

## **E-Learning Navigation Model Based on Student's Learning Behavior: Case Study in UUM**

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### **Abstract**

*The purpose of this study is about student behavior pattern in using E-learning portal for learning process. Different students will use different way to go to their desired page in searching and finding the content they needed. Some students need to spend time by going page by page in finding the appropriate page. This behavior in using E-learning portal will lead to inefficiency and not practical system when doing teaching and learning process. Thus, the objective of this project is to study and determine the student behavior pattern when using E-learning portal and then develop a conceptual model by using navigation techniques for E-learning system. The result is expected to give a better solution when students use the proposed system in the learning process.*

**Keywords:** E-learning, navigation, student behavior pattern

### **1.0 Introduction**

The field of information and communication technology (ICT) has undergone rapid development these days. On the 21<sup>st</sup> era, various discoveries, inventions and improvements in information system have been done to make the ICT more competitive and effective in the world. In the 21<sup>st</sup> century, the development of ICT has a positive impact on our daily life, such as E-learning, E-business, E-ticketing, online shopping and other aspect. Nowadays, Information sharing has become faster among the people through the internet such as e-mail and news. In the modern era of globalization, ICT plays a vital role to the world economic growth. ICT is used extensively in many organizations such as educational institutions, business application and also government sector. ICT tools are facilitating in organization management, administration and also educate people in the society. It should be disseminated among each other through the process of learning, sharing and also discovery. Therefore, ICT can become useful as a medium to make all processes more effective and efficient. One of faster way for sharing information nowadays is called electronic learning or E-learning. According to Clark (2002), E-learning is very visible, easily to see and hear all element and also more accessible instructional environment. This will give more freedom for people to learn fast as well as share knowledge via online.

Malaysia as a developing country has set a target of year 2020 to achieve the developed nation status. One of efforts to become a fully developed nation is the creation of the Multimedia Super Corridor (MSC). Malaysia has put a virtual learning as a one of the nation's flagship which later will produce professionals and human resources skills in information technology. In Malaysia, the tools of E-learning in education started when local universities offer diploma courses and degree programs through distance education (Balwi & Koharuddin, 2012). Actually, distance education systems performed remotely enable the process of teaching and learning occurs without the constraints of time, place and space of learning through the use of various electronic media. E-learning stated in the development of E-learning at present concerned with the delivery method is more effective and attractive. Recently, the most tools for E-learning that has been used are based on learning management tools such as Moodle, Blackboard, ATutor and dotLRN. Some of these tools are open source software and its offers an integrated support system for a wide range of activities in the E-learning process. The use of the latest approach in modeling the E-learning is needed to facilitate the process of searching and navigation in order to reduce time allocation. Thus, in this project, the study is focused on navigation model. This model will be used toward students to study how the navigation model influences their learning behavior.

In line with the objective of establishing educational institutions in Malaysia to be known through the world, a holistic approach is needed. Use of E-learning technology is one effort to simplify the way teaching and learning by giving a conducive environment for students to study not only in the classroom and also for lecture in preparing the material for teaching. Despite the current trend of using E-learning by many organizations to prepare their learning and teaching environment, E-learning has been involved in some issues that not meet the user requirement and sometimes user also lack in computer skills. According to Wong (2007), users or learners face some limitation on physical interactions among themselves in E-learning.

According to Evan and Hasse (2001) and Wong (2007) that learners are moderately lacking in computer proficiency and since E-learning is centered around computer technologies, it is barrier to those learners without computer skills. To overcome this problem, instructors are needed to guide learners. While instructor guide the learners how to use computer inappropriate way, it also required some effort from user to learn how to use the computer and also applications in the computer. In additional, E-learning website need to have a good and well managed user interface. This is done by providing user friendly for web interface with good navigation for user to understand the website and its content easily. Therefore, this project will also explore and study some user interface issues with navigation styles. The study will focus on the approach that have been used by user especially students in universities.

### **Navigation Model Based On Behavior Pattern**

E-learning as we know is a medium to disseminate the information and knowledge. The improvement of learning and teaching styles through electronic learning give a prediction for online learning developers to develop a better structural body of website and also the fastest way to deliver the content. For that purpose, there are a few studies have been done to determine the patterns of user behavior during web browsing. This is done by studying user behavior pattern when they navigate through the website. Herder and Juvina (2004) has found in Pirolli and Card (1999) which stated in their research's that several approaches for modeling web navigation was inspired by the information foraging theory. Based on this theory, cognitive model was developed.

Information foraging theory is an approach to understand how strategies and technologies for information seeking, gathering and consumption are adapted to the flux of information in the environment (Pirolli, Fu, Chi, & Farahat, 2005). This theory will give advantages for the user to change the navigational structure or of the website environment to maximize the seeking valuable information. When applied this strategy, the user will have more capabilities to search more valuable information from short distance browsing rather than wasting their time to find the desired content and also improving the performance of the system itself. To support this theory, cognitive model has been developed. Cognitive models assumes that selecting of user's actions are determine by utility assessments such as link labels and make predictions about distal related content (Herder & Juvina, 2004). The user assessments later will be used to stimulate the navigation behavior of real user in term of producing the same navigation patterns as actual user would do (Juvina & van Oostendorp, 2008).

Every person who uses the website have different styles of browsing. Individual differences, ranging from gender differences through system experience to cognitive styles, significantly influence the way that people navigate through hypermedia systems (Herder & Juvina, 2004). In effort to understand the people styles of browsing, the navigation approach will be used to identify the pattern of user behavior and provide users with adaptive navigation support based on user's navigation styles (Herder & Juvina, 2004). Thus, this definition is adopted in this study to determine the interaction pattern among UUM students in using e-learning system. From literature, there are some techniques that have been used to determine and predict the users' behavior pattern for next page requests and all collected data has been used to develop a navigation model. The data collected through server browser logs, user profiles, user sessions, user transactions, cookies, bookmark data and many other ways. There are some browsing capture techniques and approaches for predicting and analyzing user behavior patterns. The purposed models that have been developed by researchers are such as hypertext model, Relational Markov model and Markov chain models. All these techniques and approaches are an essential step to developing better websites that has good navigation structure based on user behavior pattern and also in providing and improving the quality of electronic services itself.

### **2.0 Motivation of the Study**

There are differences between user behavior patterns in using web navigation. It either influences in the graphical user interface design or navigational structure design.

Basically, user who has more experiences or expert in using computer knows how to navigate through the website and tend to use of a non-linear structure when navigate while user who lack of experience tend to navigate linearly (Herder & Juvina, 2004). Moreover, Juvina and van Oostendorp (2008) was stated in their research that typical usability was found to be a major problem. Typical usability problem has been discussed by Herder and Juvina (2004) in their research as a problem that user become disoriented or lost in website, user are unable to track of their positions and more worst they might not know where they navigate are, how they come to that page or where they can go to. This is because some website will provide many pages with a lot of links for users to navigate. User needs to choose the appropriate link to navigate to the desired page. Refer to this problem, Ch (2010) has explain that link prediction and path analysis are one of important problem with a wide range of applications ranging from personalization to websites. Both problems above were related to usability problems which have been discussed before. The problems mentioned above will result in users do not want to use a web application for purposes such as learning and teaching.

Referring to the problems mentioned in above, the same problem also happened for E-learning website. Basically, students come from different backgrounds of education and some of them might not have any computer skills or information technology (IT) background. This will give some barriers and difficulties for them when using E-learning website (Wang, Wang, Huang, & Jiao, 2010). Thus for this project, the main problem is how to structure and design the simplest and easier path or link for student to navigate to their desired page or seeking valuable information. Based on to state problem and also previous research, this project will try to overcome that problem by studying and determine the student behavior pattern when browsing an E-learning website. After determining the style and pattern of student navigation pattern, the development of a conceptual model for E-learning will be done. This E-learning website will develop using some navigation structure techniques to support the problem stated above. This project will use UUM Learning zone portal to study the student behavior pattern of using the website and then all gathered data will be used to assist in developing the conceptual model of E-learning website.

The objectives of this study will be based on the problem stated above. As for the main objective, this project is to design and develop a navigation prototype for an E-learning system which applies the structure of navigation approach. In doing so, the sub objectives to accomplish are obtain student navigation session in accessing e-learning system, identify the pattern of trails in using e-learning system and develop a navigation system that facilitate searching e-learning materials. However, for this project, the system development will be based on previous e-learning website to enhance functionality and some modification to the interface. The study is conducted only in UUM and will use UUM Learning Zone portal as indicated for this project and UUM student as a sample for data and information gathering. Also in this project, the 30 respondents will be selected from UUM student who are under the School of Computing. More specify, only students who register in Master of IT or ICT programmed will be selected for observation and interview session. All data and information gathered in this project is expected to help for better understanding about student behavior pattern when use E-learning portal for the learning process.

### **3.0 Literature Review**

E-learning was started in 1984 when George Orwell found the computer-based training system or CBT System. The vision to use CBT as a trainer for computer professional was come from Bill McCabe, an Irish entrepreneur (Cross, 2004). His vision was failed due to lack of support from computer vendor and also nobody want to learn. Despite the failure, Lotus Note appeared to become the first company to use CBT System. In mid-1980s, CD-ROM was introduced and become new training technology. After that, many companies in the world tend to use CD-based training because its lower cost from paid to instructors (Cross, 2004). In 1998, Greg Priest who has become CEO companies of CBT System was changed the method that used before. He has converted the delivery system through the CD to a web-based system. Then the system was implemented in the Unisys and has managed to increase its revenue 10 million a year. The systems helped UNISYS to provide a personalized learning portal, tracking systems, online newsletters and also discussions groups (Cross, 2004). After UNISYS tremendous success, Greg has announced to his community to make some transformation for their companies. He has changed the CBT System to new name called SmartForce which become the E-learning company. Start from here, E-learning began known and used worldwide (Cross, 2004). Before the advent of the era of E-learning, many organizations and educational institutions have been used traditional system or manual which is based on ink and paper. However, this method has many problems, particularly the problem of loss or damage.

For instance, a file that contains staff records will probably fade and lose color lettering or destroyed when stored too long. It needs similar to lecturers or teachers to bring all of the material to the class. When E-learning is introduced, many organizations and educational institutions began to use it. It is an alternative way to the existing system since all the functions available in the E-learning easy to use and also have all hardware such as computer to access to the internet. For organization such as business companies, the implementations of E-learning give a great advantage in preparing the employees for their jobs. This will assist companies in providing the training and learning session as well as faster access to materials. Educational institutions such as schools and universities also have applied E-learning although not completely. Many schools, particularly rural areas still use manual methods due to the lack of adequate equipment. For the university, it can be said that most of them use E-learning part of teaching and learning.

The education system has evolved rapidly along with the development of technology and economy. It placed greater demands on education systems. The crucial need for students is to focus on the importance of lifelong learning which is to upgrade their knowledge and skills. It also involves the critical thinking, creativity and innovation to adapt the challenge of the globalization. Apart from this, a new learning and teaching method has been introduced in era of ICT, called electronic learning or E-learning. This system is viewed as a tool which provides opportunities for marginalized and disadvantages students or those who are unable to attend to classes due to physical, social or economic constraints (Appana, 2008). A wider range of students can be reached anytime and anywhere provided that an Internet connection is available, thus increasing the number of students who have access to the education system. Besides the effective and flexibility of E-learning, many literatures indicate that online learning or distance learning can improve quality of learning, prepares students for better knowledge-based society, provides lifelong learning opportunities and supports critical thinking skills, problem solving, communication and interaction (Appana, 2008).

### **3.1 Traditional Learning Approach**

As we know, traditional learning has been done for many years until new approach introduced. It has been used by teachers in teaching and learning process in places such as a hall, classroom or labs. For this purpose, the students would be gathered together in a classroom or labs for easy knowledge sharing and delivery. This approach has been practiced at every level of educational intuitions such as school, colleges and universities. The traditional method is similar to any other method and has its own advantages and disadvantages depend on method of what have been practiced by people. Guralnick (2006) has been listed the advantages and disadvantages of traditional learning. The advantages of learning are immediate feedback, being familiar to both instructors and students, motivating students and cultivation of a social community. While disadvantages are instructor is centralized in teaching and learning, there are lots of time and location constraints and quite expensive to deliver because of material cost such as papers.

Traditional learning depends on face to face interaction among students and between students and teacher (Francescato et al., 2006). This behavior will enable students to interact with teacher for questioning and answering session. Besides that, student can meet with others students to make groups and then create a social network. Teachers sometimes provide a space and time for students to ask the questions or opinion about the something that they not understand. According to Hay, Hodgkinson, Peltier, and Drago (2004), most of teacher and instructors provide offices for students to stop by and chat, discuss problems and their concerns.

Traditional learning methods also give influence in students' performance. The students' performance is affected by the number of students in the classroom. This factor has been studied by many researchers. In 1960, Chant Royal Commission on Education in Columbia reported that the size of the public school classrooms and teacher ratios were referred to in a number of briefings that invariably supported the view that class sizes should be reduced (Robertson, 2005). For examples, the class sizes of 20 students are more practical in delivery the knowledge rather than 40 students. This is because teacher can have more control over the small size of student and also student can give more attention when teaching process is done. The other weaknesses of traditional learning are that the students need to travel to institutions a few days a week and this even take much time (Robertson, 2005). Moreover, sometime there is no need to travel and waste the time for a little question. Thus, to overcome this problem and issues, the new approach is needed. Electronic learning or E-learning is one of new solution that can make learning and teaching process more interesting, efficient, reliable and comprehensive.

### **3.2 Modern Learning Approach – E-Learning**

The increasing of the internet usage from day by day are giving a lot of impact on daily live especially on delivering the knowledge and information. Thus, in education system, it has been created, a new model of learning and teaching process to make education more interesting instead of giving directly notes for students to write and lecturing the student. The new model of learning is called electronic learning or E-learning has been introduced. E-learning has been opened in a new era of teaching and learning process. New technology has been introduced to support the expanding of E-learning. This has given a lot of opportunities for many companies related to IT field to develop many educational materials. According to Tastle, White, and Shackleton (2005), the purposes of study and education E-learning refers to the delivery of educational material via any electronic media such as CDs, internet, extranet, intranet, audio or video, satellite broadcast and also computer-based training. Currently, many organizations and educational institutions use this model of learning based on the advantages that E-learning provided. The most important advantages of this learning model are students or teacher can access the programs anywhere at any time. These models give more benefits rather than the traditional learning model which is need students and teachers at the same location and at that time.

Besides that, E-learning is known to be associated with Web-Based Training (WBT). This is different from World Wide Web (WWW) which is a part of the web on the internet. According to Naber and Köhle (2006), reducing E-learning to WBT would leave out a large number useful Internet services especially in the communication and broadcasting. Although E-learning is spread widely in education system, it is still many online learning was designed badly. Some are little more than electronic versions of paper-based materials. Lass, Morzuch, and Rogers (2007) stated that overall reputation of online courses is not good and the exception of well-designed course that effectively teach a topic to its target students is high. The importance of learning courses for students come from its indecency to the time and not bound to locate. Furthermore, the numbers of students in virtual classrooms is not an issue since E-learning courses are based on student oriented compared to traditional learning courses that are instructor oriented. Hay et al. (2004) has found in Vygotsky (1978) statement, that interaction has been proposed as one of the key parts of any learning experience. The studies online learning indicated that dissatisfaction with online courses resulting from feelings of isolation and lack of interaction with students and teachers (Hay et al., 2004).

### **3.3 E-Learning With Navigation Support**

The rapidity of E-learning development have given impact to many organizations in choosing the best variety of E-learning website to solve their problem in learning and teaching process. The right selection will give more advantages to that organization to run the operation smoothly with efficiency and effectiveness. According to Kapp (2003), the selection of E-learning website need to consider this five characteristics which are maintainability, compatibility, usability, modularity, and accessibility. These five criteria will be as an indicator for successfully implementing. For this study, emphasize will be given to the usability criteria because navigation is part of the usability characteristic.

Usability is one of the important characteristic in selecting the E-learning website. It relates to how users can use the website in easy way. Again, Kapp (2003) has explain in his article that the important thing that need to be assured in E-learning solution is easy to use. This is important because if technology is seen as cumbersome or difficult to navigate, the potential learners or instructors will never use it because the E-learning website should be easy to find the help menu, easy to move from one section of the course to another, and easy to have communications with the instructor (Kapp, 2003). A discussion about E-learning usability issues has been discusses in Ardito et al. (2004) research. According to Ardito et al. (2004), interfaces ought to concentrate on learners' needs and goals, providing a clear idea of content organization and system functionalities, simple navigation, advanced personalization of paths and processes. Those entire things above need to be defined and included when in analyzing the user requirements, designing the function and interface and also developing the website for E-learning.

From two statements above, we can define that navigation is one of the most thing that need to be emphasize in designing and developing the E-learning website. Reyna (2009) in his article mentioned that navigation is a crucial factor to take into account when we design E-learning sites. The opportunity for fluid movement within your site encourages visitors to explore it in its entirety whereas poorly designed navigation leaves them stuck and spinning around in circles (Reyna, 2009). Without proper navigation support, user cannot do learning process because they do not know what page they need to go.

To design the navigation that meets user requirements, the study of user behavior when browsing the website are needed. According to Bousbia, Rebaï, Labat, and Balla (2010), there are four types of learners' navigation behavior:

- **Overviewing:** this value is close to the Canter "scanning" value. It implies that the learner is covering a large proportion of pages constituting the course. Through this fast reading, the user seeks to acquire an overall "panoramic" view of the course.
- **Studying:** corresponds to a partial or complete reading of the course pages, with a span of time on each.
- **Deepening:** is rather close to the preceding value. It describes a learner who remains a relatively long time on a course, careful with details, and seeking Web documents related to the course topics.
- **Flitting:** close to the Canter "wandering" value. It is a journey without a strategy or a particular goal. The main difference with the overviewing type is the lack of focusing on the course.

Those types of navigation behaviors above was identified by authors as an indicator which has high level of indicator, qualitative, derived from low and intermediate indicators Bousbia et al. (2010). Besides that, from user behavior we can define and predict the style of navigation that user does and where there will go. Herder and Juvina (2004) has found two navigation styles that used by user which called flimsy navigation and laborious navigation. This style performed well in predicting the user's navigation styles. Understanding more user navigation styles and pattern will give better design for E-learning website in the future instead of allowing the services provider to customize and adapt the site's interface for the individual user and also to improve the site's static structure within the underlying hypertext system (Borges & Levene, 2000).

### **3.4 Behavior Pattern Based on Adaptive Navigation Support**

There are many related researches adapt the modeling of user's navigation behavior in effort to provide adaptive navigation support in web applications (Herder & Juvina, 2004). Adaptation of navigation give student more advantages in personalized their views in the E-learning web pages. According Esichaikul, Lamnoi, and Bechter (2011) which they cited from Mödritscher, Garcia Barrios, and Gütl (2004), the adaptive navigation is the navigations or links that are presented within pages can be adapted to achieve several adaptation goals by providing adaptive navigation methods. These methods will help user by manage the personalized views in the web pages.

Before adaptive navigation can be applied, studies about user navigation style need to be done. In order to get data about user behavior pattern when navigate through a website, some techniques have been adopted by researchers in their research such as data mining techniques to collect the data and information. This can be seen from many researches that have been done. According to Herder and Juvina (2004), a dynamic user navigation model should consist syntactic information, semantic information and pragmatic information. Syntactic information is related to link that user followed, what does the navigation graph look like and user time spending on each page, semantic information consists of the meaning of information that the user encountered during navigation and pragmatic information related to what user using the information for and what are the users' goals and task.

To get the pattern of users' behavior, some techniques have been used by researchers. According to Gündüz and Ozsu (2002), the most common used techniques to predict the user behavior are sequential patterns, association rules and Markov models. All the techniques will work for website that does not have a complex structure but when experiment on complex sites with highly interconnected sites show that the storage space and runtime requirements of these techniques increase due to the large number of patterns for sequential pattern and association rules and also a large number of states for Markov models (Gündüz & Ozsu, 2002). Thus, to avoid from such thing above, Gündüz and Ozsu (2002) has uses only visiting time and visiting frequencies of pages without considering the access order of page requests in user sessions (Gündüz & Ozsu, 2002). In Ch (2010) paper, Markov Chains has been used for his research to develop a technique called grey relational pattern analysis and after that purposed a Grey Clustering algorithms for Sequential Data. This algorithm was purposed to find a group of data which is mining of web log data.

Another models is Hypertext Probabilistic Grammars (HPG) models, that purposed by Borges and Levene (2000) to capture user preferences when navigating through the web. According to them, HPG is a probabilistic regular grammar which has a one-to-one mapping between the set of non-terminal symbols and set of terminal symbols. Each of non-terminal symbols corresponds to a web page and a production rule corresponds to a link between pages (Borges & Levene, 2000). Figure 1 below show the example how different user use different trail when navigate. This trail can be used to predict user navigation style.

Session ID	User trail
1	$A_1 \rightarrow A_2 \rightarrow A_3 \rightarrow A_4$
2	$A_1 \rightarrow A_5 \rightarrow A_3 \rightarrow A_1 \rightarrow A_1$
3	$A_5 \rightarrow A_2 \rightarrow A_4 \rightarrow A_5$
4	$A_5 \rightarrow A_2 \rightarrow A_3$
5	$A_5 \rightarrow A_2 \rightarrow A_3 \rightarrow A_5$
6	$A_4 \rightarrow A_1 \rightarrow A_5 \rightarrow A_3$

Figure 1. An exampleset of user’s trails

HPG model has some advantages which stated in their paper as compact, self-contained, coherent and based on the well-established work in probabilistic grammars. However, this model depends on the size of web site being analyzed and not on the amount of data collected. Anderson, Domingos, and Weld (2002) in their research has purposes Relational Markov models (RMMs) which are able to predict user behavior when navigate through web-site and also capable to predict even in websites that user has never visited before. In this research, author has applied the PROTEUS architectures which can effectively learning possible in domains with very large and heterogeneous state spaces (Anderson et al., 2002). The prediction of the user behavior in this model was done by PROTEUS architecture with automatically personalized the web sites for individual visitors. Those models and method above were used by researcher to capture data and predict the behavior of website users. Figure 2 below shows the use of technology, student behavior, user session, courses, and web-based system to modeled the navigation model and then develop a personalized system.

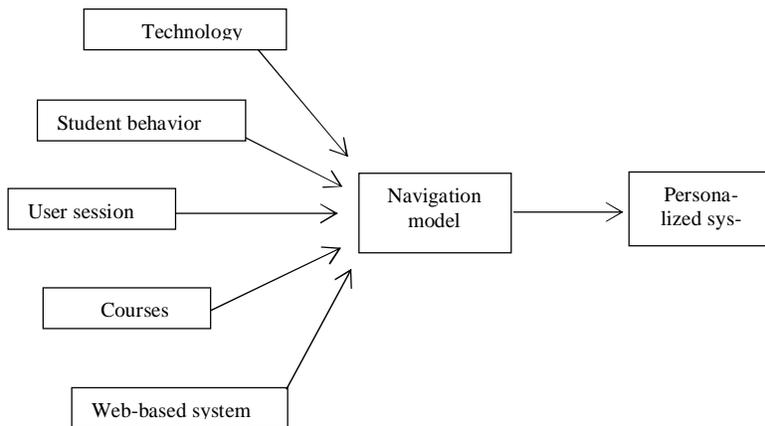


Figure 2. Navigation Model Design

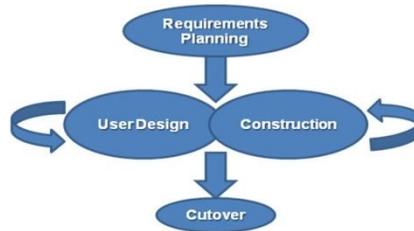
#### 4.0 Methodology

##### 4.1 Introduction

This section will describe Rapid Application Development (RAD). The UUM Learning Zone portal will be used to gather the data and information about student behavior when use for learning process. This methodology is different form another methodology because the fast way to gather information and develop the project rather than other methodology(Inc, 2000). RAD takes advantage of automated tools and techniques to restructure the process of building information systems. This process, extrapolated to the entire project, results in a profound transformation of information systems development. RAD replaces hand-design and coding processes, which are dependent upon the skills of isolated individuals, with automated design and coding, which is an inherently more stable process. RAD may give this project its first real basis for continuous improvement. In addition to being more stable, Rapid Application Development is a more capable process, as it is much faster and less error prone due to shorter time.

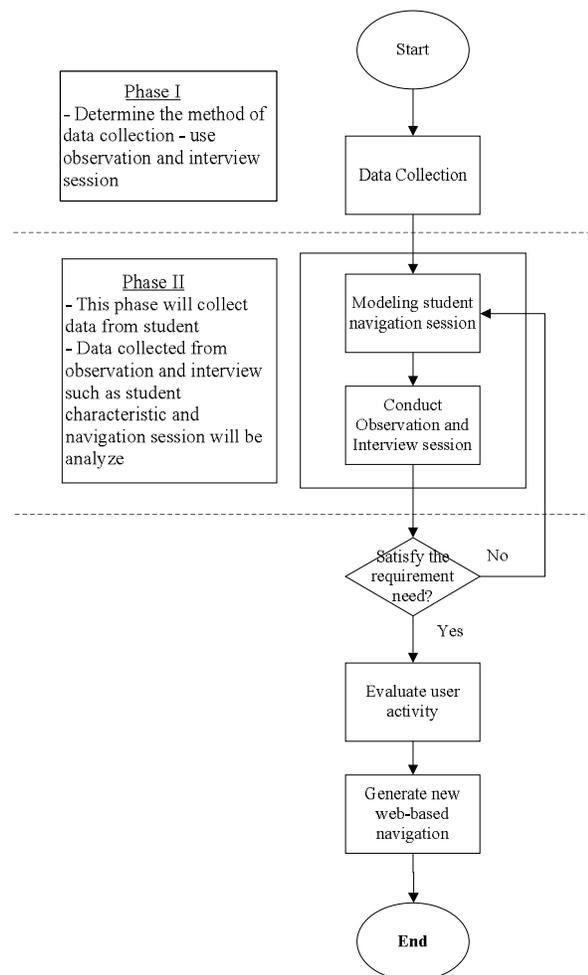
Many organizations are having a problem with a large backlog of new systems to be developed. Over half of the typical information system’s budget in many companies nowadays is spent for maintenance of existing applications and systems. The systems basically have small documentation and were developed by programmer with certain programming languages and also chosen database systems that are difficult to understand and take a lot of time to change.

Indeed, these organizations in fact, are facing dilemmawhethermaintaining and upgrading their old systems or developing new systems(Inc, 2000). Furthermore, traditional development methods are too slow and hard to meet the business demands today. A new approach and methodology must be implemented, which allows organizations to develop new software applications faster, economic, reliable and cheaper(Inc, 2000). This is why RAD has been chosen, because it will enable such development and also provide an iterative environment. Figure 3below shows the RAD process which consists of requirements planning, user design, construction and cutover. All the development will go through this process.



**Figure 3. Rapid Application Development Process**

Figure4 below show the flow chart of data collection in this project, which divided into two phases.



**Figure 4. Flowchart of Data Collection**

**4.2 Requirements Planning**

The requirement for this study has been identified to collect data and information. Data collection will be done through observation and interview session during student using the UUM learning zone portal. 30 respondents will be selected when doing the observation. The selection of respondent is from UUM students, which register under School of Computing and only students who register Master of IT or ICT programmed will be chosen.

For this project, the main location for observation and interview session will be held in libraries and partially in another location. Placed chosen is depend on situation of the student or request from student itself. In doing this observation, we were adopted the method from Herder and Juvina (2004)(refer Table 1) but with minor changes. We use interview session instead of survey to align with this study. In early observation, these methods consist of 3 stages for each session

For the first stage, data about student characteristics were collected. Then the second stage, which is navigation session will be held when student radio. This will observe the student behavior when navigate through the learning zone portal starting from logging. From this observation, we can gather all navigational data while at the same times doing some interview session. The interview questions are regarding on the user interface of learning zone portal, hyperlink provided, position of menus, which page visited always and other questions. The third stage is for student to evaluate their satisfaction with the task completion and make a few comparison with different websites (Herder & Juvina, 2004).

Once data collected, the analysis also will be performed in this phase. This analysis to determine the pattern of student behavior during navigates in the learning zone portal.

### **4.3 Data Collection**

Thirty (30) students were selected with all data from observation have been recorded. Appendix 1 below shows the data contain student gender, course, semester, time observation, location observation and methods used for collecting data.

In navigation session, example of data collected for student navigation trails has shown in the Appendix 5below. Each student will be given 20 minutes to 30 minutes to do their navigation in learning zone portal. They need to start from login and then navigate to pages that they desired. From an observation that has been made, students' intent to go to their My Course menu after login and then click the hyperlink provided. This hyperlink will navigate to their courses page that they enroll in early semester. The page consists of notes from lecture and also assignments. While in that page, the studentis directly clicking the notes or assignments link to open or download the materials.

After finishing the observation, students are required to answer a few questions duringthe interview session. The questions that have been asked are more on the user interface of learning zone portal. Below are the questions that asked to students. From the above questions, we can predict how comfortable students are with the user interface of learning zone portal.

### **5.0 Result**

There are 2 main data that obtained from students. The first data are student characteristics and second are student navigation trails including interview sessions. Student data contain student gender, course, semester, time observation, location observation and also methods used when data collected. Appendix 1shows data of students characteristic collected when doing this study. See **Appendix1**

From Appendix 2, we divided into three main characteristics of student who available and involved in this study. From the students' gender table, we can see that there are 19 or 63.3% male and 11 or 36.7% female students who involved in this study.See **Appendix2**

From Appendix 3, we can see those 18 or 60% students are from MSc of ICT and 12 or 40% from the MScin IT. See **Appendix3**

While for student semester, we can see from Appendix 4 that student from semester 1 are 13(43.3%) students, semester 2 are 5(16.7%) students, semester 3 are 8 (26.7%) students and semester 4 are 4 (13.3%) students.See **Appendix4**

The second data obtain from student navigation trails and interview sessions. First, we go into data from student navigation sessions. Appendix 5 shows the student navigation trails which consist of paging that student navigated when they use learning zone portal.See **Appendix5**

When doing the observation for navigation trails, student will be asked to navigate the start to login page. Students are free to navigate to any page while page they navigate will be noted. Appendix 5 shows summarize of data collection for student navigation trails when they use the learning zone.

Here we can see after successfully logging in Login page, the next page system display is Main page. The next page students navigate after that will be Topic Outline page or Forum page. Most students prefer to navigate from Main page go to Topic Outline page and stay on that page because all notes and assignment uploaded by lecturer are there. They just click the link provided to download all those materials. Just a few students navigate to the Forum page to see the updated news or published by the lecturer.

From data navigation session, we can predict the student navigation pattern in learning zone portal. Most of student only interested to navigate to Topic Outline page to see the notes and also their uploaded assignments. Only a few of them are interested to navigate to a different page which is from Topic Outline page to Forum page and Discussion page. This is because some students are in the last semester and doing projects. All related materials and news will be uploaded to the forum page. This behavior will lead student to use only 1 or 2 link to click and reach the destination or desired pages. After finishing downloaded or read the news from forums, student will logout from learning zone portal.

From interview sessions, students will be asked a few questions regarding to the user interface of learning zone portal. Appendix 6 shows the question and answer that obtain from student when interview session is done. See **Appendix 6**.

According to question a, 95% of students use learning zone portal more than 3 times per week and 5% of student use learning zone portal less than 2 times per week. Question b shows that 100% of students navigate to Topic Outline page while 30% of students shall navigate to the Forum page. Question c shows that 90% of students satisfied with the user interface of learning zone and 10% not satisfied with the user interface of learning zone portal. From question d, which is related to login page, it shows that 70% of students said not suitable because login page should to be on the same page while 30% of student said they are suitable with a different login page. From question e which is related to My Course menu position, it shows that 85% of students said the menu position is suitable while 15% of students said it is not suitable and need to change to another position. As related to this question, the last questions are related to the position of My Course menu. Over 87% of the students preferred menu to be on the right side while 13% of students preferred to be on the left side.

## **6.0 Conclusion and Recommendation**

From this study, the finding shows that students have a specific page they will navigate when using e-learning system. Moreover, the analysis has been done shows most students prefer to use just a certain link to navigate. They prefer to visit one or two pages at specific time and then logout from the system. For example, they prefer to visit one or two pages such as Notes page, Assignment page and Forum page and then logout from the system. Based on this finding, the conceptual model for e-learning was developed using the previous system with some navigation technique to improve and assist student for fast and effective navigation. This enhancement helps students to go to that desired page with shortest path. However, this study will need to be improved in the future by having more data collection from varieties of student and their navigation patterns. Having more navigation data from student can give a wider picture of their patterns in navigation and improved the result. Also, the conceptual system that has been developed in this project cannot be implemented in real situations for student to use because of time constraint. From this study, some recommendations that can be made for future study related to the user behavior pattern are when collecting navigation data from respondents, the researcher need to give a specific task for users to do. Furthermore, when doing the observation, researcher need to use the same tasks to another user to make sure that they use the same ways or a different ways when navigate. For respondent, researchers need to get the samples from different schools or programs because respondents come from different background and this will give a different view and pattern. Lastly, to get better results, more respondents need to involve in the project. Thus, respondents should be more than 30 peoples in order to get better results. Data from the web log server also can be used instead of using respondents to get precise results as well.

## References

- Anderson, C. R., Domingos, P., & Weld, D. S. (2002). *Relational Markov models and their application to adaptive web navigation*. Paper presented at the Proceedings of the eighth ACM SIGKDD international conference on Knowledge discovery and data mining.
- Appana, S. (2008). A review of benefits and limitations of online learning in the context of the student, the instructor and the tenured faculty. *International Journal on E-learning*, 7(1), 5-22.
- Ardito, C., De Marsico, M., Lanzilotti, R., Levialdi, S., Roselli, T., Rossano, V., & Tersigni, M. (2004). *Usability of e-learning tools*. Paper presented at the Proceedings of the working conference on Advanced visual interfaces.
- Balwi, M., & Koharuddin, M. (2012). Perkembangan, Pembangunan dan Penerimaan E-Pembelajaran di Institusi Pengajian Tinggi Malaysia. *Jurnal Teknologi*, 41(1), 55-72.
- Borges, J., & Levene, M. (2000). Data mining of user navigation patterns. *Web usage analysis and user profiling*, 92-112.
- Bousbia, N., Rebaï, I., Labat, J.-M., & Balla, A. (2010). Analysing the relationship between learning styles and navigation behaviour in web-based educational system. *Knowledge Management & E-Learning: An International Journal (KM&EL)*, 2(4), 400-421.
- Ch, B. M. (2010). Analysis of the Navigation Behavior of the Users' using Grey Relational Pattern Analysis with Markov Chains.
- Clark, R. (2002). Six principles of effective e-learning: What works and why. *The E-Learning Developer's Journal*.
- Cross, J. (2004). On The Horizon. *An informal history of eLearning*, 103-110.
- Esichaikul, V., Lamnoi, S., & Bechter, C. (2011). Student Modelling in Adaptive E-Learning Systems. *Knowledge Management & E-Learning: An International Journal (KM&EL)*, 3(3), 342-355.
- Francescato, D., Porcelli, R., Mebane, M., Cuddetta, M., Klobas, J., & Renzi, P. (2006). Evaluation of the efficacy of collaborative learning in face-to-face and computer-supported university contexts. *Computers in Human Behavior*, 22(2), 163-176.
- Gündüz, S., & Ozsu, M. T. (2002). A User Behavior Model for Web Page Navigation.
- Guralnick, D. A. (2006). User Interface Design for Effective, Engaging E-Learning. *Retrieved March, 4, 2013*.
- Hay, A., Hodgkinson, M., Peltier, J. W., & Drago, W. A. (2004). Interaction and virtual learning. *Strategic Change*, 13(4), 193-204.
- Herder, E., & Juvina, I. (2004). Discovery of individual user navigation styles.
- Inc, C. (2000). What is Rapid Application Development? [White Paper]. *Retrieved Mei, 1, 2013*.
- Juvina, I., & van Oostendorp, H. (2008). Modeling semantic and structural knowledge in Web navigation. *Discourse Processes*, 45(4-5), 346-364.
- Kapp, K. M. (2003). Five Technological Considerations When Choosing an E-Learning Solution. *E-Learning Basics*.
- Lass, D., Morzuch, B., & Rogers, R. (2007). Teaching with technology to engage students and enhance learning. *Available at SSRN 958036*.
- Mödritscher, F., Garcia Barrios, V. M., & Gütl, C. (2004). *Enhancement of SCORM to support adaptive E-Learning within the Scope of the Research Project AdeLE*. Paper presented at the World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education.
- Naber, L., & Köhle, M. (2006). E-nhance Lectures. *Journal of Digital Information*, 3(4).
- Pirolli, P., Fu, W.-t., Chi, E., & Farahat, A. (2005). *Information scent and web navigation: Theory, models and automated usability evaluation*. Paper presented at the Proc. HCI International.
- Reyna, J. (2009). Developing quality e-learning sites: A designer approach.
- Robertson, H.-J. (2005). Does size matter. *Phi Delta Kappan*, 87(3), 251-258.
- Tastle, W. J., White, B. A., & Shackleton, P. (2005). E-Learning in Higher Education: The Challenge, Effort, and Return on Investment. *International Journal on E-learning*, 4(2), 241-251.
- Wang, Y., Wang, H., Huang, W., & Jiao, Y. (2010, 24-27 Aug. 2010). *Implementing a web-based personalized learning and assessment system*. Paper presented at the Computer Science and Education (ICCSE), 2010 5th International Conference on.
- Wong, D. (2007). A critical literature review on e-learning limitations. *Journal for the Advancement of Science & Arts. School of Management & Information Technology, UCSI. Carseland*.

## Appendices

## Appendix 1

No	Gender	Course	Semester	Time	Location	Method
1	Male	MSc. ICT	2	11.30am-12.00pm	Library	Observation & Interview
2	Female	MSc. ICT	1	3.00pm-3.20pm	Library	Observation & Interview
3	Male	MSc. IT	3	12.00pm-12.30pm	Library	Observation & Interview
4	Male	MSc. ICT	4	12.30pm-12.50pm	Foyer FTM	Observation & Interview
5	Male	MSc. ICT	4	3.00pm-3.20pm	Library	Observation & Interview
6	Male	MSc. IT	1	12.30pm-12.45pm	Library	Observation & Interview
7	Female	MSc. ICT	1	1.00pm-1.20pm	Library	Observation & Interview
8	Male	MSc. IT	1	12.00pm-12.20pm	Library	Observation & Interview
9	Male	MSc. IT	3	3.20pm-3.40pm	Foyer FTM	Observation & Interview
10	Male	MSc. ICT	1	4.20pm-4.45pm	Tutorial 4	Observation & Interview
11	Female	MSc. IT	4	10.00am-10.15am	OYA	Observation & Interview
12	Male	MSc. ICT	1	2.15pm-2.30pm	Tutorial 4	Observation & Interview
13	Male	MSc. ICT	2	3.20pm-3.35pm	Library	Observation & Interview
14	Female	MSc. IT	4	4.30pm-4.45pm	OYA	Observation & Interview
15	Male	MSc. ICT	3	12.40pm-12.55pm	Library	Observation & Interview
16	Female	MSc. ICT	1	4.15pm-4.30pm	Tutorial 4	Observation & Interview
17	Male	MSc. IT	3	11.40am-11.55am	Library	Observation & Interview
18	Female	MSc. ICT	2	3.00pm-3.20pm	Library	Observation & Interview
19	Male	MSc. ICT	1	2.40pm-3.00pm	Library	Observation & Interview
20	Female	MSc. IT	3	4.10pm-4.20pm	Foyer FTM	Observation & Interview
21	Male	MSc. IT	1	12.30pm-12.50pm	Library	Observation & Interview
22	Male	MSc. IT	3	4.20pm-4.40pm	Library	Observation & Interview
23	Female	MSc. ICT	1	3.30pm-3.50pm	Tutorial 4	Observation & Interview
24	Female	MSc. IT	2	2.30pm-2.50pm	Library	Observation & Interview
25	Male	MSc. ICT	2	3.00pm-3.20pm	Library	Observation & Interview
26	Female	MSc. ICT	1	1.30pm-1.50pm	Library	Observation & Interview
27	Male	MSc. ICT	1	2.20pm-2.45pm	Library	Observation & Interview
28	Male	MSc. ICT	3	4.30pm-4.50pm	Foyer FTM	Observation & Interview
29	Male	MSc. ICT	3	3.50pm-4.10pm	Foyer FTM	Observation & Interview
30	Female	MSc. IT	1	1.15pm-1.40pm	Library	Observation & Interview

## Appendix 2

Gender	Number of Students (%)
Male	19 (63.3%)
Female	11 (36.7%)

## Appendix 3

Course	Number of Students (%)
MSc. ICT	18 (60%)
MSc. IT	12 (40%)

## Appendix 4

Semester	Number of Students (%)
1	13 (43.3%)
2	5 (16.7%)
3	8 (26.7%)
4	4 (13.3%)

**Appendix 5**

<b>Student ID</b>	<b>Student Navigation Trails</b>
1	Login Page → Main Page → Course Page / Topic Outline Page
2	Login Page → Main Page → Topic Outline Page → Forum Page → News Forum Page
3	Login Page → Main Page → Course Page / Topic Outline Page
4	Login Page → Main Page → Topic Outline Page → Forum → News Forum Page
5	Login Page → Main Page → Topic Outline Page → Forum → News Forum Page
6	Login Page → Main Page → Course Page / Topic Outline Page
7	Login Page → Main Page → Course Page / Topic Outline Page
8	Login Page → Main Page → Course Page / Topic Outline Page
9	Login Page → Main Page → Course Page / Topic Outline Page
10	Login Page → Main Page → Course Page / Topic Outline Page
11	Login Page → Main Page → Topic Outline Page → Forum → News Forum Page
12	Login Page → Main Page → Course Page / Topic Outline Page
13	Login Page → Main Page → Course Page / Topic Outline Page
14	Login Page → Main Page → Topic Outline Page → Forum → News Forum Page
15	Login Page → Main Page → Course Page / Topic Outline Page
16	Login Page → Main Page → Course Page / Topic Outline Page
17	Login Page → Main Page → Course Page / Topic Outline Page
18	Login Page → Main Page → Topic Outline Page → Forum → News Forum Page
19	Login Page → Main Page → Course Page / Topic Outline Page
20	Login Page → Main Page → Course Page / Topic Outline Page
21	Login Page → Main Page → Course Page / Topic Outline Page
22	Login Page → Main Page → Topic Outline Page → Forum → News Forum Page
23	Login Page → Main Page → Course Page / Topic Outline Page
24	Login Page → Main Page → Topic Outline Page → Forum → News Forum Page
25	Login Page → Main Page → Course Page / Topic Outline Page
26	Login Page → Main Page → Course Page / Topic Outline Page
27	Login Page → Main Page → Course Page / Topic Outline Page
28	Login Page → Main Page → Course Page / Topic Outline Page
29	Login Page → Main Page → Course Page / Topic Outline Page
30	Login Page → Main Page → Topic Outline Page → Forum → News Forum Page

**Appendix 6**

<b>Question</b>	<b>Answer</b>
a. How frequently student use learning zone portal?	95% student use more than 3 times per week, 5% student use less than 2 times per week
b. Which page he/she always navigate?	Topic Outline Page – 100%, Forum page – 30%
c. How do you feel about user interface of learning zone portal?	90% satisfied with user interface of learning zone, 10% not satisfied with user interface of learning zone
d. Is it suitable login page in a different page when to login?	70% say not suitable, 30% say suitable
e. Is it suitable My Course menu position?	85% says suitable, 15% says not suitable
f. Which side he/she prefer My Course menu?	87% prefer in the right side, 13% prefer in the left side