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**Title: Web Based Secondary Mathematic Learning (SML) System: Analysis and  
a proposal of the development.**

### **ABSTRACT**

The advent of E-learning gives a significant impact in education environment due to there are many advance features to make the system more effective to its target-users, for example multimedia contents and real time quizzes or tests. The purpose of this study/paper is to present a proposal of a Mathematics E-learning system called Secondary Mathematics Learning (SML) system. This Secondary Mathematics Learning (SML) system consist the interactive Mathematics education for all the secondary school students. There are two modules in this system, which are the teaching module and learning module. This study/paper also presented problem statements, project objectives, project scopes, and project research which include the survey analysis data in secondary school. In order to get the information for the survey analysis, the 250 sets of questionnaires have been distributed to the selected randomly students and 50 sets of questionnaires to the mathematic teachers, as respondent to get their opinion and perception. This study/paper also explains the system design and development which include the functional flow diagram, examples of module's print screen and selection tool list. Finally, this study/paper also includes the development methodology of the project and some suggestion that can further advance the system.

### **INTRODUCTION**

According to Siti Hafizah Abd Hamid and Yii Hee Ling (2006), Electronic learning or E-learning is an education via the Internet, network, or standalone computer, network-enabled transfer of skills and knowledge. E-learning often refers to using electronic applications and processes to learn. It applications and processes include web-based learning, computer-based learning, virtual classrooms, and digital collaboration where contents can be delivered via the Internet, intranet/extranet, audio or video tape, satellite TV, and CD-ROM. (Sang-Tae Park, D. W. Byun, D. W. Park, and Heebok Lee, 2005).

The Mathematics E-learning System for Secondary School is a system for the secondary school students who use to learn the mathematics through the Internet. Because of the technologies it uses, the E-learning system has many advance features to make the system more effective to its target-users for example multimedia contents, real time quizzes or tests, and very good high maintenance feature that do not only can be done by computer literate technicians, but also by non-computer-literate teachers.

According to Polsani, P., R., we are witnessing in education global shifts that reflect changes brought about by computers and communication technology. This shift may

for E-learning. E-learning is a mode of knowledge in information technologies play a decisive role.

From Wikipedia, E-learning is an all-encompassing term used to refer to computer-enhanced learning. It is naturally suited to distance learning and flexible learning and also refer to educational web sites such as those offering worksheets and interactive exercises for children.

### **Problem Statement**

The main problem for this current teaching method (conventional learning) is student lack of individual attention to the teacher. As every student has different style and rates of learning, so we should provide an opportunity for the student to learn at their own capabilities. Another problem is the materials prepared are not systematic. So, a revision and expansion of basic fundamentals should be developed. Meantime, additional examples and reading materials that are relevant and able to achieve educational and entertainment value should be included in this Mathematics E-Learning system.

Besides that, from our research on the Secondary students, we know that they face problem on some of the chapters for Mathematics subject according to different form. The main problem for them to learn Mathematics is hard to understand by class-based learning. They also stated that there are lack of examples and lack of exercises for them to improve their skill in Mathematics subject. Besides that, they also face word and calculation problems when answering the Mathematics question.

Moreover, the problem that faced by the teachers are students are shy to ask question if they are facing problem in doing mathematics. Sometimes, teachers need to find others interesting way in their teaching to attract the student attention. Additional for the conventional classroom teaching, teachers need to absolutely follow the textbook syllabus, but by using the teaching module in our SML system, teacher can have their own creativity technique to teach.

### **Project Objectives**

The system that will be built is according to the requirements of the latest KBSM syllabus released by the Ministry of Education, Malaysia. It is also an essential tool for students' assessments. This SML system applies to Secondary School Mathematics notes module, exercises (tutorials) and quizzes. Therefore, project objectives of our research study are:

- i) To develop Mathematics E-learning system for students and teachers in order to improve the quality of Mathematics at secondary schools level through the use of Internet.
- ii) To enable the Secondary School students gain the better understanding on Mathematics subject with interactive learning and teaching method.

### **Project Scope**

This Secondary Mathematics Learning (SML) system consist the interactive Mathematics education for all the secondary school students. There are two modules in this E-Learning system, which are the teaching module and learning module. For

access by everyone through the Internet. The user can according to their wish. This module will provide the the students to improve their understanding in the

subject. The student can view the notes, exercises and quizzes, submit the exercises and quizzes and answer or solution for the exercises and quizzes will be provided.

Another module of the SML system will be the teaching module which is require to login. After system verified the username and password, the student and teacher can have the virtual communication through the forum discussion where they can view and post message on it. The system also will facilitate the teachers in upload, and delete the notes, exercise questions and answers for the student to practice more on Mathematics. Besides that, teacher can view, edit or delete the student's profile and add more students to his or her group. The system will be limited the number of student in the discussion group to 20 students because of the reason of easy control and maintain by the teacher. Further more, students and teachers also can view and edit their own profile.

There is also the administration module in this SML system. The administrator can upload the notes, exercises, quizzes and solutions in the learning module. Besides that, administrator can add, view, edit and delete the teacher and student's profile and post message on discussion forum in the teaching module. The administrator also plays the role such as a database administrator, the person responsible for the database technology, security, backup and recovery and performance turning.

## MATHEMATICS E-LEARNING SYSTEM

According to our research and survey analysis, the main problem for this current teaching method (conventional learning) is student lack of individual attention to the teacher. As every student has different style and rates of learning, so we should provide an opportunity for the student to learn at their own capabilities. Another problem is the materials prepared are not systematic. So, a revision and expansion of basic fundamentals should be developed. Meantime, additional examples and reading materials that are relevant and able to achieve educational and entertainment value should be included in this Mathematics E- Learning system.

Name	Vendor	Website
Portal Pendidikan Utusan Malaysia	Utusan Melayu (M) Kuala Lumpur.	<a href="http://www.tutor.com.my">http://www.tutor.com.my</a>
Portal Myschoolnet	Kementerian Pendidikan Malaysia.	<a href="http://myschoolnet.ppk.kpm.my/indexi.htm">http://myschoolnet.ppk.kpm.my/indexi.htm</a>
KakakTua.com	Cyber Village Sdn. Bhd.	<a href="http://www.kakaktua.com">http://www.kakaktua.com</a>
Mathaid	Mathaid, LLC	<a href="http://www.mathaid.com">http://www.mathaid.com</a>
InfoMath	InfoMath Inc	<a href="http://www.infomath.com">http://www.infomath.com</a>
Aplusmath	Aplusmath.com	<a href="http://www.aplusmath.com">http://www.aplusmath.com</a>

**Figure 1.1 : The Current E-Learning Popular Website**

Besides that, from our research on the 250 secondary school students, we know that they face problem on some of the chapters for Mathematics subject according to different form. The main problem for them to learn Mathematics is hard to understand by class-based learning. They also stated that there are lack of examples and lack of

their skill in Mathematics subject. Besides that, they have some problems when answering the Mathematics question.

Moreover, the problem that faced by the teachers are students are shy to ask question if they are facing problem in doing mathematics. Sometimes, teachers need to find others interesting way in their teaching to attract the student attention. Additional for the conventional classroom teaching, teachers need to absolutely follow the textbook syllabus, but by using the teaching module in our SML system, teacher can have their own creativity technique to teach.

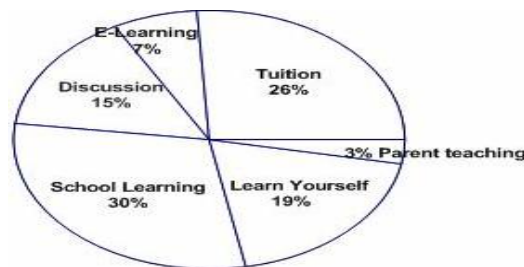
## Survey Analysis

### Analysis of the student's questionnaire:

A survey had been conducted to 250 students from four secondary school and tuition center, where students are come from SMK Convent Kajang, SMJK Yu Hua, SMK Jalan Bukit, SMK Tinggi Kajang, Sekolah Menengah Kebangsaan Taman Jasmin2, Kajang.

From the analysis, most of the students think that Mathematics is not a hard subject to learn, which consists of 67%. The reasons for the rest of the student (33%) that saying Mathematics is a difficult subject are they feel that it is not easy to understand the concept of Mathematics (38%), there is lack of exercise given by the teachers (27%) and they learn this subject by memorizing (15%). As a result, from this survey, it can conclude that the system that needs to be built should be according to the problems that have been collected from the questionnaire. So, the final product that will be produce is more efficiency to be used.

Figure 1.2 show the method that preferred by the secondary students to learn Mathematics. The most popular method is school learning, followed by tuition and self-learning.



**Figure 1.2 Methods to learn Mathematics**

Moreover, by refer to the data analysis, can conclude that secondary school students have think out the three main chapter that they feel is more difficult compare with other, which for form one students are chapter 7, chapter 9, and chapter 10, for form two students are chapter 4, chapter 9, chapter 11, for form three students are chapter 10, chapter 11, chapter 13, for form four student are chapter 3, chapter 6, chapter 7, and lastly for the form five students are chapter 2, chapter 3, and chapter 4. Therefore, our SML system will be more focus on this few chapter and the notes that display in the website shall be present in an interesting and attracting ways. So that, the students can learns from it easily and make them more understanding.

we found that 68% of the secondary school students learn Mathematics online if there have a website to learn. Most of the students think that learning through website is more interesting (51%), easy to understand (19%) and also convenient (16%).

Lastly, almost half of these secondary students (48%) know what an E-learning system is about. As a result, these students think that using E-learning system can help them learning Mathematics in new way, so that they did not need to spend additional time studying text or notes to understand the concept. Besides that, E-learning can enhance their understanding ability and learn extra information from E-learning, e.g. animation, online learning activity.

### Analysis of the teacher's questionnaire:

From the survey, 80% of the teachers saying that Mathematics is not a difficult subject to learn, 78 % of them are having good communication skill with their student in class, 15 % are very good and 7% saying that they still need to improve their communication skills. Below are the lists of chapter that they think are very important for students:-

Form 1 ó chapter 6, 7, 10

Form 4 ó chapter 2, 6, 7

Form 2 ó chapter 2, 3, 4

Form 5 ó chapter 7, 9, 10

Form 3 ó chapter 5,7,11

Below are the chapters that the teachers think are difficult for students.

Form 1 ó chapter 5, 7, 9

Form 4 ó chapter 4, 7, 10

Form 2 ó chapter 5, 7, 9, 11

Form 5 ó chapter 3, 7, 9

Form 3 ó chapter 5, 6, 12

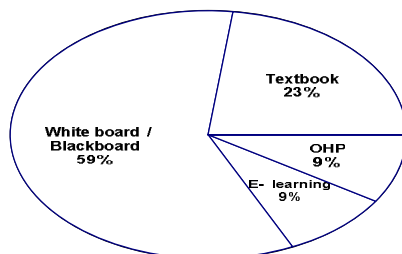


Figure 1.3 : Methods use to teach Mathematics

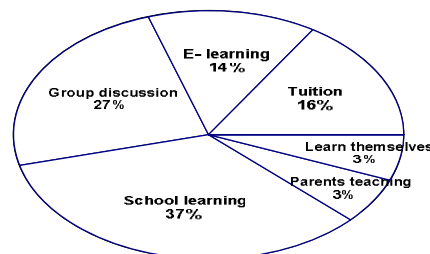


Figure 1.4 : Methods prefer by students to learn Mathematics

They are 32% of teacher think that interesting way to learn Mathematics are through playing Mathematical games, 36% are through doing quizzes, 32% are through doing exercises. The teaching methods that teachers prefer to use and learning methods that they think most of the students will prefer are shown in the figure above.

From the survey, it can be concluded that most of the teachers do not have experience in teaching through E-learning, which is 68%, and instead is 32%. From the teachers who have experience in E-learning, they said that some of the students will learn to do some mathematical games by surfing the internet when doing mathematical projects in school exhibition.

Most of the teachers have interest (67%) using multimedia tools to teach secondary Mathematics, and 13% are feeling very interest and 20% are not interest. If there have

hematics online, most of them (67%) will use this is more convenient.

## SYSTEM DESIGN AND DEVELOPMENT

### Functional Flow Diagram

There are two modules in this Secondary Mathematics Learning (SML) system. In the main page of the system, user can select to browse the teaching module or learning module. If user selects the learning module, system will prompt the user to select their Form (Form1-5) and chapter. After that, there are notes, exercises and quizzes for the students to select and browse in order to improve their understanding in the subject. The student can view the notes, exercises and quizzes, submit the exercises and quizzes where the answer or solution for the exercises and quizzes will be provided after the submission.

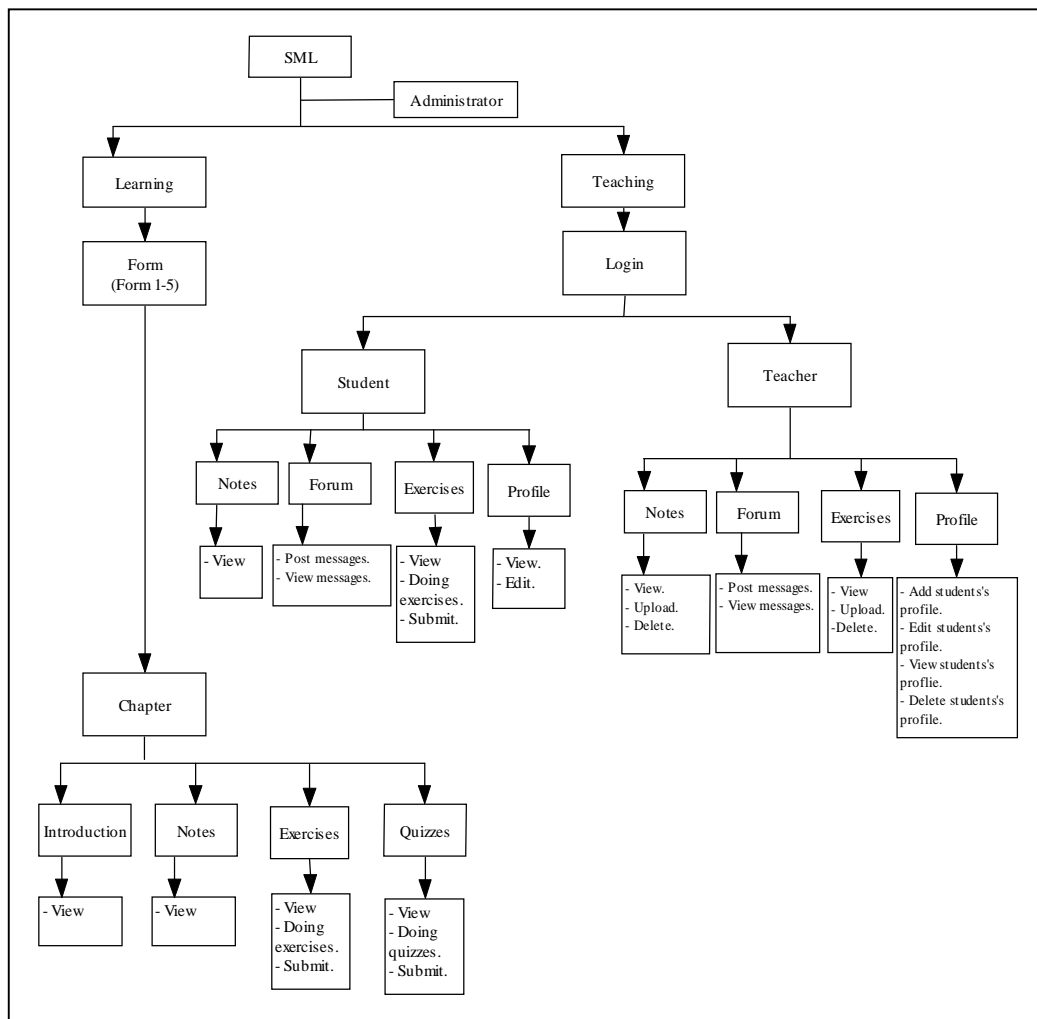


Figure 1.5 : Functional Decomposition Diagram



module, he or she is required to login. After system login, the student and teacher can select whether want to view the notes, exercises and answers. Further more, teacher also can view, edit or delete the student's profile and add more students to his or her group which limit to 20 students per group. For the student, he or she can select to do the exercises uploaded by the teacher and view the answer or solution. For the administrator, he or she can have fully control in this SML System.

## Module Of The System

There are three main modules in this system which is:-

- i). **Learning module**  
This module will provide the notes, exercises and quizzes for the students to improve their understanding in the subject. The student can view the notes, exercises and quizzes, submit the exercises and quizzes and answer or solution for the exercises and quizzes will be provided.
- ii). **Teaching module.**  
Student and teacher can have the virtual communication through the forum discussion where they can view and post message on it. Teachers can upload and delete the notes, upload exercise questions and answers for the student to practice more on Mathematics. Besides that, teacher can view, edit or delete the student's profile and add more students to his or her group. Further more, students and teachers also can view and edit their own profile.
- iii). **Administration module**  
The administrator can upload the notes, exercises, quizzes and solutions in the learning module. Besides that, administrator can add, view, edit and delete the teacher and student's profile and post message on discussion forum in the teaching module.

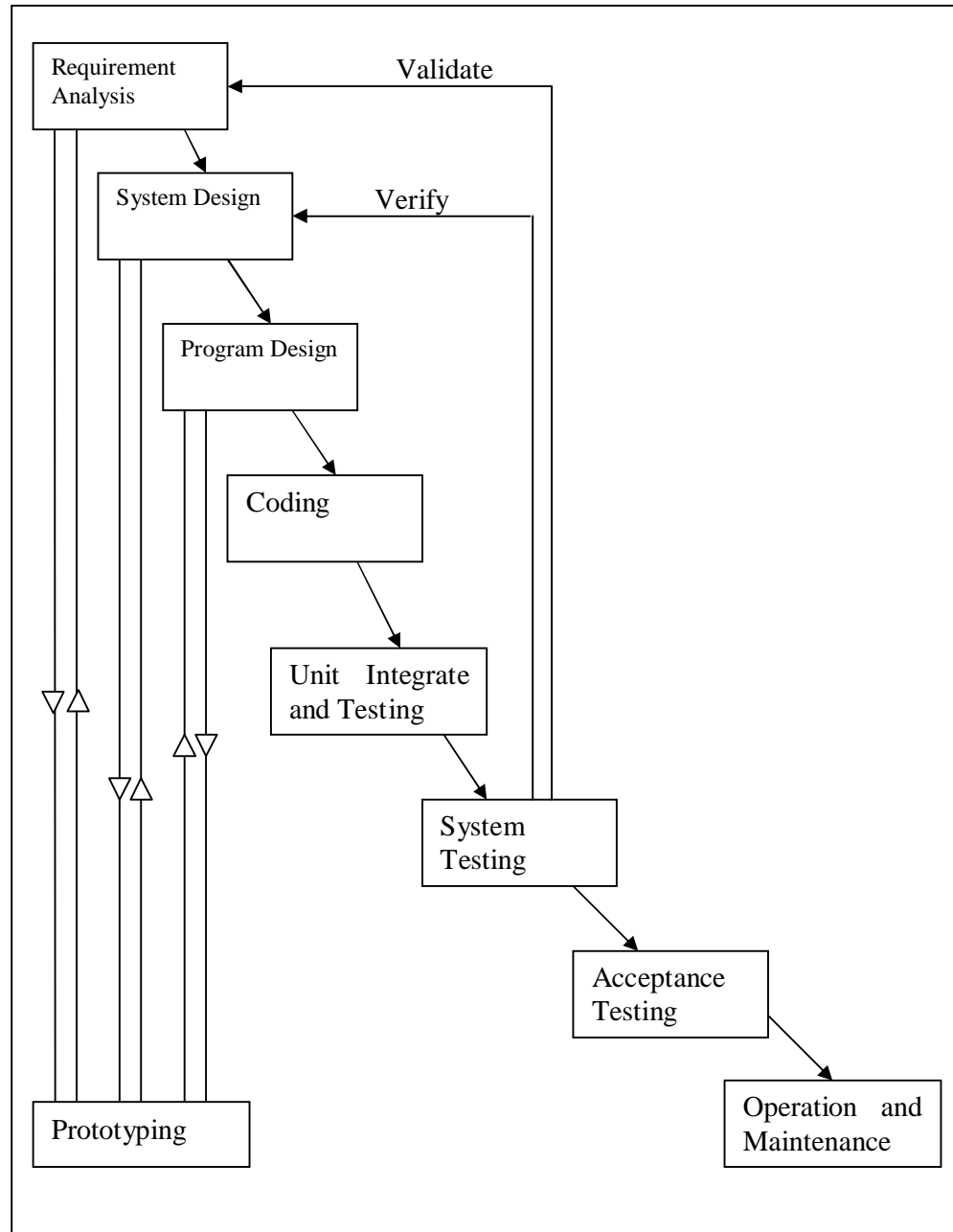
## User Interface Design

User interface design is the design of the software applications and websites with the focus on the user's experience and interaction. The goal of user interface design is to make the user's interaction experience as simple and intuitive as possible. The importance of good user interface design can be the difference between product acceptance and rejection in the marketplace. If end user it is not easy to learn, not easy to use or too cumbersome, an otherwise excellent product could fail. Good user interface design can make a product easy to understand and use, which results in greater user acceptance.

The SML system user interface design focuses on the effective general interaction between the user and the system. It also takes into account development of complete, unambiguous and easy-to-understand information displays. To be usable, an interface must be perceived as usable by those who must use it or choose to use it. They must be pleased, made comfortable and even amazed by how effectively their goals are supported by the system's design. The truly usable interface is transparent to the work the user is trying to accomplish.

## METHODOLOGY OF THE DEVELOPMENT

Therefore, a methodology have to be chosen by the developer themselves (Pfleeger, 1998). A careful selection of a methodology method could lead to a great exploitation of the soon to be develop system to the fullest potential, indirectly provoke the beneficial aspect of the methodology technique for that system and finally improving the project management and control. In the developing of the proposed system, we decided to use the development methodology that is the waterfall model with prototyping. By using this development model, we hope to get the best results in developing the proposed system.



**Figure 6: Waterfall Model with Prototyping**



with Prototyping consists of eight stages that are connected to another which are Stage 1 (Requirement Analysis), Stage 2 (Program Design), Stage 3 (Coding), Stage 4 (Unit Testing), Stage 5 (Integration and Testing), Stage 6 (System Testing), Stage 7 (Acceptance Testing) and Stage 8 (Operation and Maintenance).

Prototyping is a sub-process and prototype is a partially developed product or a simple simulator of the actual system to examine the proposed system and overview on the functionalities. It is actually an external process and it has its own development cycle, which will be developed earlier in the actual development process. Prototyping is usually an iterative process. Prototyping is used with waterfall model because it can help the developers to enhance their understanding about the system. (Pfleeger, S. L, 1998).

Prototyping is very important because of the following reasons:

- i) Requirements are often poorly understood (David, A., 1993)
- ii) Requirements usually change during the development process. (David, A., 1993)
- iii) Faster development.
- iv) Fewer changes needed after implementation.
- v) End-user involvement.
- vi) To ensure the system is practical and flexible.
- vii) To ensure the system fulfills the user's requirements.
- viii) To have an insight of how the module and sub-modules interact with each other.

The advantages of prototyping include the potential for making changes early in the process and developing a system that more closely meets the needs and requirements of the users.

### **SUGGESTION OF SYSTEM ENHANCEMENT**

The SML system will have the multimedia element to attract the student's attention and to make the learning process more fun compared with the existing conventional classroom-based teaching and text book that they are using now. Thus, the notes module in the system must have the function as same as notes in the textbook but more attractive.

In the Secondary School Examination for Mathematics subject, students are required to answer the questions with correct working-steps. The answer is still considered wrong if the student gives wrong working-steps. Most of current E-learning systems can provide a correct answer with attractive interface to attract the student's attention. However, the interface is not enough in the Mathematics learning process. This is because some students would simply guess the answer and it could be correct. Therefore, this paper proposes a Mathematics E-learning system that is not only can give a correct answer to the students but also shows them the working-steps of getting the answer.

E-learning system is important to play a role of increasing the interaction between the teachers and students. Therefore, this SML system will have a discussion forum for the student to discuss their problem with the teachers followed by the group which they

also provide option for the teachers to upload the while the student also need to submit the exercise to this system.

## CONCLUSION

In conclusion the factors above and others which are outside the scope, have an influence on the successful adoption of ICT in to the Mathematics curriculum and hence enabling the computer to become an effective tool in the teaching and learning of Mathematics. From the literature and studies done in the area Butler (1998) noted that the focus should not be "technology in education" but "educational technology". If technology continues to be a delivery vehicle and not a tool to think with, then it will have no great impact on education.

## REFERENCE

1. Pressman, R. S.(2005). Software Engineering: A Practitioner's Approach (Sixth Edition). New York: McGraw-Hill Companies.
2. Hee Ling, Y. (2006). A New Approach In E-learning for Mathematics.
3. Sang-Tae Park, D. W. Byun, D. W. Park, and Heebok, L. (2005). Evaluation System in E-learning Through the Knowledge State Analysis Method. [www.formatex.org/micte2005/370.pdf](http://www.formatex.org/micte2005/370.pdf). July 21, 2006.
4. E-learning. <http://en.wikipedia.org/wiki/E-learning>. September 13, 2006