kinds of information [5]. For instance, when a learner needs to remember a small amount of verbal information for a short period of time, information that is presented via the auditory medium is generally remembered better than information that is presented through text. In one study by Murdock [6], learners recalled and recognized 10 items from a list better when the experimenter presented the items using sound than when the experimenter used text.

As a general clarification, the popular multimedia element in as a medium for learning materials is text. However, the problem lies in the fact on how effective is text, when it is being compared with other elements? This consideration could also being notified vice versa (i.e. how effective is sound, images or animations on delivering the learning materials in the learning process).

#### **2.4 Dragging versus Clicking Mouse Function**

This issue concern on the usage of mouse function in which different user have their own perception on clicking and dragging. Some people tend to prefer clicking rather than dragging because of the ease of use. Meanwhile, the user prefer dragging when it is used in transferring any object.

According to Steve Grossman [14], the function clicking an object causes it to be selected or active. This can be applied to any object, such as an icon, any file, a window or any part of a window. When an object is selected or active it stands out from objects that are no longer selected or active by the coloring of parts of the object. In standard default mode, active or selected objects are blue and objects that are not active or selected are gray. Elsewhere, he also define dragging an object by placing the mouse pointer on the

object and at the same time click and hold the mouse button to dragging the object somewhere else and lastly, letting go the button to release the object.

The idea of dragging function is pretty simple but does not work as expected. The main issue demonstrates the problem related to dragging function is that when dragging from a source to another place in the same application, clicking the first time will cause no action taken at all [Elliot].

Meanwhile, the clicking function concerns on two issues, which are right-click versus left-click and single-click versus double-click. Left-click is a normal action taken by the user and the introduction of new technology to the right-click button has evolve the usage of right-click button. Now, when user right-clicking on an object, it will produces a popup menu for that object, and, the selections presented in the menu depend on the type of object it is. The issue of single-clicking versus double-clicking focus on the left-click mouse button. "Clicking" the mouse itself implies that you click the left button of your mouse. "Double Clicking" implies two clicks of the left mouse button in quick succession. Nowadays people tend to get use of the single-clicking option as it saves more time than double-clicking but it is less convenience to select an object. Mouse experts stated that it is better to stay with single-clicking for selecting an object and double-clicking to run or open or launch a program or application, or a file or folder [16].

Clicking and dragging option implies the same goals which both are needed to accomplish mission and must be used properly so it ends up being fairly linear. However it varies in term of interactivity [13]. Clicking offer less interactivity than dragging as it is straightforward approach rather than task-oriented offered by dragging.

## 2.5 Traditional Classroom versus E-Learning

Much of what happens in the traditional classroom was influenced heavily by the behaviorist movement, which dominated American psychology from about 1920 to 1970. Chief among the behaviorists was Skinner [18,19], who saw that human behavior is powerfully shaped by its consequences. Moreover, Skinner felt that psychology was essentially about behavior and that behavior was largely determined by its outcomes. While Skinnerian methods have been effective in learning how to train animals and helping human beings modify their behavior, the behaviorists fell short of what is most important in education for most educators. To educate, you must do more than modify behavior. To educate, you must help the student learn how to develop strategies for learning. Such is the goal of the cognitive movement in education as defined by Bruning [15].

According to Bruning cognitive psychology is a theoretical perspective that focuses on the realms of human perception, thought, and memory. It portrays learners as active processors of information; a metaphor borrowed from the computer world and assigns critical roles to the knowledge and perspective students bring to their learning. What learners do to enrich information, in the view of cognitive psychology, determines the level of understanding they ultimately achieve.

It is appropriate that Bruning borrows from the computer world in his definition of cognitive psychology. As it is already been proven, multimedia computers provide a powerful environment for helping achieve the goals of the cognitive movement in education. As articulated by Thompson (1969), students learn better when they can invent knowledge through inquiry and experimentation instead of acquiring facts presented by a teacher in class. It is difficult for a teacher to provide this kind of environment for each student in a traditional classroom. Since there is only one teacher for many students, it is physically impossible for the teacher to support each student's individual needs. Multimedia computers help by providing students with a world of interconnected

knowledge to explore. Thus, the student becomes an active processor of the information, and knowledge is the end product.

Since the learner is portrayed as an active processor who explores, discovers, reflects, and constructs knowledge, the trend to teach from this perspective is known as the constructivist movement in education. As Bruning explains, 'The aim of teaching, from a constructivist perspective, is not so much to transmit information, but rather to encourage knowledge formation and development of metacognitive processes for judging, organizing, and acquiring new information'. Several theorists have embellished this theme. Rumelhart (1981) [17], following Piaget, introduced the notion of schemata, which are mental frameworks for comprehension that function as scaffolding for organizing experience. At first, the teacher provides instructional scaffolding that helps the student construct knowledge. Gradually, the teacher provides less scaffolding until the student is able to construct knowledge independently. Skinner and the behaviorists used related techniques known as prompting and fading. A hierarchy of sequential prompts firms up and reinforces a student's skill, and fading removes the prompts gradually until the student can perform a task independently.

Vygotsky (1978) [20] emphasized the role of social interactions in knowledge construction. Social constructivism turns attention to children's interactions with parents, peers, and teachers in homes, neighborhoods, and schools. Vygotsky introduced the concept of the zone of proximal development, which is the difference between the difficulty level of a problem a student can cope with independently and the level that can be accomplished with help from others. In the zone of proximal development, a student and an expert work together on problems that the student alone could not work on successfully.

A challenge for software designers is to create programs that can function as the expert in the zone where learning and development take place. Software that succeeds can help transform the traditional teacher-centered classroom into a more learner-centered environment. Table 1 compares the teacher-dominated and cognitive perspectives.

Table 1: Comparison of the Teacher-Dominated and Cognitive Perspectives on Education

<b>Teacher-Dominated Perspective</b>	<b>Cognitive Perspective</b>
Teacher Centered	Learner Centered
Teachers Present Knowledge	Students Discover and Construct Knowledge
Students Learn Meaning	Students Create Meaning
Learner as Memorizer	Learner as Processor
Learn Facts	Develop Learning Strategies
Rote Memory	Active Memory
Teacher Structures Learning	Social Interaction Provides Instructional Scaffolding
Repetitive	Constructive
Knowledge Is Acquired	Knowledge Is Created
Teacher Provides Resources	Students Find Resources
Individual Study	Cooperative Learning and Peer Interaction
Sequential Instruction	Adaptive Learning
Teacher Manages Student Learning	Students Learn to Manage Their Own Learning
Students Learn Others' Thinking	Students Develop and Reflect on Their Own Thinking
Isolationist	Contextualist
Extrinsic Motivation	Intrinsic Motivation
Reactive Teachers	Proactive Teachers
Knowledge Transmission	Knowledge Formation
Teacher Dominates	Teacher Observes, Coaches, and Facilitates
Mechanistic	Organismic
Behavioralist	Constructivist

This literature review describe how technology is being used to transform teaching and learning from the historically teacher-dominated perspective into a student-centered environment that encourages students to learn by constructing rather than by digesting knowledge.

## 2.6 Application Comparison

There are some applications in the Internet already taught about chapter functions. Here are some of them and their details.

[http://www.physics.drexel.edu/courses/Comp\\_Phys/General/C\\_basics/c\\_tutorial.htm](http://www.physics.drexel.edu/courses/Comp_Phys/General/C_basics/c_tutorial.htm)

1#functions

This is an example of a bad tutorial homepage. This is because it links the entire C topic in one page, so it will take a lot of time loading. By only covering function call and giving 3 examples, with not even one image included, it expects users to understand the whole topic and yet the loading time for a page is faster.

<http://www.graylab.ac.uk/doc/tutorials/C/chap05.htm>

This page also will disappoint user with its dull approach, but this page has a wide coverage on title function. By not linking with other topics in C, it makes this page faster to upload. The background image also quite good plus extra links to subtopic coverage, but no function examples at all wont make any user interested to even bother to know about function.

[http://www.iota-six.com.uk/c/20\\_func.htm](http://www.iota-six.com.uk/c/20_func.htm)

This website could catch the attention of a user to further surf more about function from this page. It has a set that combines interesting background color, colorful text, and separate link with other topics in function. Examples are also given according to subtopics, easy to browse concept (using top link method) and good coverage is done in the web. But, with no special application from other sites (like using animation, multimedia oriented) makes this site is as same as others, not very promising in education users.

From the example of existing system and presentation in the web, the author can conclude that the current systems are :

- linked to another poorly.
- All examples display static content of information and notes.
- Low human-computer interface display
- Dull and boring approach
- All examples are merely the same
- Display all links together without separating according to topics
- Huge uploading time



## CHAPTER 3

### METHODOLOGY/PROJECT WORK

#### 3.1 Procedure Identification

Methodology is the steps taken in undergoing the research and project work. By referring to the basic System Development Life Cycle (SDLC), the development of this Animation Courseware is based on the waterfall model. It consists of different stages, which are processed, in a linear fashion. Waterfall Model is well-defined development process in which one phase has to be finished before the next phase.

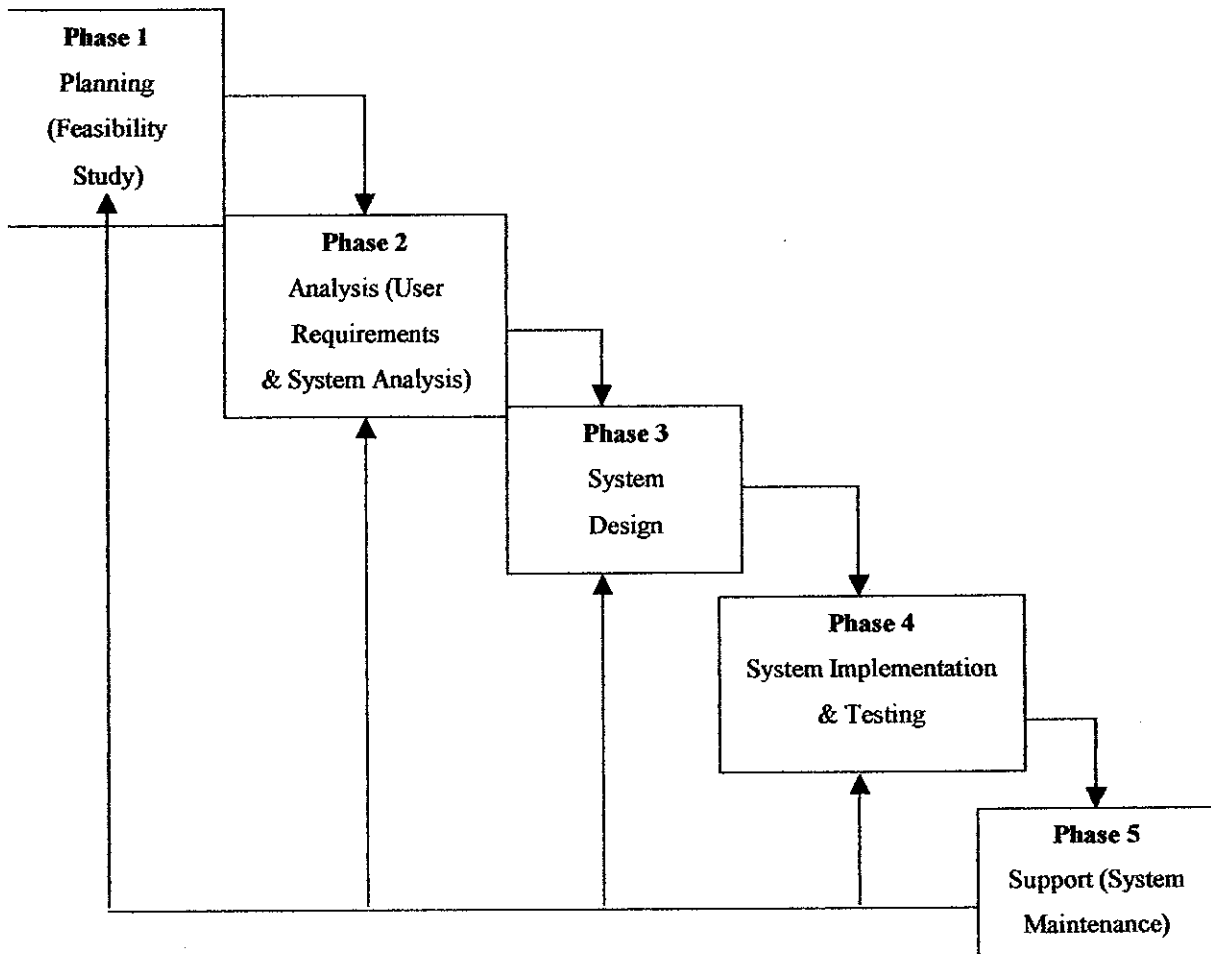


Figure 1 : Waterfall Model

Waterfall model longevity has been due to the advantages that it offers the users. The waterfall model has been used to produce almost every kind of software system known. It is easily adapted to any type of system.

### **3.1.1 Why Waterfall Model?**

Its longevity has been due to the advantages that it offers the users. The waterfall model has been used to produce almost every kind of software system known. It is easily adapted to any type of system. The waterfall model that being implemented in developing this animation courseware is using top down approach that breaks the tasks into a series of necessary sub goals.

The reason of implementing the waterfall model is due to the fact that:

- ◆ It gives a clear picture of where the development of the courseware is at a given point in time.
- ◆ The boundaries of each task are clear and unambiguous
- ◆ It is orderly and predictable

Besides, compared to other software development models, waterfall model is more rigid and better manageable.

## 3.2 Project Work

### 3.2.1 Phases of Project (Prototype)

Phases	Task
(1) Planning	Plan on 1. Proposal 2. Timeline and scope of research 3. Content of the research
(2) Analysis	Gather data and information through Internet, articles, newspaper.
(3) Design	Plan on designing the prototype as a benchmark on findings.
(4) Implementation	Presentation and Survey (Questionnaire)
(5) Support	Prepare a complete documentation

**Table 2 : Phases of Project Work**

#### 3.2.1.1 Planning

In the first phase of the life cycle, which is planning, it will give the author a clear picture of what actually the courseware being developed is like to be. In this phase the author has identified background of the project, which is the scope, objectives and the problems with current system.

Firstly, the scope of this Animation Courseware is identified. From the researches done, it is believed that by implementing the animation representation in the development of the

courseware would enhance the students learning. This is because they could learn in an interactive way with the use of the courseware's attractive features. In addition, this animation courseware would also benefit the C Language teachers and tutors. Besides, the user's requirements and the limitations are identified as well as the problems of the current system being implemented in educating the students.

The author has decided to focus on certain area only due to the time constraint given is very limited which is 14 weeks. The author has come out with a timeline for the period of 14 weeks and based on this timeline, the author focused on chapter function only. The author also mentioning about forming a discussion with his supervisor at least once in two weeks.

Basically, the users need a new way in learning instead of using books as the main materials. Therefore with the completion of this courseware would give a new dimension in school education whereby it's not only used to teach the students on their formal education, it also encourage them to learn on how to expose to the Internet. The usage of computer and Internet will enhance the current style of learning where it only concentrates in classroom.

From the study, the unattractive way of learning in student's educational system will lead them to boredom. From other point of view, learning should be fun, therefore by developing this Animation Courseware would enhance the students in their learning. Moreover, our current educational system for students is concentrating them into theory and lab exercises. Although these approaches are quite good, the development of the students' ability in thinking skills should be enhanced in today's educational world. Therefore, in this Animation Courseware, it will be included with some interactive activities that could help these students to develop themselves.

### 3.2.1.2 Analysis

After the completion of the first stage, the process of developing the courseware is proceeding to the next phase, which is *analysis*. *Analysis* is a detailed study of various operations performed by a system and their relationships within and outside the system. These stages involved a detailed study of the current system, leading to specifications of a new system. In *user requirements* phase, the subject on what the users requires from the courseware being developed are established. During this stage, the data about the present system in educating the students are collected besides determine the solutions for the limitations arose. Questionnaires and researching on available sources on the Internet are the tools used during these stages.

- ♦ **Researches on Available Sources on the Internet**

Internet is an essential information resource in fact finding whereby it has the ability to make a survey and research on current issues of education. The study on the available sources such as researches paper, journals and articles are providing lots of information on the development of this Animation Courseware. During the researches, a research paper by Dr. Carol Takacs, professor of educational psychology at Cleveland State University, published on 1991 is studied. In addition, some website on C Language of existing system is studied (refer Literature Review 2.6).

- ♦ **Browse and review C Language Lessons on Functions.**

The Author has analyzed current C Language courseware that available in the market and Internet and their activity books to get the content to put in this Animation Courseware.

### 3.2.1.3 Design

#### *Media Selection*

The delivery platform chosen is Compact Disc Read Only Memory (CD-ROM) because of its portability and accessibility.

#### *Design Description*

The design is described using the flowchart, navigational map and storyboard.

- ◆ **Flowchart**

The Structure of the prototype can be depicted by a flowchart.

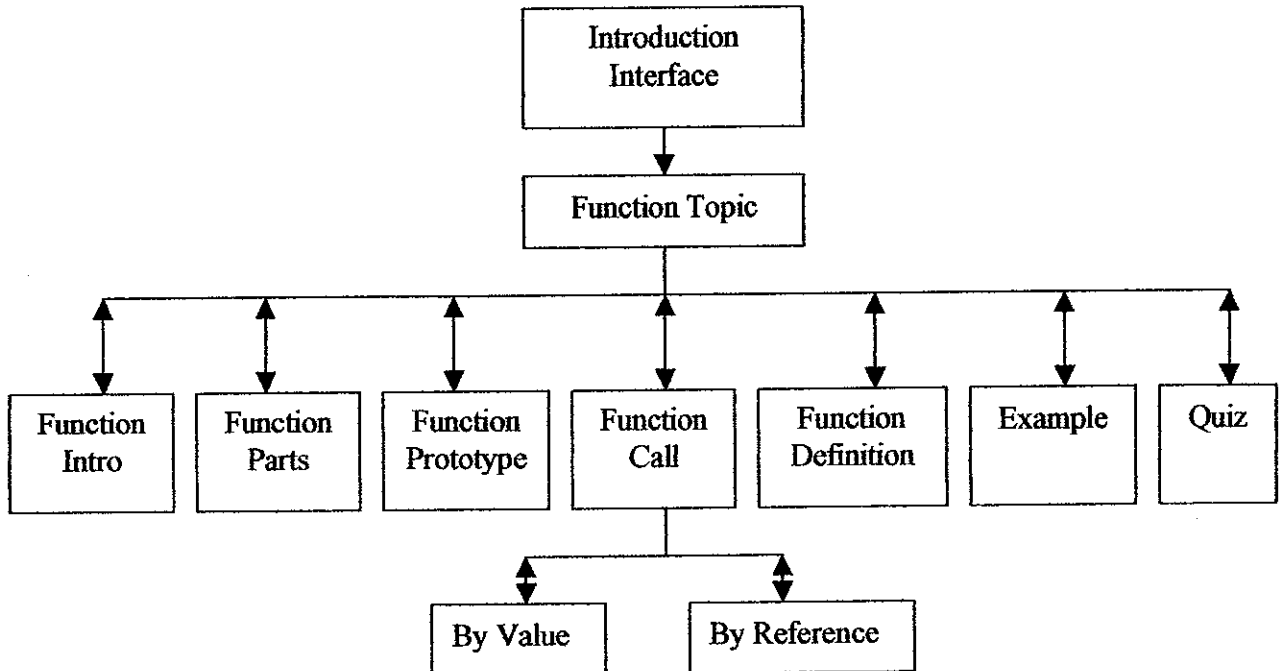


Figure 2 : Flowchart of the courseware

Based on figure 2, we could see that the flow is very easy to understand. It will create an easy navigation especially for the first-time user. Users would be presented by a very friendly user environment.

From the first page (Introduction interface), there will be only one way flow. It is because, the author wants the user to understand and feel the environment of the courseware and have their mind tuned to that environment by showing them the introductory page. By having this, user already focuses on the title of the courseware and finds it easy to adapt to the new world (which is learning C Programming interactively).

From that, user would be entering the whole presentation of function chapter. The author decided to make it two ways traffic which is the user can explore any page they wants by a single click. For example, when a user entering the Function Intro page, they can actually jumped to other page as well without going back to the page of Function Topic. The author decided to make it that way because taking into consideration that there are several users who are keen to know the animation part only. But, the subtopics are arranged accordingly so that the beginners can learn this chapter by following the right flow.

★ **Storyboard**

The layout of the elements to be displayed on the screen and the allocation of buttons, texts, graphics, pictures and animations, specification and functionality of the objects are captured in the storyboard.

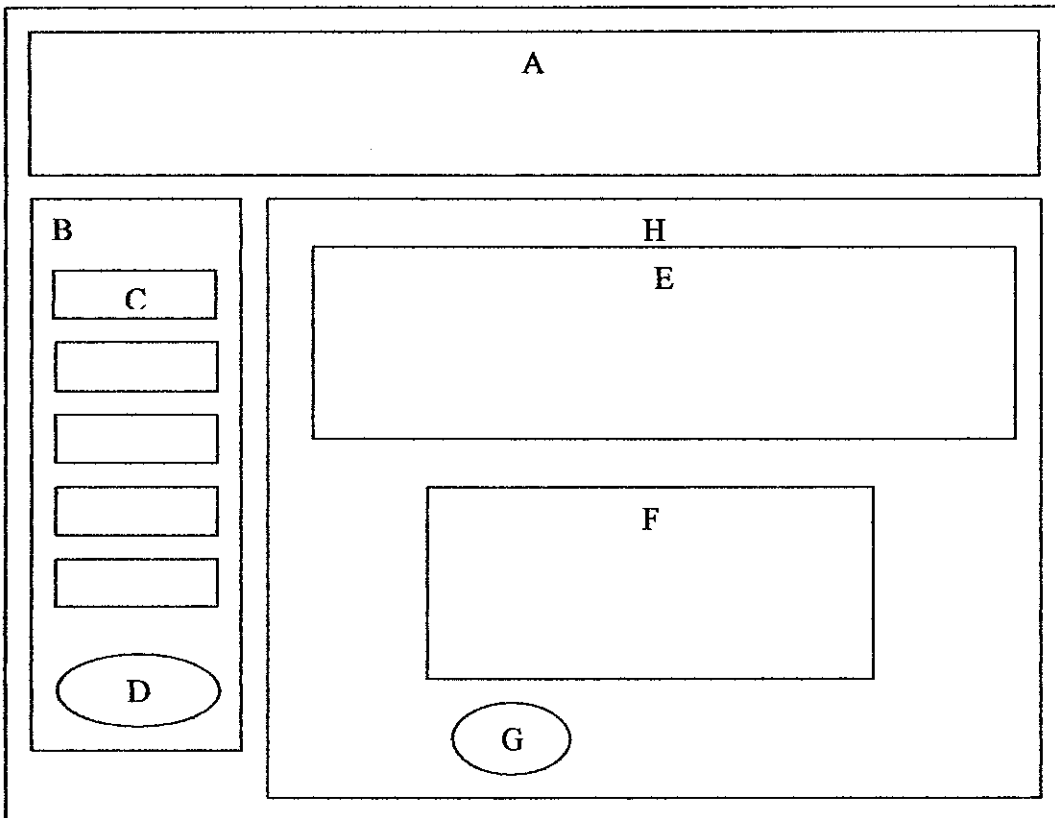


Figure 3 : Storyboard on overall tutorial page

A = Header Frame

B = Link Frame

C = Link Button

D = Close Button

E = Content Title and Topic Content

F = Animation Frame

G = Play Button (For Animation)

H = Content Frame



#### **3.2.1.4 Implementation and Testing**

This is the stage where the courseware is implemented. All the units are combined and now the whole is tested. When the combined programs are successfully tested the development of the courseware is likely to be finished. During testing, the courseware will be executed with some selected data to uncover the errors that might occur in which error is a mistake by the designer that led to the fault. After that, there will be evaluation session, where the author wants to get user feedback in improving and enhancing this courseware. In this phase also, the author will conduct user training session to teach the intended users how to use this courseware.

#### **3.2.1.5 Support and Maintenance**

System support and maintenance is one of the stages included in the development of this courseware. It involves correcting errors that have gone undetected before, improvement and other forms of support. This stage is part of the life cycle of a courseware, and not of the strict development, although improvements and fixes can still be considered as "development".

#### **3.2.6 Multimedia Guideline**

In designing the courseware, the author have emphasize the multimedia guideline on a few criteria which are fonts, color selection, graphic designed and sound-narration and background music. Mainly, in this courseware, the author has adapt the concept of 'Keep It Simple Stupid!' (KISS), in which all the content look simple but attractive and full with interesting knowledge [7].

## **Fonts**

Choosing a font to use in multimedia product maybe somewhat difficult from a design standpoint [18]. The font chosen should be appropriate to the age and reading skills of the users. For a courseware intended to the student, the font should be not too large and not too small with simple forms. Too large fonts can cause domination in illustration whereas too small fonts may cause difficulty to read.

In this matter, the author has decided to use various types of fonts which are 'arial' and 'Comic Sans MS'. This is because it is the easiest to read and student will be able to enjoy the learning process. Besides that, it also helps to avoid inconsistency.

ABCDEFGHIJKLMN  
OPQRSTUVWXYZ  
abcdefghijklmnopqrstu  
vwxyz1234567890

**Figure 3.2:Sample Typeface for Student**

The learning session is designed as a typeface for student's books and teaching materials; it features sans serif and arial letters and this is the result of a UK research project into which typefaces student find easiest to read. [9]

## *Color Selection*

Color is a critical consideration in interface design. There has been much discussion on the right and wrong of color. A safe approach is keep colors bright and bold. Color selection will concentrate on bright colors. Striking and high contrast colors are to be avoided during the development of the courseware.

Previous research has indicated that bright colors and interesting patterns are important to student and make their learning processes more enjoyable [10]. As for the marketing materials such as websites and brochures, it would be design with parents in mind. The color used maybe blue (trust, reliability), purples and pinks (nurture, sweet, security, relax, cool) and yellow (happy, playful)[11]. Here, author has decided to choose **purple** and **pink** colors to create nurture, secure, sweet, relax and cool environment.

Bright colors are happy colors and can attract student attention. Therefore, the author choose bright colors throughout the development of the courseware and also avoiding non-striking colors that can caused learners eye to be fatigue in the middle of the learning process. It is understand that having this kind of colors could attract the users to stay tune on the program and also it could avoid boredom as many people know that the programming lesson is one of the boring subject in the world. For example, having a font with red colors could add more stress to the user as the color itself (red) warn the user to stay alert and cautious thus, making the user not relax while using the program. Here, the author already creating such an interesting environment for the student to learn by only making a good color selection of the font used in the courseware.

## *Sound*

Sound is used to convey information related to the images with a voice commentary. Without doubt, sound is the best way to attract attention. But in this courseware, sound doesn't help much as programming particles is more on imaginary and pictures rather

than audio. Anyhow, author still includes narrator to gain attention from student at the beginning of the courseware.

### ***Graphic Design***

Graphics can convey messages easily. It also makes a multimedia title aesthetic in appearance and interesting. Besides, it also can captures student attention more than textual presentation. The use of pictorial information or graphics should be consistent throughout the multimedia courseware, to provide good understanding to the student.

The importance of graphics is derived from the fact that our primary sense is our visual sense, and the information conveyed in graphics has been throughout the centuries to be extraordinary and resulted to the emergence of quote by the experts saying that “One graphic is worth a thousand words”.

Even the uses of graphics were found to be good for representing information, but their overuse can be distracting. Therefore, it is recommended in the courseware that graphics and animations are kept simple enough to be understood and easy for the student to interpret the meaning it conveys.

## **3.2.2 Research**

### **3.2.1 Theoretical Framework**

First of all, the author decided to come out with two variables which are dependent variable and independent variable. The dependent variable of performance of answering the quizzes given is influenced by the two independent variables – the help of multimedia element (animation) in the application and the experience (basic/initial knowledge) of the users in C Language lessons.

The experience of a user in C Language lesson is also critical in determining the level of understand in answering the quizzes given. For example, we have two users, with both having the same treatment, first time being exposed to the environment of animation

courseware. Let's say they are learning thru that courseware, try to understand every subtopic in the chapter. The user that has a basic knowledge of C Language lesson will answer the quizzes better than the user that has just only started to learn it. This is because the more experienced user would have known a little bit of the function chapter perhaps from reading a book or being taught by their relatives. Thus, the experience of a user in answering the quizzes is important for the level of understanding in C Programming lesson.

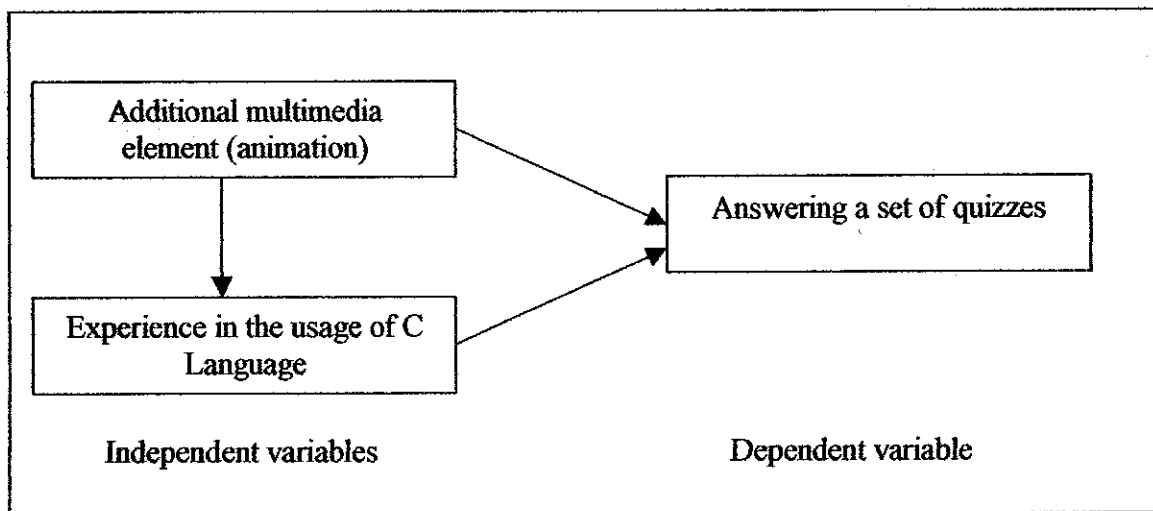


Figure 4 : Schematic diagram for the theoretical framework

### 3.2.2.2 Hypothesis Development

The author has come out with a set of hypothesis which are:

1. There is a difference between using 'Prototype' and 'Current' in understanding C Language lessons.
2. The performance level of users who are using 'Prototype' is higher than users who are using 'Current'.

The data was gathered by surveying the participants in a lab experiment on the effectiveness of interaction of the available software, which are :

1. Interactive Web Tutorial for C Language (Prototype)

2. [http://www.iota-six.com.uk/c/20\\_func.htm](http://www.iota-six.com.uk/c/20_func.htm) (Current)

### **3.2.2.3 Experimental Design**

Experimental designs are set up to examine possible cause and effect relationships among variables. This experimental design was based on the lab experiment, where contrived environments are provided. The lab experiment allows the kind of control and manipulation over other variables that might contaminate the cause and effect relationship between an independent and a dependent variable.

The author's research team has decided to conduct the experiment based on the true experimental design. It involves a treatment/experimental and a control group. Data is recorded both before and after the experimental group is exposed to the treatment.

For the experiment, it will have two groups, where one group will be the experimental group while another, would be the control group. Both the groups will be exposed to pre-test and post-test, but only the experimental group is exposed to treatment. Each group will have a total number of 20 participants. One of the rule of thumb for determining sample size as proposed by Roscoe (1975) is that sample sizes larger than 30 and less than 500 are appropriate for most research.

First of all, one experimental group and one control group will be given a questionnaire. Here, the author assumes that both groups are currently using 'Current' software. Only experimental group will then be given treatment (use the 'Prototype' software). After the experimental groups have been given treatment, they are given the same set questionnaire. The control group is also given the questionnaire.

The treatment effect can then be calculated as  $(O2-O1) - (O4-O3)$ .

Group	Pretest	Treatment	Posttest
Experimental	O1	X	O2
Control	O3		O4

Figure 5 : Pre-test and post-test experimental and control groups

There are several factors affecting the internal validity of the experiment. The major ones are the testing and history effects. The pretests are likely to have sensitized the participants to the posttests and a few of the participants may have already know about the C Language and are quite matured.

Since the experiment was done in limited time frame and with a very small group (20 participants), therefore maturity and mortality could be excluded. Instrumentation affects are not expected since the same questionnaire has measured both before and after the treatment for all participants. Since the participants are only one group of different background, the problem of selection bias is not expected to exist.

#### 3.2.2.4 Data Collection Method

For this research, we have decided to use questionnaires to obtain information from the participants. Simple unstructured questionnaires were performed on participants who were randomly chosen (among foundation students) to get their view about the use of animation in courseware. The questionnaires managed to broaden our idea on how users feel about the use of animation courseware (prototype) compared to the current software ([http://www.iota-six.com.uk/c/20\\_func.htm](http://www.iota-six.com.uk/c/20_func.htm)).

For our research, we have performed a questionnaire on the users. All of the questions asked are close-ended as we allow respondents to make choices among a set of alternatives given by the research team. This closed ended question helped the research team to code the information easily for subsequent analysis. All the questions were

phrased with simple and clear sentences, with no ambiguity involved. The questionnaires can be found in the Appendices.

As stated in the experimental design, participants are required to answer several quizzes to measure their performance of understanding the courseware. The total score for each participant is then recorded.

### **3.3 Tools Selection**

This courseware is developed by using:

1. **Macromedia Flash 5.0**

This is used to create flashy effect of image and animation to provide interactivity in order to grab the user's attention. All the animations in this courseware is designed and created in Flash 5.0.

2. **Macromedia Director 8.0**

Used to create a multimedia presentation, animation and interactive multimedia application. Director is a powerful and complex multimedia-authoring tool from Macromedia with a broad set of features.

3. **Macromedia Dreamweaver**

To create a web page in Explorer with JavaScript compatible. All resources are integrated in Dreamweaver to be uploaded via web.

4. **Microsoft Excel**

To generate chart and graph for the survey part.



## CHAPTER 4

### RESULTS AND DISCUSSION

#### 4.1 Discussions on the Questionnaires - Survey Form.

##### Definitions for User Interface Rating Tool

###### *User interface Dimension 1 – Ease of Use*

‘Ease of Use’ is concerned with the perceived facility with which a user interacts with an interactive multimedia program. It illustrates a dimension of such a program ranging from the perception that the program is very difficult to use to one that is perceived as being very easy to use. Like many of the dimensions described in this tool, ease of use is both an aggregate and individual dimension. For example, in the aggregate sense, the Windows interface is generally perceived as easier to use than the command interface of the Microsoft disk operating system (MS DOS). However, in the individual sense, some people may perceive the MS DOS interface to be easier to use because of their own unique experiences and attributes.

User interface dimensions may be highly correlated with how well users enjoy using a specific program. Whether users like a program may be more or less important, depending on the intent of the program and the context for its use. Certainly, not liking an interactive program that is intended to be highly motivating is a major problem, whereas users’ affect for a program may be less important in a training context in which strong extrinsic motivational factors exist. Nonetheless, in the long run, improving the user interface dimensions of multimedia, such as ‘ease of use’, is a highly desirable goal, regardless of context.

Criteria : Ease of Use	
Pretest	Posttest
7.15	7.7

Figure 6 : Average Score for Ease of Use

From the finding it shows that posttest (using 'prototype') score is higher than pretest (using 'current'). Perhaps the usage of the subtopic and the arrangement of the link button which is very systematic in the 'Prototype' help the user to better understand how to use the application. A very simple structure of the content also makes the user to feel more comfortable using this application.

#### ***User interface Dimension 2 – Navigation***

'Navigation' is concerned with the perceived ability to move through the contents of an interactive program in an intentional manner. It illustrates a dimension of interactive multimedia ranging from the perception that a program is difficult to navigate to one that is perceived as being easy to navigate. An important aspect of navigation is orientation, that is the degree to which a user feels that he or she knows where he or she in a program and how to go to another part of it. This is crucial variable because users frequently complain of being lost in an interactive application. Designers use several ways of supporting and maintaining orientation. A popular approach to navigation is the window-icons-mouse-pointing (WIMP) interface.

Criteria : Navigation	
Pretest	Posttest
6.85	8.00

Figure 7: Average Score for Navigation

From the finding it shows that posttest (using 'prototype') score is higher than pretest (using 'current'). This is because the user could see that the navigation chart is very simple and would create a very good flow to understand the application. It is nearly impossible for the user to get loss during navigation of the application.

### *User interface Dimension 3 – Cognitive Load*

Using an interactive program requires different mental efforts than performing tasks through printer or other media. In order to make any meaningful response to an interactive program, users must cope with and integrate at least three cognitive loads or demands, i.e., (a) the content of the program, (b) its structure, and (c) the response options available. To use interactive programs, users must perceive options, conceptual, and physical contacts with the interactive program. In terms of ‘cognitive load’, the user interface can seem unmanageable (i.e., confusing) at one end of the continuum and easily manageable (i.e., intuitive) at the other end.

Learners acquire and structure information delivered through interfaces, conducts mental operations, and accomplishes physical activities during their interactions with interactive multimedia. The limited capacity of working memory to hold only five to nine chunks of information simultaneously makes it difficult for users of complexity structured programs to reason when numerous cognitive load factors must be handled simultaneously. Users may feel overwhelmed by numerous options that increase the cognitive load. The risks of confusion are especially high when users confront programs, which by their very nature include many interactive options. The possibility of user disorientation is a major concern in the increasingly popular multimedia programs that feature a complex, flexible structure.

Criteria : Cognitive Load	
Pretest	Posttest
6.75	7.95

*Figure 8 : Average Score for Cognitive Load*

From the finding it shows that posttest (using ‘prototype’) score is higher than pretest (using ‘current’). This proves that the ‘Prototype’ is slightly better in producing the environment of health activities. By having this kind of score, it is understood that the ‘Prototype’ might reduce the confusion level that might be faced by the users while using

the application. It also revealed that this application is feasible to user especially when dealing with complicated subjects.

***User interface Dimension 4 – Mapping***

‘Mapping’ refers to the program’s ability to track and graphically represent to the user his or her path through the program. In complex, non-linear programs, use-disorientation can be alleviated if users can see what parts of the system they have already accessed. Having a detailed mapping system gives users an aid in understanding which parts and how much of the information space they have interacted with, and conversely which parts and how much of it they have not. Interactive programs falls in a continuum of containing no mapping function to an appropriately powerful mapping function.

The notion of and ‘appropriately powerful’ mapping function requires some explanation. Just as it is important to possess a map of the most usable scale when taking a road trip, it is important for interactive programs to provide enough, but not too much, detail in showing user paths. A map that shows every piece of a program’s knowledge space might prove to be so tedious or wieldy as to be of as little value as an interactive program with no map.

Criteria : Mapping	
Pretest	Posttest
7.3	7.00

*Figure 9 : Average Score for Mapping*

From the finding it shows that posttest (using ‘prototype’) score is lower than pretest (using ‘current’). It can be said that the mapping of the prototype is not good enough as certain part of this application while having navigated or already been navigated, is not being differentiate by any element. It will create a difficulty to the user to know where they already accessed and where else they are not covered yet. Perhaps, by having a checklist in the page, it will help the user to know that matter.

### ***User interface Dimension 5 – Screen Design***

‘Screen Design’ is a particularly complex dimension of interactive programs that can be easily broken down into many sub-dimensions related to text, icons, graphics, color, and other visual aspects of interactive programs. A separate dimension has been defined to deal with the artistic aspects of interactive programs. The author defines ‘screen design’ as a dimension ranging from substantial violations of principles of screen design to general adherence to principles of screen design.

There are two problems with this dimension in which the first problem is the screen design principles have not kept up with the rapidly changing nature of interactive technology. Second, creative designers may sometimes intentionally violate screen design principles for effect or to otherwise focus the user attention. Nonetheless, the author think that there exists enough knowledge about the principles of screen design that people, particularly experienced designers, can make meaningful distinctions among poorly and well designed screens in interactive programs.

Criteria : Screen Design	
Pretest	Posttest
6.70	7.70

*Figure 10 : Average Score for Screen Design*

From the finding it shows that posttest (using ‘prototype’) score is higher than pretest (using ‘current’). This is because, the screen design for the ‘prototype’ including the usage of its color and the right use of font, help the screen to be lively. Moreover, from the users point of view, it can be concluded that the creativity in terms of arrangement and presentation also help in developing a good screen design.

### ***User interface Dimension 6 – Knowledge Space Compatibility***

‘Knowledge space’ refers to the network of concepts and relationships that compose the mental schema a user possesses about a given phenomena, topic or process. Subject

matter experts and/or designers of interactive programs are generally perceived as possessing an expert knowledge space with respect to the content included in the programs they create. This expertise usually is the basis for the structure of the knowledge or information presented in a program. Novice users, on the other hand, often an inadequate knowledge space with respect to the content of the program. The knowledge space of novices may be inadequate because of ignorance, misconceptions, or some blending of ignorance, misconceptions. When a novice user initiates a search for information in an interactive program, the interface should be powerful enough so that the user perceives the resulting information is compatible with his or her current knowledge space. If the information received is not perceived as relevant to the search strategies used by the user, the system will be perceived as incompatible.

Admittedly, this is a very difficult dimension to judge. However, if a user initiates a search for information about topic, e.g., the procedures for installing new software, the resulting information should seem compatible with that search once the information is thoroughly explored. If the information seems arbitrary or irrelevant to the search that was initiated, the knowledge space representation should be judged as incompatible.

Criteria : Knowledge Space Compatibility	
Pretest	Posttest
6.75	5.80

*Figure 11 : Average Score for Knowledge Space Compatibility*

From the finding it shows that posttest (using 'prototype') score is lower than pretest (using 'current'). It is because, the animation courseware doesn't include any way for search information thus making it difficult for the user to make quick search on certain occasion. Furthermore, most of the participants are either have a little knowledge or not aware of the actual concept of function. Thus this simple conclusion reveals that the user interface design for this application is not really helping in delivering the information, but rather more towards the appearance of the application.

### ***User interface Dimension 7 – Information Presentation***

The ‘Information Presentation’ dimension is concerned with whether the information contained in the knowledge space of an interactive program is presented in an understandable form. The most elegantly designed user interface for an interactive program is useless if the information it is intended to present is incomprehensible to the user. Certainly the user might be able to find all of the information about a subject, but whether the user could then comprehend, understand, or learn the information is another matter. In each case the information requisite for understanding may be present, but would probably be difficult if not impossible to comprehend. Information presentation is defined as a dimension ranging from obtuse to clear.

Criteria : Information Presentation	
Pretest	Posttest
7.0	7.05

*Figure 12 : Average Score for Information Presentation*

From the finding it shows that posttest (using ‘prototype’) score is higher than pretest (using ‘current’). Perhaps, this is due to the fact that it simply because of this application is beneficial in terms of delivering the information needed. However, the small different between the pretest and posttest might be caused by the information received from both application are actually the same.

### ***User interface Dimension 8 – Media Integration***

The most important aspect of the media integration dimension refers to how well an interactive program combines different media to produce an effective whole. Do the various media (text, graphics, audio, video, etc.) work together to form one cohesive program, or is the program a small combination of gratuitous media segments? Are the various media components necessary to the function of the program or would the program function equally as well without them? The media integration dimension is defined as ranging form uncoordinated to coordinated.

Criteria : Media Integration	
Pretest	Posttest
7.3	7.10

*Figure 13 : Average Score for Media Integration*

From the finding it shows that posttest (using ‘prototype’) score is lower than pretest (using ‘current’). Perhaps the limitation on the usage of video is the caused of having the score quite low compared to the pretest. However, it is understood that learning a C Language doesn’t need the help of video to better understand thus, the author just concentrating on animation only.

#### ***User interface Dimension 9 – Aesthetics***

‘Aesthetics’ refers to the artistic aspects of interactive programs in the sense of possessing beauty or elegance. In the aggregate sense, many people may praise the aesthetics of an automobile design or the elegance of a dress. However, in an individual sense, aesthetics are highly unique and one person’s sense of the beautiful may seem grotesque to another. It is described as the need to develop ‘connoisseurs’ in evaluation of education and training, just as we have connoisseurs in the arts. In turn, other people, perhaps less refined and less sensitive, may become more informed by ‘consuming’ the expert reviews provided by the connoisseurs. In the absence of such connoisseurs, the aesthetics dimension of the user interface of an interactive multimedia program is defined as ranging from displeasing to pleasing.

Criteria : Aesthetics	
Pretest	Posttest
6.75	6.55

*Figure 14 : Average Score for Aesthetics*

From the finding it shows that posttest (using ‘prototype’) score is lower than pretest (using ‘current’). Perhaps, it is because the ‘prototype’ is more on commercial value rather than esthetics.



### *User interface Dimension 10 – Overall Functionality*

“Overall Functionality” is an aspect of interactive multimedia programs related to the perceived utility of the program. The perceived functionality of an interactive program is obviously highly related to the intended use of the program. A given program may have multiple uses. Its overall functionality must be judged in relation to the specific intended use that exists in the mind of the users. It illustrates a dimension of the user interface programs that ranges from dysfunctional to highly functional.

Criteria : Overall Functionality	
Pretest	Posttest
6.85	7.15

*Figure 15 : Average Score for Overall Functionality*

From the finding it shows that posttest (using ‘prototype’) score is higher than pretest (using ‘current’). Although this application is in prototype model, but all the function and navigation flow are working well and the participants have no difficulty in dealing with it.

All of the questions have comments besides them to give the participants chances to give any suggestion and recommendation to the particular application. It is not rated since the participants can give any answer, which pleases them. This is important since these comments can be used to upgrade or modify the current application since the applications are for their use. The questionnaire also ensures confidentiality of the information provided by them since it will give rather unbiased answers. The data are gathered with sensitivity to the participants’ feelings and with respect to privacy.

## **4.2 Data analysis**

After collecting data from a representative sample of the population, the next step is to analyze them to test the research hypothesis. For our data analysis, we have used the Microsoft Excel program. This program allows both descriptive and inferential statistical analysis. Excellent graphs and charts can also be generated using Microsoft Excel.

To perform our data analysis, we will use descriptive statistics followed by inferential statistics. Descriptive statistics describe some of the characteristics of the distribution of scores we have collected, such as the average score on a variable or the variance within the variable. However, inferential statistics are analysis tools used to help us make decision about how the data we collect relates to our hypotheses and how these results might be generalizable to a larger number of subjects than those who were tested.

### **4.2.1 Descriptive Statistics**

The main analysis in descriptive statistics is the measure of central tendency and dispersion. The results in Table 3 were obtained using the Data Analysis Tool in Excel which calculates the mean, median, standard deviation, variance and many more. It shows these descriptive statistics for the total score of both the user of 'Prototype' which is with treatment and 'Current' which is without treatment.

The results seem to indicate that users with treatment have a mean of 6.15 in total score, , as compared to the users without treatment with only 5.25 . This shows that users with treatment tend to score higher compared to the users without treatment. The variances in the sample for user with treatment are also smaller if compared to the variance for the users without treatment.

Respondent	Total Score	
	With Treatment	Without Treatment
1	5	2
2	7	3
3	8	7
4	4	4
5	5	5
6	7	6
7	5	4
8	8	6
9	5	5
10	8	8
11	5	6
12	7	5
13	5	4
14	8	7
15	5	4
16	4	7
17	7	4
18	6	6
19	7	4
20	7	8
<b>Total Score</b>	<b>123</b>	<b>105</b>
<b>Mean</b>	<b>6.15</b>	<b>5.25</b>
<b>Median</b>	<b>6.5</b>	<b>5</b>
<b>Mode</b>	<b>5</b>	<b>4</b>
<b>Standard Deviation</b>	<b>1.386969434</b>	<b>1.650358813</b>
<b>Sample Variance</b>	<b>1.923684211</b>	<b>2.723684211</b>
<b>Kurtosis</b>	<b>-1.490179346</b>	<b>-0.660327031</b>
<b>Skewness</b>	<b>-0.033205946</b>	<b>0.024393271</b>
<b>Range</b>	<b>5</b>	<b>7</b>
<b>Min</b>	<b>4</b>	<b>2</b>
<b>Max</b>	<b>8</b>	<b>8</b>
<b>Sum</b>	<b>123</b>	<b>105</b>
<b>Count</b>	<b>20</b>	<b>20</b>
<b>Confidence Level (95%)</b>	<b>0.038895123</b>	<b>0.039114936</b>

**Table 3 : Output A**

#### **4.2.2 Inferential Statistic**

The next step of analysis is to infer the result findings from sample to a larger population form that the data were originally selected. The author will perform the t-test and the chi-square test to test the hypotheses that have been put forward earlier.

**Hypothesis 1: Use of t-Test**

Hypothesis 1 can be stated in the null and alternate form as follows:

**H1o:** There will be no difference between using ‘Current’ and ‘Prototype’ in understanding C Language lesson.

Statistically expressed : **H1o is  $\mu_C = \mu_P$**

**H1A:** There will be a difference between using ‘Current’ and ‘Prototype’ in understanding C Language lesson.

Statistically expressed: **H1A is  $\mu_C \neq \mu_P$**

t-Test: Two-Sample Assuming Unequal Variances

	Variable 1	Variable 2
Mean	6.15	5.25
Variance	1.923684211	2.723684211
Observations	20	20
Hypothesized Mean Difference	0	
df	38	
<b>t Stat</b>	<b>2.365726337</b>	
P(T<=t) one-tail	0.01067903	
t Critical one-tail	1.671553491	
P(T<=t) two-tail	0.02135806	
<b>t Critical two-tail</b>	<b>2.001715984</b>	

*Table 4 : Output B*

The results of the t-Test are shown in Table 4 Output B. The t-Test is used for two samples assuming unequal variance. The alternate hypothesis, H1A is **non-directional**. Therefore in this case, we will use the two-tail statistical test Figure 16.

The t value of 2.062 is significant (fell within the Ho rejection region on both tails), so the null hypothesis can be rejected. Thus, hypothesis 1 can be substantiated. There will be a significant difference between using ‘Current’ and ‘Prototype’ in understanding C Language lesson.

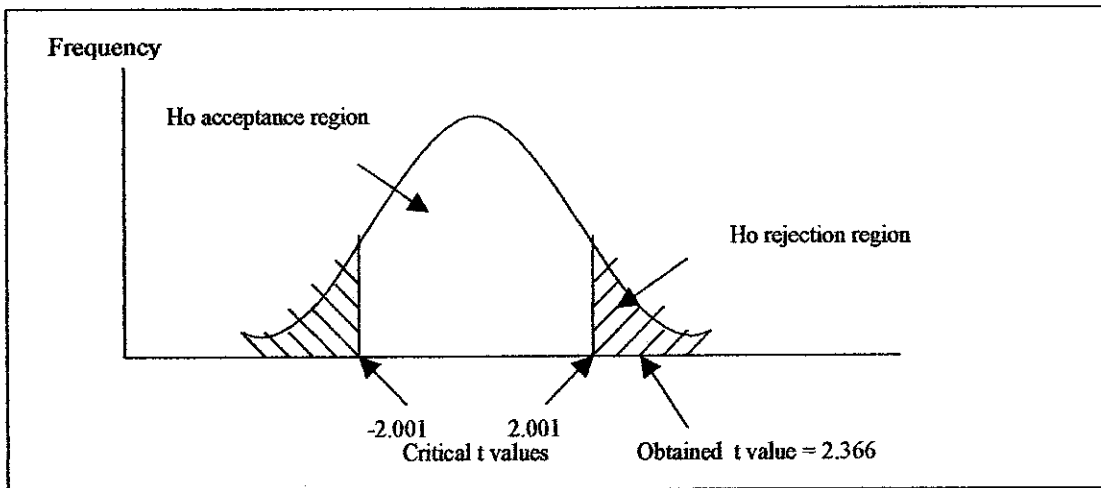


Figure 16 : Two-tailed statistical test for hypothesis 1

### Hypothesis 2: Use of t-Test

Hypothesis 2 can be stated in the null and alternate form as follows:

**H2o:** There will be no difference between using 'Current' and 'Prototype' in understanding C Language lesson.

Statistically expressed : **H2o is  $\mu_C = \mu_P$**

**H2a:** The performance level of users using 'Prototype' is higher compared to the performance level of users using 'Current'.

Statistically expressed : **H2a is  $\mu_P > \mu_C$**

t-Test: Two-Sample Assuming Unequal Variances

	Variable 1	Variable 2
Mean	10.1	8.966666667
Variance	3.334482759	3.550574713
Observations	30	30
Hypothesized Mean Difference	0	
df	58	
<b>t Stat</b>	<b>2.365726337</b>	
P(T<=t) one-tail	0.01067903	
<b>t Critical one-tail</b>	<b>1.671553491</b>	
P(T<=t) two-tail	0.02135806	
<b>t Critical two-tail</b>	<b>2.001715984</b>	

Table 5 : Output C

The results of the  $t$ -Test are shown in Table 5 Output C. The  $t$ -Test is used for two samples assuming unequal variance. The  $t$ -Test performed for Hypothesis 2 is the same with the  $t$ -Test performed on Hypothesis 1. However, the difference is that in Hypothesis 2, the alternate hypothesis,  $H_{2A}$  is **directional**. Therefore in this case, we will use the one-tail statistical test.

The  $t$  value of 2.062 is significant (higher than the  $t$  Critical one-tail value), so the null hypothesis can be rejected. Thus, hypothesis 2 can be substantiated. That is to say, that the performance level of users using 'Prototype' is higher than users using 'Current'.

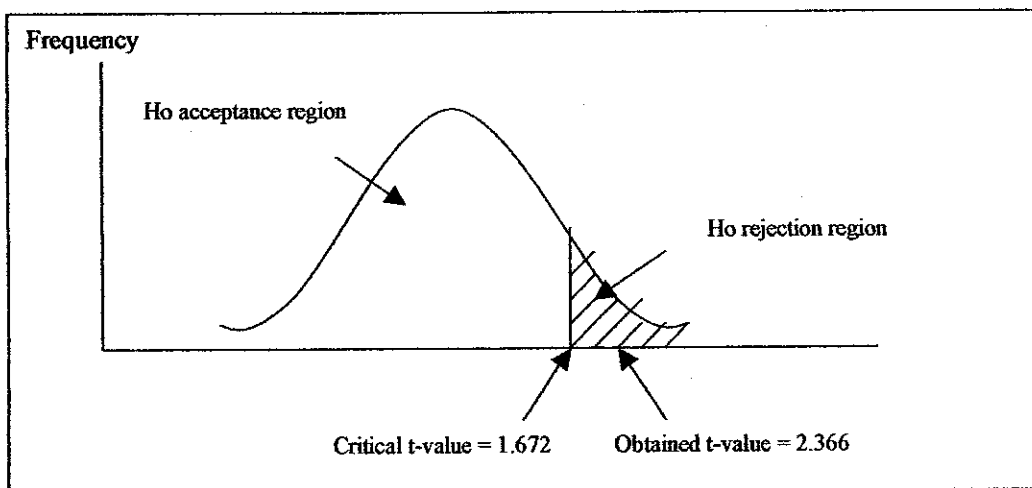


Figure 17 : One-tailed statistical test for hypothesis 2

### 4.3 Results from the Observation – Comments

From the author's observation during presentation to the lecturer and different group of audience, the author has received a warm appraisal from the audience who are mostly students from various majors.

Most of the comments given are encouraging and positive towards this project such as, 'It's nice and cute!', 'Good and interesting' and etc. This shows that this courseware is able to deliver the intended message to the targeted user which are the students of C

Language. However, there is some recommendation in order to improve this courseware that will be mentioned in the next chapter.

#### **4.4 The Prototype**

This section of report will present several selected print screens of the courseware Please refer to Appendix F to view the selected print screen that shows the integration of the C Language web page in the interactive multimedia application.

## CHAPTER 5

### CONCLUSION AND RECOMMENDATION

#### 5.1 Conclusion

Throughout this period, the author has understood on how the integration of multimedia and Programming lesson could be used by the student. All the elements of multimedia combined together producing learning or teaching material is totally different from an exercise book, which has nothing but only text and static pictures. Obviously, students are more attracted to learning environment throughout the interactive courseware since they feel involved in it. This new learning environment gives an opportunity to the student to view things in different ways. Hence, it would encourage them to think and build their interest in learning.

This courseware is a system that is fully required these days due to its fulfillment in interactive needs today. Living in a fast lane in the world today, this is very precious indeed. For people that are in the run, manual old-fashioned approach in big fuzz. Therefore, learning interactively can save time thus having understand the same as attending conventional classes, sometimes more.

Imagine you as a student, having a special tutor all by yourself without sharing the tutor with your other classmates. This tutor is able to interact with you and also check your understanding through examples and quizzes offered in the application. These special attentions could only be achieved through this tutorial system. This prove that the approach of this design has informational-based and also formal-based on the objectives and scope of this project.

The prototype of this courseware has been developed and need to be touch up to enhance its usability and improved the application. There is no problem in the development of the project as the flow of it is smooth and systematic.



For the research part, results acquired from the research have shown that the 'Prototype' brings better performance compared to the 'Current' in understanding C Language lesson. The main reason for the results is because the 'Prototype' has more multimedia elements and the integration of all elements are superbly arranged. With the availability of more elements, users could understand more of the lesson. The results also proved that the newly designed animation courseware have much greater advantage compared to the current application as shown from the experiment performed.

In the future, more research is needed to compromise with the latest technology on probably synchronizing or integrating the multimedia and web development thus eliminating another excessive hardware or software from the personal computer. Therefore there might be a better way of using the multimedia elements thus minimizing the side effect of using a conventional class in learning process.

## **5.2 Recommendation**

For the prototype, it is suggested to have more chapters in the future enhancement, not only focusing on function chapter. Also, the feature could be upgraded by trying to include more graphical interface to enhance the usability of this courseware. Furthermore, it is suggested to have more narration throughout the application so that user will feel lively.

Another recommendation is to provide multiple languages in the courseware such as Bahasa Melayu and Chinese to enhance the literacy of the user. Besides that it would be more interesting with the addition of games quizzes so that the user will feel like playing games while actually having a learning process.

For the research part, it could be enhanced by trying to include the test of chi-square. Also, it is better in the future to add more hypothesis so that the research would be more accurate and interesting.

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# **APPENDICES**

# C Language Tutorials

## Function

Function Parts

Function Prototype

Function Call

by value

by reference

Function Definition

Parameter Passing

Recursion

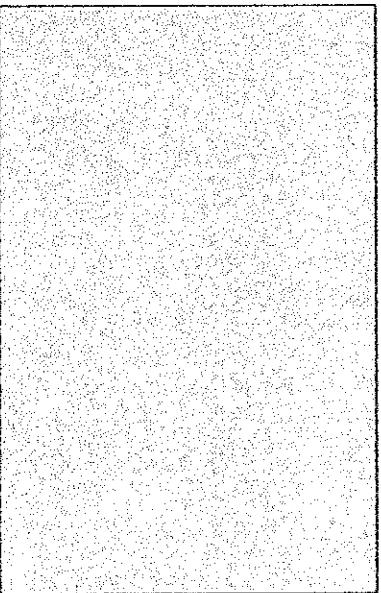
Examples

Quiz

Close

### Introduction to Function

Most computer programs that solve real world problems are much larger than the programs presented in the first few chapters. Experience has shown that best way to develop and maintain a large program is to construct it from smaller pieces or modules each of which is more manageable than the original program. The technique is called **divide and conquer**. Play the movie below to get the illustrated meaning of divide and conquer. This chapter describes the features of the C language that facilitate the design, implementation, operation and maintenance of large programs.



## Function

- ..... Function Parts
- ..... Function Prototype
- ..... Function Call
  - ..... by value
  - ..... by reference
- ..... Function Definition
- ..... Parameter Passing
- ..... Recursion
- ..... Examples
- ..... Quiz

Close

### Function Prototype

Function prototype tells the compiler the type of data returned by the function, the number of parameters the function expects to receive, the types of the parameter and the order in which these parameter are expected. The compiler uses function prototypes to validate function calls.  
Function prototype's format is:

***Data-type function-name (parameter-list);***

**P**arameter-list: contains type of all parameter that becomes input functions. Parameter name can be ignored.

In the above example, the function prototype is:

***float kira\_luas (int);***

**T**his function prototype states that kira\_luas takes one argument of type int, and returns a result of type float.

# C Language Tutorials

## Function

..... Function Parts

..... Function Prototype

..... Function Call

..... by value

..... by reference

..... Function Definition

..... Parameter Passing

..... Recursion

..... Examples

..... Quiz

Close

## Function Call

Below is a Function Call format:

***Function-name (parameter-list)***

***parameter-list***: parameter that is sent as input for function. List can be of an identifier and variable.

In the example given, the function call is:

***luas\_bulatan = kira\_luas (j);***

# C Language Tutorials

## Function

Function Parts

Function Prototype

Function Call

by value

by reference

Function Definition

Parameter Passing

Recursion

Examples

Quiz

Close

### Function Definition

The given example has a function definition of:

```
float kira_luas (int jejari)
{
    float luas;
    luas = (22.0/7.0) * jejari * jejari;
    return luas;
}
```

Format of a function definition is:

**Return-value-type function-name (parameter-list)**

```
{
    declarations
    statements
}
```



# C Language Tutorials

## Function

### Parameter Passing

Parameter for function that was called will be passed using value. This means value for the parameter is copied and passed to function. This is known as **Call by Value**. Any changes within formal parameter (parameter in function scope) wont bring any impact to the actual parameter (parameter from the calling place). A value can be returned as function name using the **return** statement. Function parameter can also bring back the value using **pointer**.

- ..... Function Parts
- ..... Function Prototype
- ..... Function Call
  - ..... by value
  - ..... by reference
- ..... Function Definition
- ..... Parameter Passing
- ..... Recursion
- ..... Examples
- ..... Quiz
- Close

# C Language Tutorials

## Function

Function Parts

Function Prototype

Function Call

by value

by reference

Function Definition

Parameter Passing

Recursion

Examples

Quiz

Close

## Recursion

C also lets users write recursion function. A recursive function is a function that calls itself either directly or indirectly through another function. 2 conditions that must be followed when writing a function are:

- Problem must be written in recursion form
- Must have a stop sign

The factorial of a nonnegative integer n, written n! (and pronounced "n factorial"), is the product

$$n*(n-1)*(n-2)*\dots*1$$

with 1! Equal to 1, and 0! Defined to be 1. for example, 5! Is the product 5\*4\*3\*2\*1, which is equal to 120.

# C Language Tutorials

## Function

- Function Parts
- Function Prototype
- Function Call
  - by value
  - by reference
- Function Definition
- Parameter Passing
- Recursion
- Examples
- Quiz
- Close

### Example 1

```
#include <stdio.h>

float kira_luas (int);

main ()
{
    luas1 = kira_luas(5);
    printf("%f.2", luas1);
    return 0;
}

float kira_luas (int jajar1)
{
    float luas;
    luas = (22/7)*jajar1*jajar1;
    return luas;
}
```

#### Output Screen

78.55

Explanation:

# C Language Tutorials

## Function

- ..... Function Parts
- ..... Function Prototype
- ..... Function Call
  - ..... by value
  - ..... by reference
- ..... Function Definition
- ..... Parameter Passing
- ..... Recursion
- ..... Examples
- ..... Quiz

Close

### Example 2

```
#include <stdio.h>

long factorial (long);

main()
{
  int i;
  for (i = 1; i <= 3; i++)
    printf ("%2d! = %10d\n", i, factorial (i));
  return 0;
}

long factorial (long numbers)
{
  if (number <= 1)
    return 1;
  else
    return (number * factorial (number - 1));
}
```



Output Screen

11 = 1

1 2 3

The example on the left shows how a recursion program is executed. Work out on the understanding as the output is given below.

# C Language Tutorials

## Function

- ..... Function Parts
- ..... Function Prototype
- ..... Function Call
  - ..... by value
  - ..... by reference
- ..... Function Definition
- ..... Parameter Passing
- ..... Recursion
- ..... Examples
- ..... Quiz

### C Programming

#### WEB TUTORIAL FOR C LANGUAGE: Functions

To run this test requires a JavaScript enabled browser

#### MULTIPLE CHOICE QUESTIONS

1. The function called *menu* which prints the text string "Menu choices", and does not pass any data back, and does not accept any data as parameters, looks like

function 1

```
void menu( void ) {
  printf("Menu choices");
}
```

function 2

```
int menu( void ) {
  printf("Menu choices");
}
```

function 3

Close



**APPENDIX D**  
**- RESEARCH FINDINGS**

[http://www.iota-six.com.uk/c/20\\_funct.htm](http://www.iota-six.com.uk/c/20_funct.htm)

**PRETEST**

Respondent	Criteria of Questionnaire									
	1	2	3	4	5	6	7	8	9	10
1	7	7	6	7	6	6	9	6	7	6
2	6	6	7	7	6	7	6	8	7	6
3	8	7	6	7	5	6	7	8	6	7
4	7	7	6	6	6	6	8	7	7	6
5	7	7	7	7	7	7	7	6	7	6
6	6	6	7	7	7	6	6	7	8	7
7	7	6	6	7	6	6	7	8	7	7
8	6	8	8	8	7	7	8	8	7	6
9	5	7	7	7	7	8	7	8	6	7
10	8	7	7	8	7	6	6	7	6	7
11	9	8	8	8	8	7	7	7	6	8
12	8	7	8	7	5	7	8	8	5	7
13	8	7	7	8	7	8	7	7	7	7
14	7	6	5	8	7	7	8	7	8	8
15	8	5	6	7	8	7	7	8	7	7
16	7	6	6	8	7	8	6	8	7	7
17	6	7	7	8	7	7	6	6	8	6
18	8	7	6	8	7	6	7	7	6	7
19	8	8	7	7	8	6	6	8	7	7
20	7	8	8	6	6	7	7	7	6	8
Average Score	7.15	6.85	6.75	7.3	6.7	6.75	7	7.3	6.75	6.85

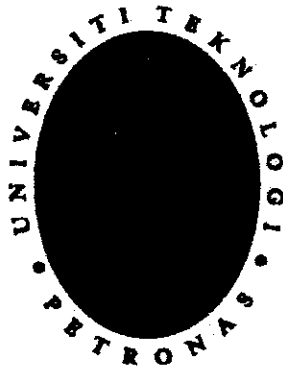
**Interactive Web Tutorial for C Language**

**POSTTEST**

Respondent	Criteria of Questionnaire									
	1	2	3	4	5	6	7	8	9	10
1	9	8	8	8	7	6	7	7	7	7
2	8	9	9	8	8	7	8	6	6	8
3	9	8	8	6	7	6	7	8	6	7
4	8	7	7	6	8	5	7	8	6	8
5	7	8	8	6	8	7	8	7	7	8
6	8	9	9	6	7	7	7	6	7	7
7	7	8	8	8	7	5	6	7	7	8
8	6	7	7	7	8	5	7	7	6	7
9	7	8	8	8	8	7	8	7	7	7
10	8	8	9	8	9	6	7	8	7	6
11	7	9	8	6	9	5	8	7	6	7
12	8	8	7	6	8	5	7	7	7	7
13	7	9	8	7	7	5	8	8	6	8
14	7	8	8	8	7	5	7	8	7	8
15	8	7	7	8	8	6	6	7	7	7
16	8	8	8	8	7	5	6	7	5	6
17	8	7	9	7	8	5	7	6	7	7
18	7	8	8	7	6	8	6	6	8	6
19	8	8	7	6	8	5	7	7	5	8
20	9	8	8	6	9	5	7	8	7	6
Average Score	7.7	8	7.95	7	7.7	5.75	7.05	7.1	6.55	7.15

**APPENDIX A**  
**- QUESTIONNAIRE**





## **Questionnaire on the Current Application**

University Technology Petronas,  
31750 Tronoh, Perak.

November 2004

**PRE-TEST**

---

Dear Participant,

This questionnaire is designed to study on acceptance of the current application which is [http://www.iota-six.com.uk/c/20\\_funct.htm](http://www.iota-six.com.uk/c/20_funct.htm). The information you provide will help us better understands for what is happening in the situation. Because you are the one who can give us a correct picture of how experience your work life, I request you to respond to the questions frankly and honestly.

Your response will be *kept strictly confidential*. Only members of the research team will have access to the information you give.

Thank you very much for your time and cooperation. We greatly appreciate your helping furthering this research endeavor.

---



**Questionnaire on the Prototype**

University Technology Petronas,  
31750 Tronoh, Perak.

November 2004

**POSTTEST**

---

Dear Participant,

This questionnaire is designed to study on acceptance of the current application which is Interactive Web Tutorial for C Language. The information you provide will help us better understands for what is happening in the situation. Because you are the one who can give us a correct picture of how experience your work life, I request you to respond to the questions frankly and honestly.

Your response will be *kept strictly confidential*. Only members of the research team will have access to the information you give.

Thank you very much for your time and cooperation. We greatly appreciate your helping furthering this research endeavor.

---

**Project Title: Animation Courseware as a Learning Aids for C Language**  
**Student: A Feasibility Study of Psychological Impact on Multimedia Application.**

### Questionnaire

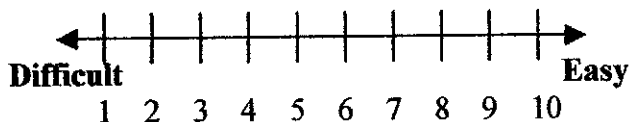
*Questionnaire produced by Alxy-Reen Awaludin, Information Technology (IT) Final Year Student of Universiti Teknologi PETRONAS, Tronoh, Perak regarding the Final Year Project*

#### **Abstract:**

This questionnaire is prepared for research purposes entitled *“The Suitability of Multimedia Component Combinations Towards Effective Learning”*. The target audiences are students from different background of studies. This questionnaire is used to collect and gather information, opinion and feedback for the research work.

#### **1) Ease of use**

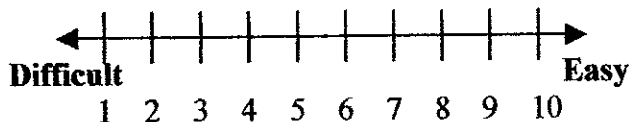
*- Concerned with the perceived facility with which a user interacts with this interactive program.*



Comments:

#### **2) Navigation**

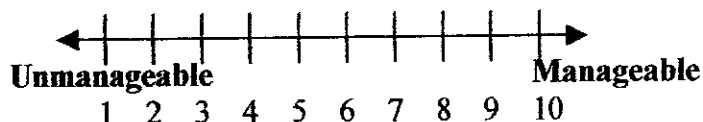
*- Concerned with the perceived ability to move through the contents of an interactive program in an intentional manner.*



Comments:

#### **3) Cognitive Load**

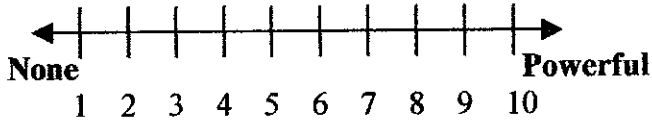
*- Concerned with the user interface whether it is confusing (unmanageable) or intuitive (easily manageable).*



Comments:

**4) Mapping**

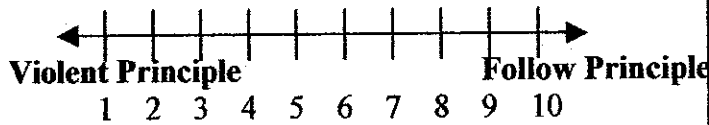
- Refers to the program's ability to track and graphically represent to the user his/her path through the program.



Comments:

**5) Screen Design**

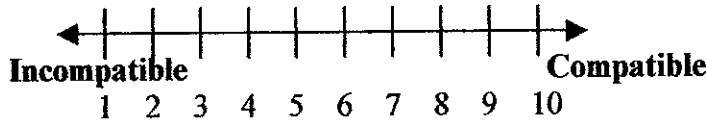
- Particularly complex dimension of interactive programs that related to text, icons, graphics, color, and other visual aspects of interactive programs.



Comments:

**6) Knowledge Space Compatibility**

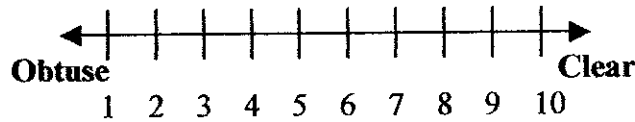
- Refers to the network of concepts and relationships that compose the mental schema a user possesses about given phenomena, topic or process.



Comments:

**7) Information Presentation**

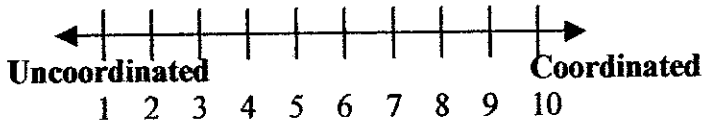
- Concerned with whether the information contained in the knowledge space of an interactive program is presented in an understandable form.



Comments:

**8) Media Integration**

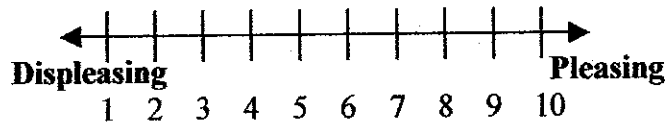
- Refers to how well an interactive program combines different media (text, graphics, audio, video, etc.) to produce an effective whole.



Comments:

**9) Aesthetic**

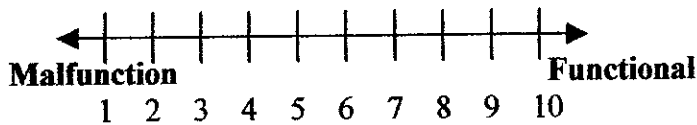
- Refers to the artistic aspects of interactive programs in the sense of possessing beauty or elegance.



Comments:

**10) Overall Functionality**

- Aspect of interactive multimedia programs related to the perceived utility of the program.



Comments:

**11) Please comment the feasibility of the text provided in this Application, with respect to its usefulness in delivering the message.**

**APPENDIX B**  
**- ARTICLE**

# Best practices in e-learning environment

NST Computimes  
Monday 2 Sept 02

By CHANDRA DEVI  
chandra@nstp.com.my

**T**HE Government, through the Education Ministry, has been urged to look into measures to ensure that student-centred learning remains at the heart of a technology-driven education.

These include building a strong telecommunications network and Web-based portal based on open standards to enable electronic learning to take place in schools, and to facilitate teaching.

Sun Microsystems Inc's vice president of global education and research line of business Kim Jones said by doing so, the Ministry could make available content and put together best practices lesson plans, activities, discussion groups, educational applications for students, electronic mail (e-mail) for communications and online tutorials, among others, to all schools in the country.

"By implementing and providing an efficient Web-based learning system, teachers can focus on what they do best - help students learn," she said in Kuala Lumpur last week.

According to Jones, with the advent of the Internet, the Ministry would be able to use the multimedia-based learning and teaching approach, which can help check the declining interest on science and maths subjects in schools and universities.

"Introducing multimedia-based teaching at all levels for these subjects will change the perception about these subjects. With multimedia, the classroom is transformed into



**Jones:** A nationwide Web-based learning system for schools.

a dimension of sight, sound and mind, and made more exciting for students," she said.

"For example, students in a science class can view materials customised for their class with the added advantage of interactivity. They can view the formation of a certain thing or turn objects to any angle to get a better view or click on particular parts of the presented information to get more details."

Jones said besides the interactivity in multimedia-based learning, it could also address different learner capabilities, thus enabling children of various learning abilities to learn at their pace.

"Unlike in the traditional classroom teaching, technology mediated learning provides the means to customise the curriculum for different learner levels," she said.

"We can address the need of the weak and advanced students, hence continuing to encourage their interest in it."

**APPENDIX C**  
**- PRINT SCREEN**