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EDITORIAL REMARKS

Advances in technology and the growth of e-learning and mobile technology provide educators and trainers with unique opportunities to enhance the learning and teaching experience in corporate, government, and higher education environments. IJeL serves as a medium to facilitate the international exchange of information on the current research and development, practice of e-learning, online learning and mobile learning in higher education.

Lead by an Editorial Review Board from experts in the field of e-Learning from all over the world, the Journal is particularly designed for the following audiences; researchers, developers, and practitioners in higher education. Therefore, making IJEL is a peer-reviewed journal.

I am honoured to announce the launch of the first volume of the International Journal of e-Learning (IJeL) by the Universiti Teknologi MARA Malaysia. This first issue comprises of a selection of revised and selected paper at the UiTM International Conference on e-Learning (UiCeL) held at Shah Alam City, Malaysia in December 2007. This volume is stressed much on the theme of content development as the essential and most crucial element in making successful e-learning application.

I would like to take this opportunity, in representing editorial board of this publication to thank all writers, contributors, and reviewers in making this first publication a success. I welcome all professionals, experts and academicians as well as practitioners to contribute papers and research findings by participating in our 2nd International Conference on e-Learning in December 2009. May our endeavours suit our aspiration for better future of e-learning, online learning and mobile learning.

Best Regards

Assoc Prof Dr Posiah Mohd Isa
Chief Editor

Pre-
Annoucement of International Conference on e-learning 2009

Call for Paper

The conference, to be held in December 2009, invites qualitative, experience-based and quantitative papers, case studies and report works in progress on both theory and practice of all aspects of quality assurance in content development. Submissions are welcomed from academics, practitioners, vendors and government departments.

Main topics have been identified (see below). However, innovative contributions that don't fit into these areas will also be considered since they might be of benefit to conference attendees. Acceptance will be based primarily on originality, significance and quality of contribution. Topics for this conference include, but are not limited to:

For abstracts and papers submision, please send them to our official email, icel2009@salam.uitm.edu.my

Submission Guidelines

Abstracts and Papers will be selected by peer review. Please submit either :

>> an abstract (about 250 - 300 words long) headed by your title, name, address and email address.

OR

>> a completed paper with an abstract (100 - 200 words long) headed by your title, name, address and email address.

For abstracts and papers submission, please send them to our official email, icel2009@salam.uitm.edu.my with the subject "Abstract/Paper Submission - Your Name".

Thanks for joining us!

Important Date

Abstracts Submission Dateline	30 April 2009
Notification of abstract acceptance	31 May 2009
Abstracts Submission Dateline (Extended)	31 May 2009
Notification of abstract acceptance (Extended)	15 Jun 2009
Full paper for review	31 July 2009
Final paper due	31 September 2009
Registration due	15 November 2009

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INSTRUCTIONAL STRATEGY IN THE TEACHING OF COMPUTER PROGRAMMING: A NEEDS ASSESSMENT ANALYSES

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ABSTRACT

The process of Instructional Design deals with the production of an effective, efficient and appealing instructional material under different condition, method and outcome. Computer programming is part and parcel of computer education. Research done in western countries has shown that programming requires problem solving and analytical thinking skill; unfortunately these skills are found to be deficient among many students pursuing computer programming courses. A needs assessment was done to identify whether such a problem exists amongst Malaysian students pursuing computer programming courses in a Malaysian university. Among others, the aim of the needs assessment is to identify the instructional problems pertaining to the current strategies used for the teaching of programming. This paper reports and discusses the findings collected from the interviews with five computer science lecturers from the faculty of computer science in a local university. The result shows that there are deficiencies in knowledge, understanding and application of computer programming among computer science students. Recommendations are given for further investigation into a more effective strategy as an alternative in the teaching of computer programming courses

1. INTRODUCTION

Computer programming is part and parcel of the computer science education. It is an essential skill that must be mastered by anyone interested in studying computer science. Normally, in teaching computer programming, students will first be introduced to the concept of programming and data structure where they are taught on how to analyze problems, use specific techniques to represent the problem solution and validate the solution. Next the learners are required to convert the problem solution into a program using a specific programming language. They are then required to test their program to verify for syntactical or logical errors to ensure that the output is correct according to the problem requirement. Maintenance is the last process in implementation phase and it is based on user requirement needs. Maintenance is required when there are changes in user requirements or important components. The whole process of computer programming is shown in Figure 1. Experience in teaching university level computer programming has proven to be a challenge to the first author. Many students found programming to be difficult and dis heartening. Since programming is the basic skill required of computer programmers, the negative impact of these basic introductory courses may have harmful consequences in the learners' attitude towards the field.

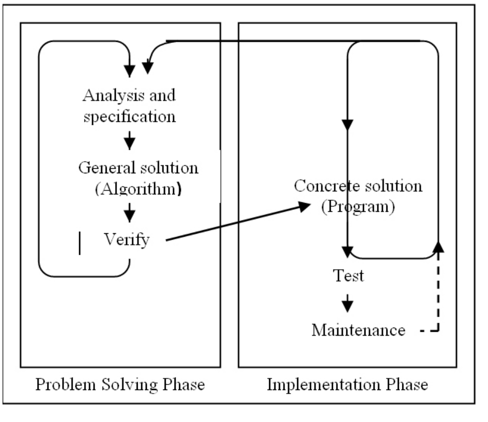

Figure 1: Programming Process (Dale, Weems & Headington, 1996)

2. PROBLEM STATEMENT

Learners' difficulty with computer programming is not unique to the Malaysian audience. Research done in western countries has shown problems with regard to computer programming. The skills that have been identified with the ability to do programming are problem solving and analytical skills (Riley, 1981; Henderson, 1986; Maheshwari, 1997b; Bonar & Soloway, 1989; Linn & Clancy, 1992). However, according to Riley (1981), many students entering college have problem-solving skills that are "woefully inadequate". Henderson (1986) notes that problem solving and analytical thinking skills are students' major weaknesses in a computer science course and that a major theme of a computer science course should be emphasized on these skills. Programming is said to be a study of clear thinking and problem solving in providing the students the practice of building representations and working in a methodical manner (Maheshwari, 1997b). Maheshwari also argues that programming fosters problem solving through a top-down approach, whereby large problems are separated into manageable components to be solved individually and then assembled into the correct solution to the problem. Programming encourages learners to evaluate their solutions and thinking process; this cognitive process allows them to transfer newly acquired problem solving skills to novel problem situations. Whatever approach to problem solving is adopted, it is recognized that it is an essential part and the first step taken in the development of software. In addition to problem solving and analytical skills, difficulty in programming is also attributed to the prior knowledge and practices; errors also occur in trying to transfer a step-by-step problem-solving solution directly from a natural language into a program (Bonar & Soloway, 1989). The differences between the natural language and a programming language can easily cause problems. For example, some novices have understood that the condition in a "while" loop needs to apply continuously rather than tested once per iteration. Linn & Clancy (1992) found that "for programmers to develop competency, they need to have good problem solving skills and a thoroughly organized knowledge of a programming language". In problem solving phase, a solution or design is generated to solve the problem and in the implementation phase the proposed solution is translated into a programming language. According to Rist (1996), the main source of difficulty does not seem to be only on the syntax or understanding of concepts, but rather on the program planning. A student can learn to explain and understand a programming concept, e.g., what does a pointer mean, but still fails to use it appropriately in a program. Winslow (in Soloway & Spohrer, 1989) noticed that students may know the syntax and semantics of individual statements, but they do not know how to combine these features into valid programs. Even when they know how to solve the problem manually, they have trouble translating it into an equivalent computer program. Most of the introductory text books on computer programming emphasize on the study of a programming language; the pre-programming topics such as introduction to algorithmic (pre-coding), and the running of programs on a computer are eliminated. According to Gal-Ezer (1996), even if a lecturer has introduction to algorithmic in mind, the emphasis in practice is always on the technicalities of a programming language, coding and running programs on a computer. Linn and Clancy (1992) claimed that most introductory programming language textbooks reinforce the emphasis on syntax and on the learning of individual examples rather than encouraging students to recognize and reuse more complex patterns. McGill and Volet (1997) found that most of the introductory computer programming courses and text books only emphasize on lower level knowledge or known as declarative knowledge and procedural knowledge that emphasize on "know that" and "know how" that are related to programming concepts and syntax. As a result, students fail to understand and are not able to explain semantics actions in a program. The emphasis on low level knowledge will cause students not to understand and master the programming syntax and constructs. Thus, learners are not able to apply correct rules of syntax during programming and are not able to use semantic knowledge of programming in writing program to solve novel problems. Most programming courses are taught using the traditional approaches including a blend of lectures, reading and practical sessions (Gray, Boyle & Smith, 1998). The environments for these types of approaches will only produce students who are passive information receivers, allow minimal interaction between teacher and students especially when a large group of students is involved. Gage and Berliner (1992) also argued that this type of lecturing is not appropriate if specific goals and objectives need to be addressed, need long period of information retention, the learning materials are complex and abstracts, students participation in class are essential to achieve learning objectives and higher level of cognitive objectives (analysis, synthesis and evaluation) are the purpose of the instruction. Dalton and Goodrum (1991) have suggested that computer programming and problem solving strategy instruction, when used together may provide an effective means of teaching transferable problem solving skills. Maheshwari (1997a)also suggested that programming lessons should employ systematically designed direct instruction activities, rich in feedback and practice opportunities. Programming activities should be designed to encourage the application of problem solving strategies such as planning, simplification and modeling. She also stated that lessons should quickly develop a rudimentary mastery of language syn tax and move quickly to produce application and problem solving. In other words, teaching programming should be interesting, motivating and stimulating for both students and lecturers. The first author's experience as a lecturer in computer science field has shown that students need to acquire reasoning, analytical thinking and problem solving skills for analyzing problem before they learn how to use and apply problem representation tools and computer programming languages. The students need to understand how to interpret the given problem before they can represent the correct solution and effectively use specific tools or techniques. The later skills can be acquired by doing a lot of practices in problem solving that involved planning, logical thinking and reasoning strategies. However, mastery in the reasoning and problem solving skills does not necessary mean that students are able to write good computer program as writing programming languages requires the mastering of the syntax and functions of the specific programming languages. Mastering of these elements require the students to be actively engaged in practical exercises in writing program by using correct syntax and constructs. Students usually react passively during lecturing and tutorial session and this makes assessment of student's mental understanding difficult. At the same time, they believe that computer programming skill is complex and difficult to be acquired and this could hinder them from asking questions for clarification. Usually, students who are able to acquire the programming skill are those who are highly motivated and interested in exploring the programming problems. They are usually actively involved in class and always seek help and discuss any problems relating to computer programming with their lecturers and colleagues. Table 1 shows the problems identified in the literature concerning problems in computer programming.

Table 1: Problems in computer programming as identified in the literature

Problem Solving Phase		Implementation Phase
Analysis	General Solution	Detail Solution
• Lack of problem-solving skills • Lack of analytical thinking skills • Lack of logical and reasoning skills • Lack of programming planning • Lack of programming conceptual understanding • Lack of algorithmic skills	• Inefficient tools used in representing problem solution • Do not understand and unable to explain semantics actions in a program • Ineffective design and testing problem solution	• Do not understand and master the programming syntax and functions • Unable to apply correct rules of syntax when programming • Unable to use semantic knowledge of programming to write program • Ineffective code and testing program to solve novel problem

3. OBJECTIVE

The main aim of this research is to identify the problems in computer programming education in Malaysia. A need assessment was conducted to identify problems relating to teaching and learning programming and finding possible solutions to this problem. The paper will present the result of this need assessment.

4. METHODOLOGY

4.1 Participants

The needs assessment was done by collecting data from interviews with five expert lecturers in computer science field at a local university. An interview protocol to elicit information on the problem under discussion was created and used as a guideline during the interview sessions. The participation was voluntary in nature and each interview session was around an hour to two hours. Five university lecturers participated in the study. The selection of the participants is based on year of experience in teaching computer science programming courses. Two of them are doctorate and the others are master degree holders. Four of the participants have been teaching for more than ten years; meanwhile, the other one has seven years of teaching programming with vast experiences in software engineering, managing a software development company involved in developing commercial computer application systems. The lecturers are experienced in teaching various types of programming languages and paradigms such as C language for structured programming, C++ for object-oriented programming and Prolog and LISP for logic and artificial intelligence programming language at both the undergraduate and graduate levels. Two of the participants are supervising doctoral students at the university. They are also actively involved in research projects and consultations regarding software engineering, artificial intelligence, parallel processing et cetera.

4.2 Interview Protocol

An interview protocol was developed to elicit information concerning the lecturers' perception on the importance of students' understanding of programming concepts, problems and causes of problems in learning programming. In addition to identifying the problems faced by students in computer programming courses, the expert participants were also asked to talk about the solutions, methods and strategies they used as suggestions to their students and used by them in overcoming some of the problems identified.

5. FINDINGS AND DISCUSSION

In this section, the findings from the needs assessment are discussed. Basically, the four main problems were identified by the expert participants. A summary of the problems is shown in Table 2 and the following discussion will be based on these four main problems, solutions to some of the problems identified by the experts and recommendation by authors on some research possibilities as the solutions for some of these problems.

5.1 Problem Type I: Lack of Skills in Analyzing Problems

All the five experts interviewed agree that students' understanding of problem solving concepts in a programming course is essential for them to learn programming languages. They said that the lack of understanding of the programming concepts at most basic problem solving level will cause difficulty in the students' further understanding of programming syntax and functions. The experts believe that most students take the skills in problem solving for granted and fail to identify their programming weaknesses at this level. However, the experts disagree on the reasons behind the lack of these skills in this area.

Table 2: Problems identified in the needs assessment process

Problem Type
I. Lack of skills in analyzing problems
II. Ineffective use of problem representation techniques for problem solving
III. Ineffective use of teaching strategies for problem solving and coding
IV. Do not understand and master the programming syntax and constructs

One expert believes that the students should be introduced to a course in discrete mathematics and logic before taking any course in programming. In other words, the students do not have the prerequisite skills to take programming courses. Three of the experts said that the students were not actually taught and exposed to proper algorithm solution as the goals for most programming courses are for the students to be able to write programs. Understanding the programming concepts and semantics behind the program were assumed to be acquired by doing the programming exercises. Suggestions by the experts to solve the problems at this phase of programming include the need for the students to acquire problem solving, planning, discrete mathematics, logic, and creative thinking skills before they learn programming concepts.

5.2 Problem Type II: Ineffective Use of Problem Representation Techniques for Problem Solving

According to the expert participants, at the basic level of programming (problem solving phase), two-way discussion approach is used to discuss the definition statement of programming problem. After defining the problem statement, problem solution are usually designed using algorithm representation techniques. Techniques such as pseudo code and flow chart are used to present the algorithm during problem solving phase. Both techniques are the accepted standard or conventional techniques and are used to explain the concept of programming in most Malaysian universities. The same techniques are also being used in the computer programming books written by the authors from western countries. Both techniques are based on structured problem solving method whereby a problem is presented in a form of procedural statements similar to the actual programming code (pseudo code) and presented in a form of control flow or data flow process (flow chart). At this phase, the problem appears to be similar to the type of programming codes that are being taught to the students. All expert participants agreed that the conventional techniques used to represent the algorithm have created some problems for the students, especially for those doing object-oriented programming. According to them, these conventional techniques are more suitable for structured programming approach and can cause the students to be confused and unable to translate the algorithm into the correct programming coding. They also agreed that the concept of programming that is based on object oriented approach should be introduced to the students in semester two, that is after they have already grasp the foundation on structured approach. Also, according to them, the object oriented approach is best used to explain a problem in a form of program entity. Furthermore, at the basic level, most of the experts interviewed agreed that concept programming that uses structured approach is much easier to understand by the students since this is the approach human use in thinking. Some of the solutions suggested by the experts include the use of different problem representation tools for different types of programming. This is to say that structured programming approach should use a different problem representation tools than object oriented approach. The instruction should also be supported by using visualization approach that would enable the students to have a mental representation of the problem. Lastly, the time spent for the teaching of concepts of programming should also be made longer to about 3 or 4 weeks. Currently, the time spent for teaching the concepts of programming is only about 2 weeks.

5.3 Problem Type III: Ineffective Use of Teaching Strategies for Problem Solving and Coding

Three of the expert participants claimed that the difficulty in understanding the concept of programming and coding is because of the ineffective teaching strategies used during problem solving and coding. These experiences will undoubtedly influence the students' perceptions on programming courses as difficult and complex. One expert participant argued that factors such as lecturer using ineffective teaching strategies and taking the matter into granted contribute to the difficulty in understanding and confused the students when they try to apply the concept into programming code. According to this expert participant, the effective teaching strategies should start with teaching structured or procedural type of programming language; object-oriented type of programming language is not a good starting point to introduce the students to the basic concept of programming. Two other expert participants believe that the main cause for the above problems is the inactive involvement of students during programming practical session. All the expert participants also agreed that the concept of programming should be taught to the students in a form that support their spatial and visualization abilities as these aspects will help them to understand and visualize the process of control and data flow in a program in a more general context. All of them agreed that techniques, approaches and strategies used in teaching programming should be applicable to the content of programming with different paradigms in order to help students strengthen their basic problem solving skills and be able to plan and organize the solution by using an effective cognitive strategy. The cognitive strategy will hopefully help them to acquire the problem solving skills that together with knowledge on the syntax of a programming language can help them to solve novel problems. Some of the problems suggested by the experts include doing enough practical exercises relating to real world examples as these would allow them to apply the concept of programming correctly to solve novel problem. Practical sessions or tutorial should also be enriched with activities, feedback and practice opportunities.

5.4 Problem Type IV: Do Not Understand and Master the Programming Syntax and Constructs

According to the experts, students need to have both the understanding of the concept of programming and the knowledge of syntax and constructs of a specific programming language in order for them to be able to write a good program. They added that lecturers normally give lectures on the concepts and principles of programming along with simple examples of problems and provide students with practical exercises to build program concepts and translate them into programs. Practical exercises are done in the computer laboratory during tutorial sessions. For the weak students, they are urged to make appointment for consultation or create small group remedial session to help them overcome these problems. The experts also added that practical exercises are important and students should be active participants during these tutorial sessions and should spend time understanding the syntax, construct, and concept of the programming languages. In order to overcome these problems, the experts have also suggested the collaborative and cooperative group work amongst the students. Team work allows for the use of scaffolding and coaching on how to programming effectively thus allowing them to explain and understand the programming concept, know the syntax and semantics of programming statements and know how to combine these features into valid computer programs.

6. DISCUSSION AND CONCLUSION

Analyses of the data from the needs assessment revealed some similarities between problems identified by the expert participants and the first author's experience in teaching similar courses. There are gaps or deficiencies in students' knowledge in computer programming course in each phase of the programming processes. Four main problems were identified, including (i) the lack of skills in analyzing problems, (ii) ineffective use of problem representation techniques for problem solving, (iii) ineffective use of teaching strategies for problem solving and coding, and (iv) the difficulty in mastering programming syntaxes and functions. According to McGill and Volet (1997), most introductory computer programming courses and text books emphasize only the lower level knowledge, also known as declarative and procedural knowledge. Declarative and procedural knowledge are types of knowledge that emphasize the knowledge of "what" and "how" respectively. As such, these are knowledge that are related to the what and how of programming concepts and syntax. Rist (1996) believes that the acquisition of only low level knowledge made it difficult for students to apply a complete form of programming even though they are able to explain and understand the programming concept. This will cause the development of inert knowledge to the students during the learning process. This is the same observation made by Winslow (in Soloway & Spohrer, 1989) where he noticed that students may know the syntax and semantics of individual statements, but they do not know how to combine these features into valid programs. Computer programming requires higher level knowledge or knowledge at the strategic or conditional level. This is the knowledge of “when and why” which requires meta-cognitive skills which are apparently are lacking among the students. Lack of meta-cognitive skills has been reported in several studies on computer programming courses (Linn, 1985; Linn & Clancy, 1992; McGill & Volet, 1997; Oliver, 1993; Volet, 1991). If one were to look at the different phases of the programming processes as shown in Table 1, even at the initial and first phase of problem solving, analysis of the problem requires the student to be able to identify, analyze, plan and create possible ways to put the problem into whatever programming language at hand, a task that requires the highest cognitive dimension identified in the Revised Bloom Taxonomy (Anderson & Krahwohl, 2001). The experts’ opinion from this needs assessment concur with the literature on computer programming education in that the critical part of the programming process starts at the analysis of the problem solving and consequently will have an effect on the next phase of the programming sequence. Is there a teaching or learning strategy that can be used to help lessen the burden at this stage? Is there a need for a specific kind of technique to represent the individual’s knowledge and understanding regarding computer programming problem? Are pseudo codes and flowcharts adequate in helping the students to see the problem to be programmed? What are some of the visual representations other than the flowchart that can be used at this stage? These are some of the questions that need to be answered and further research need to be done to find the solution. Otherwise our computer programmers in the future will not have the skills necessary to create new applications, merely users of programs created by others. In the era of digital technology and knowledge workers, these are inadequate skills that need to be addressed in the field of Instructional Technology.

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IMPROVEMENT OF AN E-LEARNING COURSE WITH QFD ANALYSIS

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ABSTRACT

An investigational study was done through a blended PhD course; "Distance education and international co-operation in education" of Chiba University. Here, e-learning with LMS was used to provide lesson content, mentoring, discussion, assignment and learning activities using both Japanese and English to cover overall period of the course. And, the author introduced Quality Function Deployment (QFD) analysis to clarify proper measures for improvement of the course. QFD is a systematic process that helps us quickly understand and integrate our unintentional needs into the course. QFD enables to introduce integrated "tacit knowledge" into "procedural measures" by using decision making method, and also provides a transferable document that covers comprehension areas to related staff members. As result, one of extracted elements by QFD was to concern the installation of communication software that could not be perceived during data collection period. Difference between pre-perceived elements and QFD elements was 10% of weight in improvement actions.

1. INTRODUCTION

While a systems view of distance education (DE) is a good conceptual tool that helps us understanding and is essential to its successful practice (Moore & Kearsley,1996). Even when we do not use the term; systems approach (SA), our thinking is influenced by a systems perspective. A DE system consists of all the component processes that make up DE, including indispensable subsystems; management, faculty and technology (Yoshida, 2002). The systems view helps us not only recognize issues that separate DE from conventional F2F, but also distinguish good DE from bad. Lack of integration of the system, limited interaction among sections frequently induced fatal stagnation of effects ofDE. It must have a transducer that can exchange opinions of a section practitioner to be recognized by all other section members and should have a chance to discuss near future improvement of DE system among staff members of different expertise. Quality Function Deployment; QFD is a comprehensive group decision technique that enables experiences of practitioners into a transferable deployment. Thus, QFD forces to reveal hidden tacit knowledge to the style of explicit knowledge with putting a scale and priority in it (Figure 1).

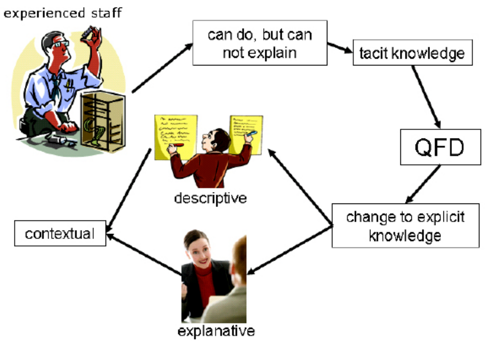


Figure 1: Tacit Knowledge to Explicit Knowledge

2. QFD

QFD was initially developed in Japan in the late 1960s for manufacturing and service sectors, and then it was rapidly spreading to the variety of US sectors in the 1980s. Later, many industries and service sectors in the world used QFD to know appropriate technical requirements for each stage of the system. The results of QFD, called House of Quality (HOQ), yield transparent and visible matrices that can be used for a system improvement. Recently, QFD evolved from a number of different initiatives, but still original purpose was involved (Hill, 1994),

1) To improve the "quality of design"
2) To provide staff deployment before the this

initial production run Academic organization is a special one that has evidence of QFD application to conduct quality education and research (Chan & Wu, 2002). QFD had been made slow distribution during 1980s in educational institutions, and many studies are appeared from late 1990. Although there were few chances for educational institutions to conduct a systematical educational project that went beyond pedagogical designing in a classroom, ICT innovation introduced new mode of learning. SA into education and QFD was immediately used powerful potential into quality improvement of DE project in terms of course design, training design and service (Murgatroyd, 1993). This movement convinces us if we look at matured total quality control (TQC) and practical use of QFD in content improvement of me dia production houses and ETV stations. On the other hand, recent QFD softwaretoolenhancetoprocessintegratingknow-how and to focus on the essentials proactively.

3. PERCEIVED CUSTOMER

QFD was initially designed to attain higher levels of customer delight. This customer integrated decision making (CIDM) was already reconsidered for the educational project. Kushner et al. (1994) clarifies customers of educational institutions by internal and external functions.

> *In a school setting, customers could include students, faculty, staff, volunteer, parents, the community, business and industry, government, and various levels of post-secondary education and training.*

Clearly, only opinions of students are not compatible to CIMD in educational system. Murgatroyd (1993) also showed nine components of DE process to be basics of an excellent course, those were includes view points of many DE functions in addition to students' opinions. Here, we need to consider SA as components of CIMD to illustrate the project. Then, in our experimental study, the author organized a team for QFD that could propose outcome quality in all subsystems of DE.

4. METHOD

The subject of this study is an e-learning lesson that occupies 2/3 in a blended education of a PhD course. There are following three characteristics of our PhD courses.
1) Small sized class
2) Requiring integrated and authentic activities of students outside the country
3) Provision of novel information
1) is the same situation across the world, and 2) and 3) are the special condition of difference in Ph.D. courses among the world.
Then, QFD was vest suite for improvement of this up-grading course.

4.1 E-LEARNING LESSON.

Course title : "Distance education and international cooperation in education" of graduate school of social science and humanities, Chiba University
LMS : Chula e-learning system, English menu version (course contents, streaming audio/video, self-check examination, message board, chat function equipped)
Content : Instructional content was described in Japanese and English.
Fieldwork assignments in e-learning: open questions; investigation of foreign DE project, develop Gantt and Part charts of the DE project, Cost calculation of the DE project, describe a cartogram and a conceptual group
Learning period: from October 2006 to February 2007

4.2 A STUDY TEAM

A study team was organized by three PhD course students and a professor in charge. All the members were involved in the target e-learning course, and here, the team could cover versatile areas of specialties; Distance Education, Educational Technology, Psychology, Science & Technology, and Public Communication. The team gathered empirical cases for improving e-learning execution as well as learned about subject area of the course. It was similar concept in the triangulation technique of the action research, by joint work of different experts, confirmed validity of each item. Students: One Japanese and two Asian students (One needs to learn in Japanese and another needs to learn in English.)

4.3 PERCEIVED PROBLEMS

The perceived problems by the team before QFD analysis are as follows.

1) Communication difficulties among students of different language speakers
2) Difficulties to expand interests and lead spontaneous applied activities of students

4.4 STUDENT ACCESSES

Access distribution
All the students had own computers with broadband connection in their home, and also they had chances to

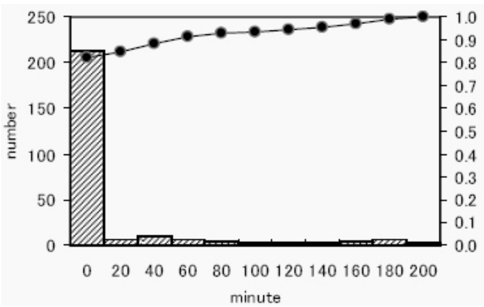


Figure 3 : Frequency Distribution and Cumulative Frequency Graph of Students' Accesses

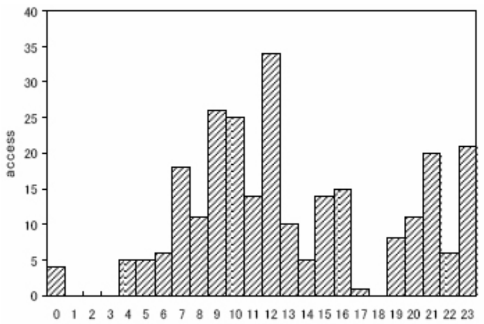


Figure 2: Access Time

use computer service inside the campus without any difficulties. Figure 3 is a frequency distribution and cumulative frequency graph of students' accesses. Finally, 260 accesses were automatically recorded in the LMS. 82% of total accesses were short learning time, within 20 minutes, and they saved information, or moved to recommending links and processed their activities. Surprisingly, 17% of accesses were within 5 minutes, but they said it was enough time to get information under broadband connection. Access time There were two peaks of access time in day and night except midnight and evening (Figure 2). Day time was more preferred by them. Maximum accesses were seen in lunch time.

4.5 ANALYSIS

In this study, QFD software; Visio QFD Tool v1.2 developed by xknowledge was used to analyze data (xKnowledge, 2007).

4.6 PROCEDURE

Gathered cases were discussed in F2F session where the team chose cases that could transform to output qualities for improving e-learning. Analysis procedure was as follows,

1) Describing output quality items that define required target quality from considerations of confirmed cases
2) Using KJ (Kawakita Jiro)-method and making groups of output quality items in three hierarchical levels
3) Using paired-comparison method among output quality items and relative rating (1-9) between items
4) Conducting an analytic hierarchy process (AHP) sheet
5) Quality planning by putting number in target quality with benchmark scaling (1-5)
6) Listing up connotation elements of each output quality item
7) Using KJ-method and making groups of connotation element items in three hierar chical levels 8) Valuing and rating (1-4) cells of matrix in HOQ

Table 1 shows the arranged output quality items in three hierarchical levels. Following analysis to AHP was processed based on second level, and also second level of connotation elements were used (Table 2) in the continuing analysis to HOQ. AHP was developed by Satty, T.L. (1980), and provides to deal with complex decision making by a mathematical mechanism for checking the consistency of evaluation measures and minimizing common pitfalls of decision

Table 1: Grouped Output Quality

FIRST LABEL	SECOND LABEL	THIRD LABEL (ORIGINAL)
learners' competencies	communication skills	student can search relating expert
		a student can do professional interview in the field study
		students can communicate one another through cyber space
	creativity	assignment products include more creativity than an example
		a student can expand interest to the world
		students can make linkage with their own dissertation
	attitudes	students are punctual for F2F session
		students can keep time limit of assignments
		students can finish reading before F2F
		a student accomplish field study to the sufficient level
		students can conduct steady access to e-learning
		students spend enough time to read through content
		students do not send duplicate e-mail
		proper course selection by students
		students can follow the directions of an assignment
computer literacy	functional e-mail	a teacher can forward personal mail reply to all students
		easy to modify a name list of mailing list
		easy to sort e-mails into lots
		prepared measures against no reply to e-mail
	computer skills	students have enough graphics skills to conduct assignments
		students can select proper tools for documentation
online administration	monitoring function	teacher can monitor the progress of field work of students
		teacher can confirm that all students mastered prerequisite of the course
		students' product show what they did for
		teacher can monitor students' activities in cyberspace
		a teacher know existence of students in e-learning
	online service	easy to introduce a student's product into e-learning
		fast uploading files
		system has a link to external learning tools
		easy to develop multi languages pages
		student can manage ID and PASS
		there are links to teach how to use application software
		easy to replace proposed assignment to new one

Table 2: Grouped Connotation Elements

FIRST LEVEL	SECOND LEVEL	THIRD LEVEL
skills	Getting Things Done	self control
		responsibility
		time securing
		scheduling
		motivation
		sincerity
		involvement
	academism	subject area knowledge
		creative power
		interdisciplinary approach
		flexibility
	sociability	story telling
		collaboration skill
		intercultural mind
	LifeHack	IT knowledge
		searcher skill
		graphics technique
		documentation technique
strategies of design	field work	open question
		portfolio
		mentoring
technical specification	software	sophistication of mailer soft
		functional mailing list
		instant messaging
	LMS function	RSS
		asp
		mobility
		up-dating Web
		multi lingual
reliability of system	online management	technical guide
		security knowledge
		personal data management
		data management

making process by the team for reducing bias. In the calculation of this study, geometric mean method was used for rating each paired outcome quality items. This was the process that transfers qualitative data into quantitative data. For calculations of absolute weight in HOQ, benchmark technique was used by comparison of the following projects.

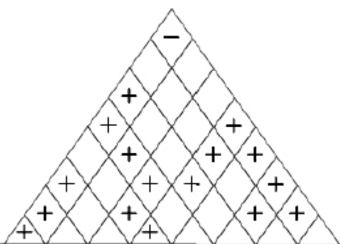
Thailand TCU: It provides nationwide e-learning courses developed by leading universities organized by MOE, Thailand. (users; 31,064, teachers; 2,175, courses; 402, Oct. 2007)

Chula Online: It offers more than 300 courses which cover from secondary education level to continuing education managed by the dominant university in Thailand. They use same LMS system of this study.

Figure 4 is the HOQ that shows output qualities in rows and connotation elements in columns. As results, student attitudes toward learning in the course has highest weight for quality planning; 43%, and following monitoring function of online system improvement has 25%. For scaling target quality, "Thailand TCU" and "Chula Online" were selected for benchmarking, because these projects use LMS of same origin. Both project are well organized nationwide e-learning project with large size, and have developed services. However, content development is frequently based on outsourcing. Although our e-learning is small sized laboratory based project, assignments are designed as open questions, where students required their distributing self-initiated investigation during periods. Therefore, even low grade-up rate (1.5) in monitoring function of quality planning; but it was marked as higher weight. In the matrix, ◎, ○, and △ show rated as 4, 2, and 1 respectively. Connotation elements in columns could be categorized into three subcategories (shown in Table2). The most elements are also in "learning and instructional (*faculty*)" area, and occupies 69% in weight. The second enhancement area could be seen in *technology* area, 24%. An element of *management* area contributes only 7%. Within extracted connotation elements, *fieldwork* which is closely related to open question assignments has the most multiple links to outcome qualities. However, in the quality planning of connotation elements, GTD is selected as highest weight; 25%. The second enhancement element is *fieldwork* and *software*, both 17%.

6. DISCUSSION

Blended education was accepted by students. The course gave a conceptualization chance to foreign students during F2F session and active field work during e-learning lesson. A professor could provide learning contents in Japanese and English without difficulties. And, students could learn about their selected foreign country by their preferable linguistic background. Nevertheless, communication among students was quite limited, and each student worked independently and did not have so much interest in information developed by other students. Therefore, the author introduces discussion between perceived problems (described in sec 4.4 above) and QFD results, in addition to appeared successful course work of students. About the first perceived problem, it must increase collaborative and communicative assignments and also provide assistance for multi-linguistic environment. In HOQ, the setting of fieldwork by a professor in the front, and also sociability of students in the back (28% in total) would enhance the quality of communication. The next, perspective view and profound recognition are crucial in PhD courses. Then, the second perceived



connotation elements deployment / outcome quality deployment	connotation elements: faculty					technology		manag-ement		quality planning: Benchmark			planning			weight	
	getting things done, GTD	academism	sociability	lifehack	field work	software	LMS function	online management	importance	our e-learning	Thailand TCU	Chula Online	target quality	level of grade-up	empasis	absolute weight	relative outcome quality
communication skills			◎ 1.27	△ 0.32	◎ 1.27				0.08	1	3	3	4	4.0		0.318	0.14
creativity	△ 0.11	◎ 0.43		○ 0.21	◎ 0.43	△ 0.11			0.07	2	3	2	3	1.5		0.107	0.05
attitudes	◎ 3.94	△ 0.99	△ 0.99	△ 0.99	△ 0.99				0.41	2	3	4	4	2.0	○	0.986	0.43
functional mailer						◎ 0.98	△ 0.25	△ 0.25	0.15	3	2	4	5	1.7		0.245	0.11
computer skills				◎ 0.24	○ 0.12	○ 0.12			0.02	1	3	3	3	3.0		0.060	0.03
monitoring function	○ 1.15				△ 0.58	◎ 2.31	○ 1.15	○ 1.15	0.26	2	3	4	3	1.5	◎	0.577	0.25
online service					△ 0.02	△ 0.02	◎ 0.09	○ 0.04	0.01	2	4	4	3	1.5		0.022	0.01
importance of connotation elem.	5.21	1.41	2.26	1.76	3.40	3.54	1.49	1.44	20.51							2.316	1.00
relative connotation elements	0.25	0.07	0.11	0.09	0.17	0.17	0.07	0.07	1.00								
our e-learning	2	2	2	1	3	3	3	2									
Thailand TCU	3	2	2	3	2	2	3	4									
Chula Online	4	2	2	3	2	2	3	4									
target quality	4	4	4	3	5	4	4	3									

Figure 4: House of Quality

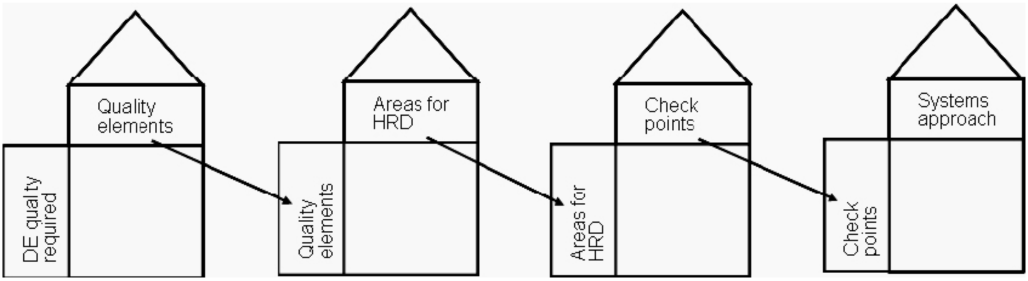


Figure 5: Four Phase Model for DE Project

problem is related with academism (7%) and GTD (25%). Both elements occupied 32% in total. As a result, perceived problems and those measures were concerned 60% of analyzed connotation elements. On the other side, GTD, field work, software and sociability were scored as higher priorities in QFD results (70%), and could conclude as immediate measures of improvement from this analysis. It was also clarified weight difference between before analysis and after analysis as 10% (software > academism). Thus, QFD could cover comprehension area of DE project, and reveal potential importance from different field. As a countermeasure, the author modified LMS to be able to connect communicative Wedget programs. If a DE project is managed by a large number of people, it is better to process continuous QFD analysis to show particular units within connotation elements to staff members. Now continuous phase analysis by QFD is general procedure (King, 1989), and the author also indicated an example of implementation phase of QFD for large DE project improvement (see Figure 5, cited from Yoshida, 2007).

7. ACKNOWLEDGEMENTS

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PERCEIVED SUCCESSFULNESS OF E-LEARNING CURRICULUM DEVELOPMENT

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ABSTRACT

E-learning may become one of the most prominent technology enabler of providing education to the masses. However, if its curriculum is inadequately planned and poorly managed, Institutions of Higher Learning (IHLs) may require some re-engineering to make it right and in doing so, tie up management resources. This study seeks to determine the perceived successfulness of e-learning curriculum development in the Malaysian environment from the perspectives of the learner, instructor and institution, respectively. Six factors (needs analysis, collaborative development, consistency and standardization, attention to the delivery mode, expertise, and training support) associated with curriculum development are used for this determination. The primary data for this study was collected by means of a questionnaire survey conducted among 14 Malaysian private and public IHLs. Returned questionnaires totaled 140 from institutions, 145 from instructors and 180 from learners. Findings from the survey indicate that, from the perspectives of the learner, instructor and institution, all six factors exhibit significant association with the level of perceived successfulness in e-learning curriculum development. Through the findings, IHLs would be better able to focus on strengthening some crucial aspects of curriculum development that would contribute to a better planned e-learning curriculum.

1. INTRODUCTION

The use of information and communication technology (ICT) in education has fundamentally altered the practice of distance teaching and learning. Online distance learning or electronic learning (e-learning) has become one of the most prominent technology enablers of providing education to the masses. In Malaysia, the provision for education is one of the biggest challenges for the government as the nation strives to become a fully developed country by the year 2020. In order to become a competitive player in the global arena, the Malaysian government realized the need for a transition of its production economy to a knowledge-based economy. The government identified e-learning as one of the essential initiatives required to increase the information technology (IT) literate workforce of knowledge workers to support continued economic development (Mageswary Jaiballan and Asirvatham, 2003). However, one of the essential elements of e-learning is the development of its curriculum. If the e-learning curriculum is inadequately planned and poorly managed, IHLs may require some re-engineering to make it right and in doing so, tie up management resources. The objective of this paper is to present empirical findings on the perceived successfulness of e-learning curriculum development in the Malaysian environment from the perspectives of the learner, instructor and institution, respectively.

2. E-LEARNING AND CURRICULUM DEVELOPMENT

Today, with the pervasiveness of computers in the home and workplace together with rapid improvements in bandwidth, affordability of information technology through mass market customization, increasing numbers of knowledge workers, the need for quick response, increasing innovative developments in information systems to derive the competitive advantage, and globalization, there seems to be more focus on e-learning especially for developing countries like Malaysia. Although it is a growing business in developed countries, developing countries have been slow in embracing its many beneficial aspects and opportunities. However the local scene is changing with increasing developments in ICT and the necessity of a knowledge society in the face of globalization. According to the latest Internetworldstats.com survey (updated June 30, 2007), Malaysia has about 13.5 million Internet users with a penetration rate of 47.8%. In the year 2000, the number of Malaysian Internet users was estimated at 3.7 million. These statistics indicate a significant growth of Internet users, since the turn of the millennium century, which may contribute positively to e-learning adoption among Malaysian citizens. In October 2002, Malaysia's National Steering Committee on e-Learning was established by related ministries and IHLs to promote e-learning. Such an initiative by the government has paved the way for e-learning to become increasingly common in Malaysia in the future. In a 2002 survey research on e-learning, conducted in Malaysia, the following prominent IHLs provided several course activities that were related to e-learning: Multimedia University, Universiti Tun Abdul Razak, Universiti Sains Malaysia, Open University Malaysia, Universiti Teknologi MARA, Universiti Putra Malaysia, and the National Institute of Public Administration Malaysia. Such IHLs that introduced e-learning then are improving their technology and endeavoring to increase e-learning user participation while others are realizing its benefits and have started incorporating it as an alternative and/or support technology to traditional classroom learning. In contemporary online education settings, academic and management support services are directly integrated with the students' e-learning environment. Teaching strategies involve virtual and physical learning resources and communication methods that are designed to facilitate active learning among students. The main concern of developers of such an environment stems from harnessing the ICT capabilities with pedagogical and learning requirements while balancing organizational opportunities and constraints, such as provision of necessary ICT solutions, willingness to adopt online modes of teaching and learning, and institutional policies. In order to better integrate such elements, McPherson and Nunes (2002) proposed an e-learning framework that highlighted all aspects involved and provided a holistic view of the e-learning development process. This framework is based on the five main areas: organizational infrastructure, enabling technologies, curriculum development, instructional design, and course delivery. However, as this study is about e-learning curriculum development, further details on the remaining four areas will not be provided. Incidentally, the proposed framework from McPher son and Nunes was adapted and improved from an original proposal by Al Rawas (2001). Curriculum development in general focuses on the application of the following four basic principles in the development of any curricula projects (Tyler, 1949):

1.Defining appropriate learning objectives.
2.Establishing useful learning experiences.
3.Organizing learning experiences to have a maximum cumulative effect.
4.Evaluating the curriculum and revising those aspects that did not prove to be effective.

As a result of these basic principles, expected learning outcomes became the prime factor in determination of student learning and hence, the effectiveness of teaching practices. Curriculum development is one of the fundamental aspects of e-learning. The factors identified for e-learning curriculum development were derived from an ICCE 2002 conference workshop conducted to address critical success factots (CSFs) for implementing eLearning (McPherson, 2002). Six significant factors associated with curriculum development CSFs were identified and they are: needs analysis, collaborative development, consistency and standardization, attention to the delivery mode, expertise, and training support.

3. RESEARCH METHODOLOGY

An empirical study using three sets of questionnaire surveys were applied in this research. Both primary and secondary data were used in order to achieve the research objective. The primary data for this study was collected by means of a questionnaire survey conducted among 14 Malaysian private and public IHLs. The IHLs are registered with the Malaysian Ministry of Higher Education and most of them have Multimedia Super Corridor (MSC) status. Based on the secondary data, the factors used to determine the perceived successfulness of e-learning curriculum development were derived from previous research conducted mainly in New Zealand, the United Kingdom and Ireland. These factors are used in this research to determine the perceived successfulness of e-learning curriculum development among Malaysian IHLs. The surveys were targeted at three group segments involved in the e-learning environment, namely, the IHLs, instructors, and learners.

4. RESEARCH MODEL

The research model in Figure 1 is built based on CSFs associated with e-learning curriculum development identified during the ICCE 2002 conference workshop conducted to address CSFs for implementing eLearning (McPherson, 2002). The model depicts the six factors used in determining the perceived successfulness of e-learning curriculum development. The six factors are needs analysis (Hall and Concannon, 2002; McPherson, 2002), collaborative development (McPherson, 2002; Nunes, 2002; Segrave and Holt, 2003; McPherson and Nunes, 2006), consistency and standardization (Currier and Campbell, 2002; McPherson, 2002), attention to the delivery mode (Coman, 2002; Hall and Concannon, 2002; McPherson, 2002; McPherson and Nunes, 2006), expertise (McPherson, 2002; Nunes, 2002), and training support (McPherson, 2002; Selim, 2003; Moody, 2004; Tallent-Runnels et al., 2005). Based on the six factors, the research has formed the following hypotheses:

H1: Needs analysis on e-learning is significantly associated with the level of perceived successfulness in curriculum development.

H2: Collaborative development is significantly associated with the level of perceived successfulness in curriculum development.

H3: Consistency and standardization is significantly associated with the level of perceived successfulness in curriculum development.

H4: Attention to the delivery mode is significantly associated with the level of perceived successfulness in curriculum development.

H5: Expertise on e-learning is significantly associated with the level of perceived successfulness in curriculum development.

H6: Training support on e-learning is significantly associated with the level of perceived successfulness in curriculum development.

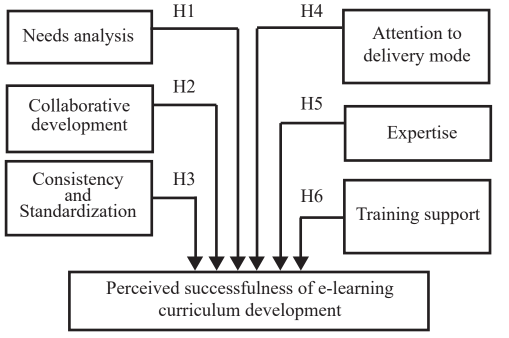

Figure 1 Research Model on Perceived Successfulness of E-Learning Curriculum Development

5. FINDINGS AND RESULTS

The survey questionnaires captured background data of respondents profile as well as their e-learning related profile. The study was conducted among IHLs in the Klang Valley region during a two month period in the second half of 2006. Only 14 IHLs were approached as they had on-going e-learning programs. 150 sets of questionnaires were distributed to institutions, 150 to instructors and 200 sets to learners in order to obtain sample sizes that are adequate for the study. Returned questionnaires totalled 140 from institutions, 145 from instructors and 180 from learners. This section discusses the outcome of the study in terms of the perceived successfulness of e-learning curriculum development from the perspectives of the learner, instructor and institution, respectively.

5.1 Demographic profile

Demographic characteristics examined in general included gender and respondent's age. For the survey directed at IHLs, additional questions such as respondent's position and number of years position was held were posed. The instructor's survey included in addition, the type of work, mode of employment and number of years the position was held. For the learner's survey, questions on the type of courses offered and course disciplines, together with student status were asked. When analyzing the IHL respondents' responses, it was noted that 26.4 percent were IT or

E-learning managers or higher while the rest were senior IT staff. About 16.4 percent have held their positions for more than 4 years. From the instructor's respondent group, it was found that 71 percent was involved in teaching while the remainder provided the management and support work. Also, a high response rate of 85.5 percent of the respondents are working full-time with 43.4 percent having held their positions for more than 4 years. Analysis from the learner respondent group indicated that a majority (68.3%) are within the ages of 18 to 25 years, with 69.4 percent being full-time students. Only 16.1 percent are distance learners. In the category of type of courses offered, about 98 percent responses showed that their institutions offered combinations of online distance learning courses, traditional courses with technology or both.

5.2 Reliability Tests

Cronbach's Alpha Coefficient was used to test the survey items' reliability in this study. A coefficient value which is closer to value '1' is desired. Since all measured items in Table 1 had a reliability of more than 0.7, the scales for these constructs were deemed to exhibit an adequate reliability.

Table 1 Reliability Test for Curriculum Development

	Item	Cronbach's alpha	N
Institution	6	0.802	140
Instructor	6	0.861	145
Learner	6	0.740	180

Note: Item – Number of variables
N – Total number of respondents

5.3 Results of Factors Associated with Curriculum Development

The highest mean in Table 2 represents the most important factor while the lowest mean represents the least important factor associated with e-learning curriculum development. From the institution's perspective, the 'attention to delivery mode' factor is ranked the highest. This is probably due to the fact that IHLs practicing e-learning endeavour to provide instructors and learners with a good delivery system in order to access online resources as well as to participate in any online discussions. This finding is consistent with studies from past literature. Another observation is regarding the 'collaborative development' factor that is ranked second in this study. Its significance is consistent with past studies as such a curriculum development would involve collaborative effort amongst educationists, technologists and subject matter experts to design and develop an appropriate curriculum that meets the learning and pedagogical concerns of online education.

Table 2 Ranking of Factors Associated with Curriculum Development (Institution's Perspective)

No.	Factors	Mean
1	Attention to the delivery mode	4.06
2	Collaborative development	4.04
3	Consistency and standardzation	3.94
4	Needs analyses	3.89
5	Expertise	3.87
6	Training support	3.71

The results further indicate that the 'training support' factor exhibits the least important association with e-learning curriculum development. The observation made here is that these results reflect current practice in the local scene. Hence, the need arises for further improvement of the training support provided so as to provide more effective service to all parties involved in the e-learning environment From the instructor's perspective, the ranking of the 'attention to the delivery mode' factor in Table 3 is consistent with previous studies. However, in Table 3, the 'training support' factor is ranked higher probably owing to the critical role an e-learning instructor plays in providing support to learner queries and questions pertaining to the instructor's subject matter. Understandably, the 'needs analysis' factor showed the least important association as needs analysis is generally conducted by the curriculum committee appointed by the institution.

Table 3 Ranking of Factors Associated with Curriculum Development (Instructor's Perspective)

No.	Factors	Mean
1	Attention to the delivery mode	3.87
2	Training support	3.64
3	Expertise	3.60
4	Collaborative development	3.59
5	Consistency and standardzation	3.53
6	Needs analyses	3.46

In Table 4, the results indicated that, from the learner's perspective, the 'attention to the delivery mode' was the most important factor associated with the development of the curriculum. Apparently, learners feel that the delivery mode need to be interesting enough to ensure their online attention with user friendly features, easy navigability, and overall screen display attractiveness. The 'collaborative development' factor was ranked second in the learner's perspective. Students embarking on proper online distance learning programs lack face-to-face interaction. Hence in their opinion, online forums provide strong interaction and discussion platforms for students to collaborate on projects as well as to be actively involved in discussions on current or subject matter issues.

Table 4 Ranking of Factors Associated with Curriculum Development (Learner's Perspective)

No.	Factors	Mean
1	Attention to the delivery mode	3.83
2	Training support	3.78
3	Expertise	3.73
4	Collaborative development	3.67
5	Consistency and standardzation	3.64
6	Needs analyses	3.62

The 'training support' factor was unexpectedly ranked the lowest. This could probably be due to late feedback from instructors with regards to questions asked on their related subject areas. To ensure continuous successful online education, it is vital that instructors be prompt in providingappropriaterelevantresponsestolearners' online queries on related subject matters.

5.4 Results of Hypotheses Testing

The factors associated with e-learning curriculum development are needs analysis, collaborative development, consistency and standardization, attention to the delivery mode, expertise, and training support. Pearson's Correlation Coefficient analysis was used to determine correlations between these factors and their associations with the level of perceived successfulness in curriculum development from three perspectives. In order to test these hypotheses, the value of Pearson's correlation coefficient was calculated. Weak relationship is indicated by a value of less than 0.3, value between 0.3 to 0.7 indicate moderate relationship while a strong relationship has a value higher than 0.7. The results of the hypotheses testing show that all the hypotheses are accepted and that all the factors have significant associations with the level of perceived successfulness in e-learning curriculum development.

Table 5 Relationship between Factors and Perceived Successfulness of E-Learning Curriculum Development (Institution's Perspective)

Hyp	Person Coeff.	Sig	Result
H1	0.619	.000*	Moderate +ve relationship
H2	0.510	.000*	Moderate +ve relationship
H3	0.619	.000*	Moderate +ve relationship
H4	0.487	.000*	Moderate +ve relationship
H5	0.618	.000*	Moderate +ve relationship
H6	0.631	.000*	Moderate +ve relationship

**Significance at 0.05 levels*

Results in Table 5 show that all the hypotheses (H1 to H6) were accepted where p-value < 0.05. However, all hypotheses displayed only moderate positive relationships. Although hypothesis H4 result is seen to contradict the findings in Table 2, it may be assumed that as some of the

14 IHLs had implemented e-learning a while back, the perspective of the institution could be that online delivery modes are deemed as common basic facilities required. The institutions probably felt that more emphasis should be placed on bridging closer interaction between instructors and learners. Hence, that may be the reason why H6 showed such a significant association. The assumption is that in the institution's perspective, instructors should be better able to provide prompt and accurate information to learners through efficient training support, thereby ascertaining a 'lock-in' effect on students as well as minimizing student attrition.

Table 6 Relationship between Factors and Perceived Successfulness of E-Learning Curriculum Development (Instructor's Perspective)

Hyp	Person Coeff.	Sig	Result
H1	0.743	.000*	High +ve relationship
H2	0.699	.000*	Moderate +ve relationship
H3	0.797	.000*	High +ve relationship
H4	0.663	.000*	Moderate +ve relationship
H5	0.600	.000*	Moderate +ve relationship
H6	0.722	.000*	High +ve relationship

**Significance at 0.05 levels*

From Table 6 above, all the hypotheses (H1 to H6) were accepted where p-value < 0.05. Hypotheses H1, H3 and H6 showed strong positive relationships while the remainder indicated moderate positive relationships. The result of hypothesis H3 indicates that there must be consistency in the online resource materials provided in terms of format, display, etc. Accordingly, assessments and evaluations must be in line with guidelines and standards set by the institution's management. Hypothesis H5, on the other hand, does support the opinion that instructors do not need to have e-learning expertise. Their contribution is their expertise in their respective subject areas as input for curriculum development.

Table 7 Relationship between Factors and Perceived Successfulness of E-Learning Curriculum Development (Learner's Perspective)

Hyp	Person Coeff.	Sig	Result
H1	0.648	.000*	Moderate +ve relationship
H2	0.490	.000*	Moderate +ve relationship
H3	0.562	.000*	Moderate +ve relationship
H4	0.567	.000*	Moderate +ve relationship
H5	0.539	.000*	Moderate +ve relationship
H6	0.583	.000*	Moderate +ve relationship

**Significance at 0.05 levels*

Table 7 results indicate the acceptance of all the hypotheses (H1 to H6) as p-value < 0.05. All the hypotheses showed moderate positive relationships. As may be expected, before curricula are developed, needs analyses must be conducted and the data analyzed. Hence, from the learner's perspective, H1 result depicts the strongest positive relationship as input from learners' needs is very useful for curriculum development. The result of hypothesis H2 has the weakest positive relationship and this is consistent with an observation that, from students' perception, online forums have little bearing on the perceived successfulness of curriculum development. The students have neither active nor direct involvement in an institution's curriculum development.

6. CONCLUSION

The provision for education is one of the biggest challenges faced by the Malaysian government as the nation strives to become a fully developed country by the year 2020. The solution is to use technology as an enabler to bring education to the masses. IHLs are taking up the challenge by not only updating their programme content but more importantly, utilizing the latest technologies to improve the delivery of education. As a result, e-learning is rapidly becoming the way of providing education to the masses. One critical area of e-learning is its curriculum development. In order to attain some measure of success, its curriculum must be well-planned, -coordinated and -managed. Findings from the study indicate that, from the perspectives of the learner, instructor and institution, all six factors used in the study exhibited significant associations with the level of perceived successfulness in e-learning curriculum development. Through the findings, IHLs would be better able to focus on strengthening some crucial aspects of curriculum development that would contribute to a better planned e-learning curriculum.

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INTEGRATION OF NON-VERBAL AUDIO IN EDUCATIONAL COURSEWARE

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ABSTRACT

This research will identify situations where non-verbal audio is integrated in educational courseware. Previously there were no standards to integrate the non-verbal audio in educational courseware. Practically the integration of the audio usually depends on the designer of the courseware thus it can be declared as an ineffective way to use the non-verbal audio. This research is conducted to improve the proper usage of non-verbal audio and identify which part of the educational courseware it needs to be used. An informal analysis technique was designed to identify the proper cue to add the non-verbal sound in the educational courseware. Interactions in courseware can be in the form of events, status or modes. Interaction is usually used to find information and this information will be delivered to user(s) in the form of feedback. The method was evaluated by testing the non-verbal audio at the point of interactions such as introduction, background, mouse click, button press, appearance of dialogue box, occurrence of errors and closing window. The results showed that non-verbal audio could improve usability by increasing concentration and interest among the user(s). Results also showed that user(s) were not annoyed with the audio. Thus the integration of non-verbal audio in educational courseware is shown to be effective when applied to existing courseware interface.

1. INTRODUCTION

Educational software, or courseware, is rapidly moving into the mainstream of teaching in the Malaysia higher education. More and more lecturers are using courseware as an integral part of the course lectures. There are a number of reasons for this emergence of courseware as a teaching tool. They include falling power/cost ratio of desktop computing, improved quality and availability of multimedia courseware, appreciation of pedagogical advantages of courseware and government encouragement Unfortunately the quality of educational software in the past has left a lot to be desired. Software production has often been a 'cottage industry', the province of enthusiastic academics and amateurs with some knowledge of a programming language or authoring system. Although the educational content has often been very high the quality of the software has been patchy - interfaces have been unfriendly and difficult to use, technical support has varied from good to non-existent, bugs have been legion, and many packages have had an unnerving tendency to fall over unexpectedly. The interactive courseware with non-verbal audio in educational technology has been found to enhance learning and motivate students to facilitate learning. However, because the use of courseware with non-verbal audio in educational technology is still in its early stages, there exists little empirical research showing the proper cue or part to add the non-verbal sound in the educational courseware. Advances in multimedia have facilitated the development of innovative courseware. Course management systems and Flash animations have made courseware an attractive option for instructors. Furthermore, the interest in using non-verbal audio in recent courseware are because "new technologies have made them more accessible" (Craig et al.,2002, p.428), and they have proven to be very effective in encouraging and motivating students to learn and change students' attitudes towards learning (André, Rist, & Müller, 1997; Barron, 2004; Johnson, Rickel, & Lester, 2000; Maes, Darrell, Blumberg, Pentland, 1995; Stone & Lester, 1996; Tu & Terzopoulos, 1994).

2. LITERATURE REVIEW

Audio and video provides a very powerful resource for learning. Boyle (1997) explains that video clips can greatly enhance the authenticity of a computer-based learning environment. This experience may be the central focus of the system or it may be an important additional resource that students cannot normally access. However, video is a time-based phe nomenon. When it starts it "takes the floor" and holds it until it is finished. This aspect of video has to be handled very carefully (Boyle, 1997). According to Teng, Tront, Muramatsu, and Agogino (2005), Multimedia provides alternatives to purely text-based content and enables the learner to visualize content in new and novel ways, perhaps addressing a particular learning style. However, as the technology to produce multimedia continually improves and bandwidth to deliver it increases, it continues to be important to ensure that if multimedia is used, 1) it is used appropriately and not gratuitously, 2) does not provide ambiguity or misconceptions, 3) it is of high visual and aural quality and 4) overall it helps learners construct interrelated (e.g. visual and numerical) knowledge. According to C.S Steffey (2001), in order to obtain the full benefits of video for learning, the video should be used as an active resource. The learners should not just view the video, they should use it. The use of computer technology and audio-visual materials in the classroom obscures an equally effective, cost-efficient means of communication. The following are suggested ways to use five audio sources in the classroom (Lisa Pertillar Brevard, 1998):

- Music: Courses in social studies, history, or literature/English provide fertile ground for the use of music during class time hours. Music may be used to usher in the class session to create a mood within the classroom conducive. Or it can be used to mark the transition from one topic to the next, or moving from one philosophical point of view to the next.
- Books on Tape: Perhaps the biggest stereotype of books on tape is that they are solely for those with visual problems or people who are simply too lazy to read the assigned. Books on tape provide a necessary human dimension to the process of reading and encourage students to read with great care and attention to detail.
- Oral Traditions (Interviews and Oral Histories): Interviews and oral histories provide an added dimension to the study of the use of language in humanities courses. In addition to providing specific first-hand information about a particular topic, they also give students an opportunity to participate in building a catalogue of sound for the classroom
- Vintage Radio Programs: An effective means of using such programs is to listen to the broadcasts and create a series of related questions that may be used as discussion topics in class or as a worksheet or handout.
- Audio-Recorded Poetry: The mere hearing of a poem and its varied sounds helps students remember difficult passages and decipher symbolism and metaphor.

The use of audio sources in the classroom need not be relegated to music or language laboratories. It is time to rethink the function of sound in our lives and equip our classrooms accordingly. In the mad rush to link our classrooms to the information superhighway, we must be careful not to ignore the powerful, enduring legacy of sound (Lisa Pertillar Brevard, 1998).

4. METHODOLOGY

The purpose of this study was threefold. First, it serves as to identify the situations where non-verbal audio should be integrated in educational courseware. Second, it identifies the necessity of integrating the non-verbal audio. Third, it is used to identify whether non-verbal audio should continue to be used in educational courseware. Subjects of the study were 300 students of the university, randomly selected from 5 faculties and subjects were required to use Computer and Information Processing courseware. The questionnaire was designed to contain two sections; Section A is concerned with the overall satisfaction of non-verbal audio; Section B consists of questions concerning the usage of non-verbal audio.

4. RESULTS AND FINDINGS

4.1 Overall Satisfactory Level using Non-Verbal Audio

Respondents were asked to answer questions concerning the overall satisfaction of non-verbal audio in Section A.

4.1.1 The Quality Level of Non-Verbal Audio at Satisfactory Level.
Figure 1 illustrates the results for the subjects' perception on the quality level of non-verbal audio.

Quality of Non Verbal Audio is Satisfactory

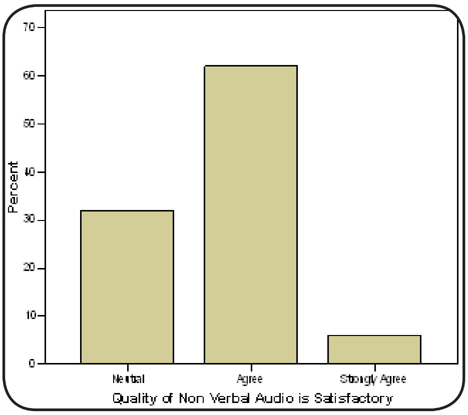

Figure 1: The Quality Level of Non Verbal Audio

4.1.2 The Non-Verbal Audio is not Annoying to User at Satisfactory Level
Figure 2 shows the overall percentage of respondents' perception on the annoying level of non-verbal audio.

Non Verbal Audio is Not Annoying to User

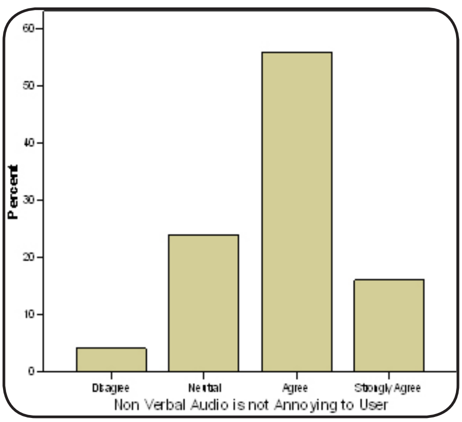

Figure 2: The Annoying Level of Non-Verbal Audio

4.1.3 The Non-Verbal Audio should be Continuously used for Courseware
Figure 3 shows the overall percentage of respondents' perception on whether the non-verbal audio should be included in other courseware.

Non Verbal Audio Should be Used in Courseware

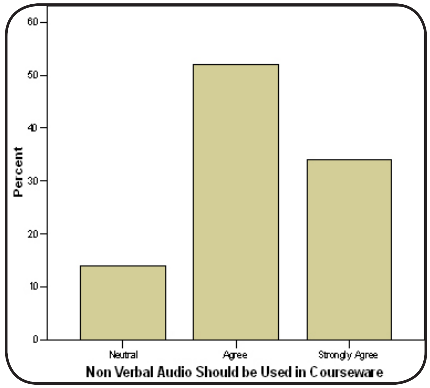

Figure 3: The Non-Verbal Audio should be Continuously used for Courseware

4.1.4 The Non-Verbal Audio Is Very Important For Learning Process
Figure 4 shows the overall percentage of respondents' perception on the important of non-verbal audio in learning process.

Non Verbal Audio is Important for Learning Prosess

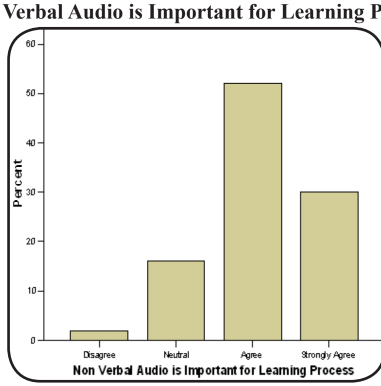

Figure 4: The Importance Level of Non-Verbal Audio in Learning Process

4.2 Usage of Non-Verbal Audio

Respondents were asked to answer questions concerning the Usage of Non-Verbal Audio variable in Section B.

4.2.1 The Non-Verbal Audio can Increase Concentration and Interest when Integrated in Courseware.
Figure 7 and 8 shows the respondents' perception on the implementa

tion of Non-Verbal Audio in Courseware.

Increase the Concentration in Learning

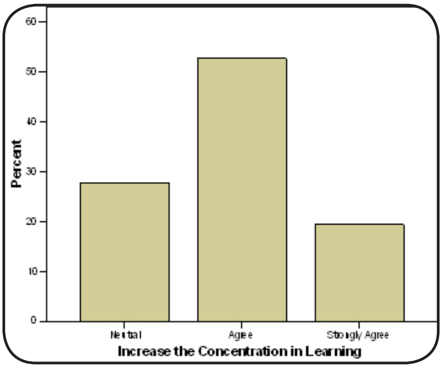

Figure 5: The Non-Verbal Audio can Increase Concentration.

Increase the Interest in Learning

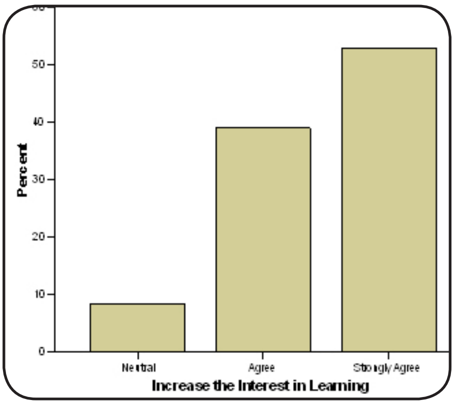

Figure 6: The Non-Verbal Audio can Increase Interest

4.2.3 The Level of Confidence on Non-Verbal Audio can Increase Learning Process.

Figure 9 illustrates the respondents' perception on the level of confidence using non-verbal audio can increase learning process

Non Verbal Audio can Increase Learning Process

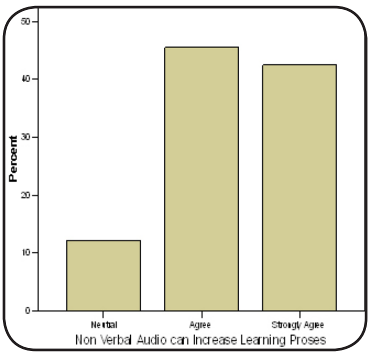

Figure 7: The Level of Confidence on Non-Verbal Audio can Increase Learning Process

4.2.4 The Situations where Non-Verbal Audio should be Used.

Figure 10 - 16 shows the perception of the respondents on the situations where non-verbal audio should be used.

Introduction

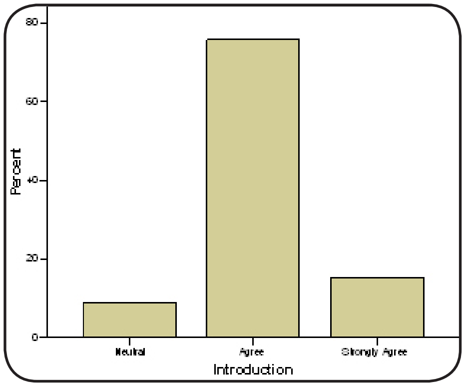

Figure 8: The usage of Non-Verbal Audio during Introduction

Button Press

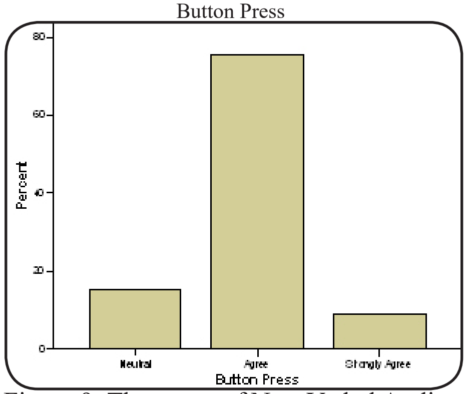

Figure 9: The usage of Non-Verbal Audio during Button Press

Mouse Click

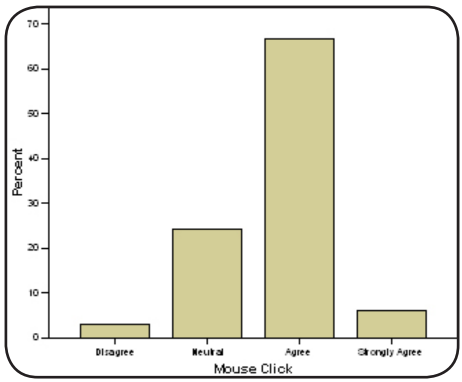

Figure 10: The usage of Non-Verbal Audio during Mouse Click

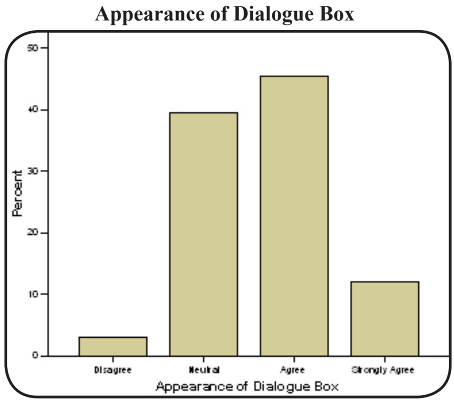

Figure 11: The usage of Non-Verbal Audio during Appearance of Dialogue Box

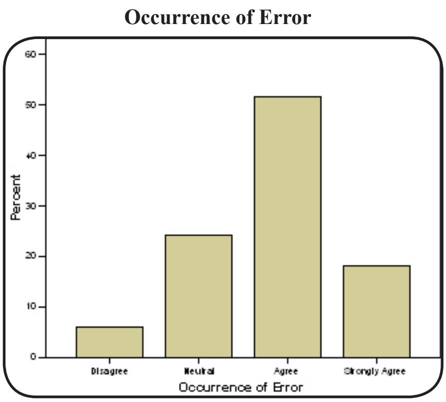

Figure 12: The usage of Non-Verbal Audio during Occurrence of Error

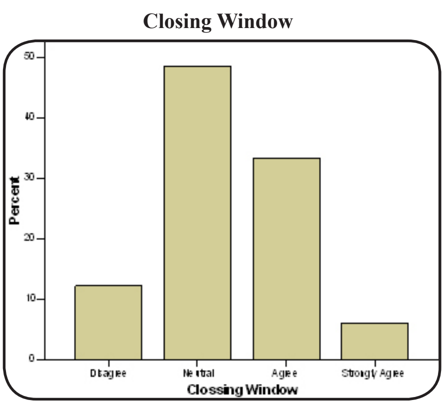

Figure 13: The usage of Non-Verbal Audio during Closing Window

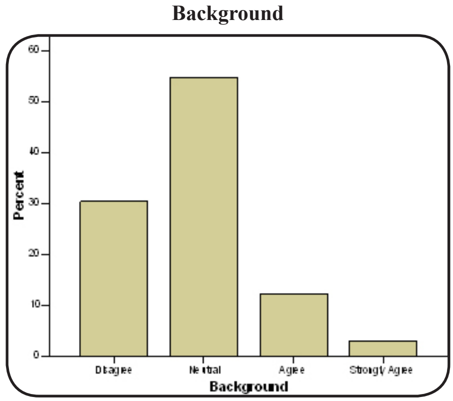

Figure 14: The usage of Non-Verbal Audio in Introduction

5. CONCLUSION AND FUTURE WORK

This research shows some of the situation where non-verbal audio can be integrated in educational courseware. From the user's perceptions, non-verbal audio is preferred during introduction, button press and mouse click, appearance of dialogue box and occurrence of error. Non-verbal audio is not preferred by user during closing a window and as a background sound. Preference shows that it is a distraction while learning. Overall non-verbal audio can be continuously used in future educational courseware to increase the learning process. This is because; using non-verbal audio can increase the concentration interest and focus of the user during the learning process. In conclusion the work in this research was aimed to decide on the situations where the non-verbal audio can be used in the educational software. As for the future research; analysis on what types of non-verbal audio should be integrated in educational software can be done.

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NEED ANALYSIS FOR CONTENT DEVELOPMENT TO IMPROVE QUALITY IN RESEARCH

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ABSTRACT

The aim of the study is to examine the issues and current practices of the doctoral students of 12 universities spread all over Pakistan who are conducting their research. The research issues of the study are whether or not the doctoral students know various stages of the research such as proposal, introduction, literature review, methodology, results and discussion from the very beginning of the research. It was an experimental study over a span of one month held in 2006. The data were collected from 27 experienced university teachers selected randomly. First, the subjects were examined in the beginning of the Research Methodology Workshop, and later after a month on the completion of the Workshop held at Higher Education Commission, Islamabad. The results have shown a significant difference in the current practices and quality of research before and after the workshop. The applied research which is conducted here is one way of accomplishing just that, by approaching a common sport – rock climbing – from a scientific direction and engaging wider researchers in the methods of research by using Need Analysis for Content Development.

1. INTRODUCTION

Research, as explained by Mouly (1978), is best conceived as the process of arriving at dependable solutions to problems through a planned and systematic collection, analysis, and interpretation of data…a back and forth movement in which the investigator first operates inductively from observations to hypotheses, and then deductively from these hypotheses to their implications in order to check their validity from the standpoint of compatibility with accepted knowledge. After revision, these hypotheses are submitted to further test through the collection of data specifically designed to test their validity at the empirical level. The major objectives of the study are to investigate whether or not the research:

1. is conducted in a systematic and controlled manner being its operations on the inductive deductive approach, and
2. is empirical. Subjective belief is checked against objective reality.

1.1 Research Question

Keeping in view the objectives stated above, the study investigates whether or not the doctoral students know various stages of the research from the start of the research? The research question of the study is to know how much knowledge the doctoral students have about research procedure a) before the taught course of Research Methodology? b) after the taught course of Research Methodology? Since there is no single blueprint for planning research, research design is governed by the notion of 'fitness for purpose'. The objectives of the research determine the methodology and design of the research.

1.2 A framework for the research design

The process of operationalization is critical for effective research. What is required here is translating a very general research aim or purpose into specific, concrete questions to which specific, concrete answers can be given.

The process moves from the general to the particular, from the abstract to the concrete. Thus, the framework for research design presented by Murrison (1993) is followed. The basic components of the research are given below:

a. orienting decision,
b. writing proposal
c. research design and methodology,
d. data analysis, and
e. presenting and reporting the results.

2. LITERATURE REVIEW

Literature review indicates the ways in which the previous researches under reviewing will be relevant to the research (e.g. information; theory; methodology). It also demonstrates that the researcher understands the similarities and differences between these works and paradigms (i.e. Where do they stand in relation to each other? Where does his research stand in relation to them?) The works that the researcher refers to should reflect recent scholarship as well as those considered to be of seminal importance and if the study is cross-disciplinary or comparative the researcher need to describe how the different areas of research can be drawn together in a meaningful way. Basically literature review considers the following important factors:

- Provides a conceptual framework for the research
- Provides an integrated overview of the field of study
- Helps establish a need for the research
- May help clarify the research problem
- Helps to demonstrate researcher's familiarity with the area under consideration (theory and / or methods)

All the five areas (a-e) given above will be looked into detail for our analysis for the empirical evidence of the study.

a. Orienting decisions

Orienting decisions set the boundaries or the parameters of constraints on the research. They address to i) be inclusive in thinking for building on the ideas for a longer time to identify the strength of different research areas to be creative, ii) jot down ideas for revisiting them later on for further modification or changes, iii) select the topic of personal interest rather than to be overly influenced by others, iv) be realistic about the time framework in terms of short-term and long-term issues and questions, v) have the clear understanding of the steps necessary in conduction the research along with the derive of motivation, vi) have comprehensive background knowledge of the literature related to the research, and vii) have clear rationale behind the methodology the research has chosen.

b. Writing a proposal

This section examines whether the researchers have a complete knowledge of writing a good proposal which consists of the first there chapters of the dissertation, that is to say, a) statement of the problem/background information, b) review of the literature, and c) research methodology.

c. Research design and methodology

The methodology section shows the researcher how he is going to set about looking for answers to the research question (including, if appropriate, materials and methods to be used). It must include enough detail to demonstrate that he is competent and the project is feasible. The proposed methods must be appropriate to the type of research. Research should describe the detailed methodology for proposing a specific method, that is, how the study is to be conducted to give a clear picture to its reader to evaluate the research design and method. Mostly the method is typically reported as given below:

c. Hypothesis
d. Research design
e. Data collection procedures
f. Sampling/study area
g. Measurement instruments
h. Data analysis (statistical approach)

d. Data collection Procedures

Procedure explains what was done earlier and how. It includes a description of the research design and how to achieve the purpose of the research.

2.1 Sample

Sample explains the persons or subjects who participated in the study and how they were selected, that is, the proposed sample size of the population etc. This decision must be done early in the overall planning of research. The most important factor here is the need to think out in advance of any data collection the sorts of relationships that researcher wishes to explore within subgroups. Where simple random sampling is used, the sample size needed to reflect the population value of the particular variable depends both on the size of the population and the amount of heterogeneity in the population (Bailey, 1978). Random sampling and purposive sampling are the two main methods of sampling given by Cohan and Holliday (1979, 1982, 1996) and Schofield (1996).

2.2 Instruments

Instruments enable researcher to decide on the most appropriate instruments for data collection such as interviews, questionnaires, tests, and observation etc. as explained by Kvale (1996), Tuckman (1972), Patton (1990) and Morrison (1993).

2.3 Statistical analysis

Decisions will need to be taken with regard to the statistical tests that will be used in data analysis as this will affect the layout of the research items (e.g. in a questionnaire), and the computer package that are available for processing quantitative and qualitative data e.g. SPSS.

3. QUALITATIVE AND QUANTATIVE DATA

The terms 'qualitative' and 'quantitative' are research approaches. **Qualitative** approaches involve the collection of extensive narrative data in order to gain insights into phenomena of interest; data analysis includes the coding of the data and production of a verbal synthesis. **Quantitative** approaches involve the collection of numerical data in order to explain, predict, and /or control phenomena of interest; data analysis is mainly statistical. Qualitative data involves primarily induction while quantitative data involves primarily deduction. If hypotheses are involved, a qualitative approach is much more likely to generate them whereas a quantitative approach is much more likely to test them.

3.1 Data Analysis

The researcher needs to consider the mode of the data analysis to be employed whether or not it has a specific bearing on the form of the instrumentation. For example, it is important to plan the layout and structure of a questionnaire survey very carefully in order to assist data entry for computer reading and analysis; an inappropriate layout may obstruct data entry and subsequent analysis by computer. The planning of the data analysis will need to consider a) what needs to be done with the data when they have been collected, b) how will they be proceeded and analyzed? c) how will the results of the analysis be verified, cross-checked and validated?

e. Presenting and reporting the results

Presenting and reporting of the research and its results need proper planning of data analysis. There is some general consensus that when writing up research the aim is to:

- Give the abstract of the research
- Explain the purpose of the research
- Give review of the literature
- Describe how the research was done
- Present the results
- Discuss and analyze the findings
- Reach conclusions

Decisions here need to be considered:

- How to write up and report the research?
- When to write up and report the research (e.g. ongoing or summative)?
- How to present the results in tabular or written- out form?
- How to present the results in non-verbal form?
- Vital information to be included when writing up research.

3.2 Data collection and analysis of the present study

A longitudinal study was carried out over the period of one month on 27 experienced university teachers from natural sciences, social sciences and humanities selected randomly from all over Pakistani universities. First the subjects were examined in the beginning of Research Methodology Workshop to find out their existing knowledge on research design, and later how much learning has taken place after the completion of the workshop. The subjects were also asked to give assessment about their resource person. For the purpose of the study, all the subjects completed the same writing task before the Workshop and one month later, at the end of the Workshop. The scoring pattern for rating the mini research project from 1 to 5 (5 for the strongest and 1 for the weakest) was used. Adapting the scoring criterion given by Jacobs et al, (1981), ratings were assigned for five criteria:

4. RESULTS

The pre- and post-test ratings given to the research projects produced by the 27 subjects were compared along with the average scores in both tests which is shown in Fig 1 below.

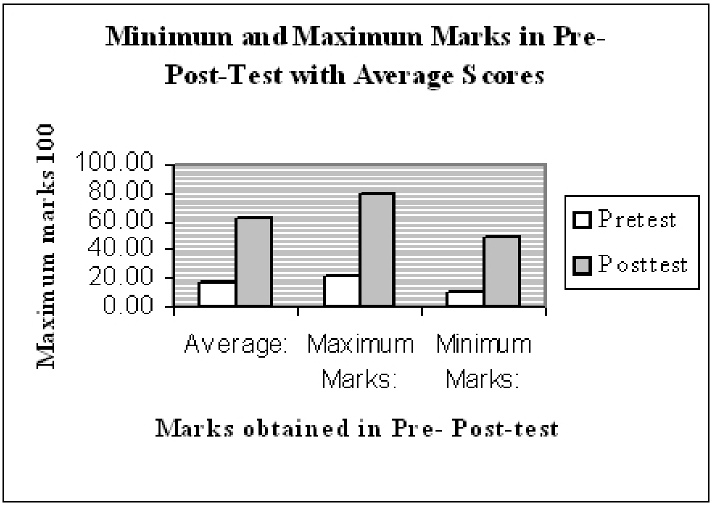


Figure 1 is spelled out in detail in Table 1 below for convenience

Minimum and Maximum % Marks in Pre - Post - Test

Table 1 **P <.01

	Pretest	Posttest
Maximum Marks:	**22.00**	**80.00**
Manimum Marks:	**10.00**	**50.00**
Average:	**17.40**	**63.38**
Standars Deviation:	**1.64**	**4.07**

Fig1 and Table 1 shows the significant difference between the scores of Pre- and Post-Test which answers our research question (a & b), that is, how much knowledge the doctoral students have about research procedure before and after the taught course of Research Methodology? In Pre-Test maximum and minimum per cent scores are abstract, statement of the problem/background information, review of the literature, methodology, data collection and discussion. The two raters scored each research project independently. The final score for each research project was then calculated by recording the mean of the two raters' scores. 22:10 as compared with the Post-Test which are 80:50 with the average marks 17.40 in Pre-Test and 63.38 in Post-Test. Descriptive statistics from t-test were available for a total 27 subjects. Means for the pre- and post-test ratings are presented in Table 2 below.

Comparisons of pre Test and Post Test Mean Scores

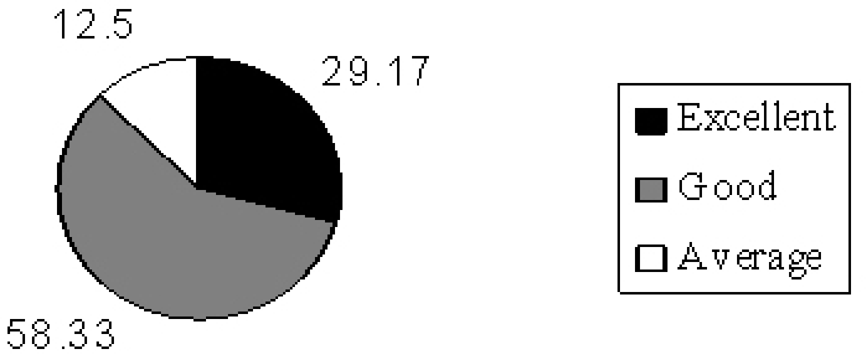
Table 2

No. of Participants	Excellent	Good	Average
27	29.17	58.33	12.50

t-test was conducted to compare the pre- and post-test scores. t (26) = -30.706, p=0.000. The result was significant at α = .01. This test failed to provide the evidence that the mean scores of pre-test and Mean score of post test are same.

The results on the significance of the Research Program show that the participants of the program developed their understanding of research methods, and overwhelmingly endorsed the program. The results are shown in Fig 2 below.

Percentage of Response for Program Evaluation



The Figure 2 is given in Table 3 below for convenience.

Percentage of Response for Program Evaluation

Table 3

Test	N	Mean	SD	SE	t -value
Pre Test	27	8.70	1.64	.32	-30.71**
Post Test	27	31.69	4.07	.78	

Table 3 and Figure 2 show that out of 27 participants, 29.17 % participants rated the program an excellent effort of Higher Education Commission whereas, a majority 58.33% of the participants declared the program as a good attempt of HEC. Overall 87.50% favoured the program, where as only 12.5% of the participants rated it as an average program. The empirical data also show that a profound demand of participants to introduce such research and development crash programs to raise the quality of research in the country. They unanimously believe that lack of research knowledge hamper the faulty further progress in the main stream of overseas and indigenous publications.

5. DISCUSSION

The statistical data of the study show that the teaching research methodology has its advantages over the traditional approach where students start doing research on their own without knowing the scientific ways of conducting research. Considering the teaching process as a whole, we can see that it stimulates the researchers' thinking and enables them to create ideas and organize the raw materials in a logical order. Essentially writing up in an organized way is a methodological research. This is an absolutely necessary stage at which researchers should have prior knowledge and skills to apply to the writing to find out what knowledge they already obtain and what they still need. Also, by classifying research as abstract, statement of the problem, literature review, methodology, results and discussion, the researchers can arrange their research ideas into proper categories to contribute something new.

6. CONCLUSION

The findings of the study imply that the teaching research methodology was effective in improving the quality of research. The results have shown a significant difference of knowledge between pre- and post-test. The findings of the study have approved the research questions and shown a significant difference in achievement before and after the tests. The study recommends that in order to improve quality in research, the taught course work should be implemented compulsorily before conducting the actual research. The teachers should change their attitudes towards the research. Instead of expectations, teachers should focus on teaching their researchers how to conduct a scientific research providing their researchers with opportunities to interact with each other. It is a universal fact, now hardly disagreed with by any one that any nation in the world, which ruled the world, did so just by virtue of its excellent system of research available to its people in general. And if Pakistan wants to make any significant positive impact internally in the country or externally on the world affairs, the only course to follow is to have a comprehensive and meaningful system of research to all researchers indiscriminately. This is particularly significant when the researchers lack research knowledge. By controlling and monitoring the on-going research, the researchers will inevitably produce quality in their work.

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MATHEMATICS PROBLEM SOLVING ASSESSMENT TEST

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ABSTRACT

Evaluation of students programming skills involves various measures including mathematical problem solving skill. The Mathematics Problem Solving Assessment Test (MPSAT) attempts to help students and lecturers of introductory programming courses to evaluate student's mathematics problem solving skills prior and after attending an introductory programming course. Offering a single-time registration and quick assessment, development of MPSAT has considered various aspects including the type of questions, timing of assessment, scoring guide and the development method. MPSAT is written for Windows platform using PHP and Javascript. The preliminary test and post test, each consists of 40 questions are intelligently selected from the database. Automatic result and performance analysis adapting the six strands of California High School Exit Examination (CAHSEE) Mathematic Release Test, offers prompt evaluation on the student's performance in mathematics problem solving.

Keywords:
Computer Science education, mathematics problem solving, introductory programming

1. INTRODUCTION

Mathematics problem solving is one of the basic skills needed by students in programming course, but there is no specific test conducted yet to evaluate the level of mathematics problem solving skills among introductory programming students. Objective of the project is to implement an automated Mathematics Problem Solving Assessment Test (MPSAT) to evaluate student's mathematics problem solving skills. MPSAT will be administered once in the beginning of the semester, and once at the end of semester. Results of both tests should be compared and analyzed by the system to see whether the introductory programming course assist student's performance in mathematics problem solving skills. Lecturers can also apply learning and teaching strategies based on the diagnostic information as well as improve awareness. Krulik and Rudnick, (1996,1995), Repenning and Sumner (1994), and Langley and Rogers, (1996) defined problem solving as process of understanding a problem and come out with a means-end analysis. Programming is about writing step by step instructions to solve a problem. Studies on Mathematics in computer course have been studied by many researches. Stein (1998), Kelemen, etc (1999), Gudzial, (2003), Kaplen, (2004) and Assiter (2005)studied the relationship between mathemathics problem solving and computer science. Kelemen, etc. (1999) highlighted the adoption of mathematics in programming including use of De Morgan's prepositional rules to solve the negation process in if and if-else statements. Assiter (2005) observed that students who use mathematics in the form of formal methods (symbols and notation, logical precise reasoning, using patterns, problem analysis, modeling, abstraction, generalization, understanding software) developed better software than those who do not. Web-based assessments allow students to have independent practice and self-evaluation. Brusilovsky and Pathak (2002), Dreher and Williams (2004) and Sosnovsky (2004) explored the development of automated web based test instruments. Nguyen and Kulm (2005) conducted a study on 95 students from two different middle schools in Southeast Texas. Prior to the study, all students took mathematics pre-test and at the end of the study, they took mathematics post-test. From the survey results, 94% preferred web-based over paper-and-pencil practice (Nguyen and Kulm, 2005).

2. CRITERIA OF MPSAT

Mathematics Problem Solving Assessment Test MPSAT utilized the same strands used in California High School Exit Examination (CAHSEE). CAHSEE was administered to high school diploma students from California public schools. All questions on the CAHSEE was evaluated by committees of content experts, including California educators, teachers, and administrators, to ensure the questions' appropriateness for measuring the designated California academic content standards in mathematics. Following the actual implementation in CAHSEE environment, the Mathematics Released Test includes statistics, data analysis and probability, number sense, measurement and geometry, mathematical reasoning, and algebra. Table 1, lists each strand, the number of items that appear on the exam and the total number of released test questions.

Table 1: Questions Distribution

Strand	No. of Questions on CAHSEE	No. of Questions on MPSAT	No. of Questions on Database
Number Sense	14	7	29
Statistic, Data Analysis, and Probability	12	6	23
Algebra and Function	17	9	30
Measurement and Geometry	17	8	30
Mathematical Reasoning	8	4	35
Algebra I	12	6	17
Total	**80**	**40**	**164**

For convenient purposes, the MPSAT scoring guide was adopted from the Mathematics Problem Solving guide developed by Northwest Regional Educational Laboratory, Mathematics and Science Education Center. The categories include: conceptual understanding, strategies and reasoning, Computation and Execution, Communication and Insights. The MPSAT is specially designed to evaluate mathematics problem solving skills for introductory programming students in computer science program. To evaluate how this introductory programming course has assist students in their mathematics problem solving skills, the students have to take two tests; pre test at the early of semester and post test at the end of semester. In this way, students result of both test can be compared and analyzed to see if their mathematics problem solving abilities have improved after completing the introductory computer programming course MPSAT consists of 40 objective questions for each test These 40 questions are selected randomly according to their strand from the total of 164 questions available in the database (refer Table 1). All 164 questions are from available online databases and adopted into MPSAT, each question is given a unique code so that it is easier to manage. The code begins with two alphabets or numbers, which represents the question's strand, followed by two numbers to differentiate questions from the same strand. MPSAT scoring guide is divided into 4 levels, which are Emerging, Developing, Proficient and Exemplary. The levels were specified based on Scoring guide by Northwest Regional Educational Laboratory, Mathematics and Science Education Center. There are 4 levels of score, which are:

1. 0 - 42 (Fail)
2. 43 - 58 (Pass)
3. 59 - 72 (Proficient)
4. 73 – 80 (Advance)

Two Computer Assisted Assessment (CAA) are included in MPSAT; the calculator and the scoring assistant. The on screen calculator feature enables the student to calculate faster in order to solve the mathematics problem of the questions. MPSAT also provide students with automated scoring with detail report on pre test and post test results as well as performance analysis instantly after each test. MPSAT architecture consists of three layers which is data layer, application layer and presentation layer. In data layer, 164 CAHSEE questions from six strands are inserted into MYSQL database. Then, in application layer, these questions are selected randomly according to their strand. 7 questions is selected from Number Sense (NS), 6 from Statistics, Data Analysis and Probability (PS), 9 from Algebra and Functioning (AF), 8 from Measurement and Geometry, 4 from Mathematical Reasoning (MR) and 6 from Algebra I (1A). In presentation layer, all these selected questions are displayed as a set of 40 questions in MPSAT.

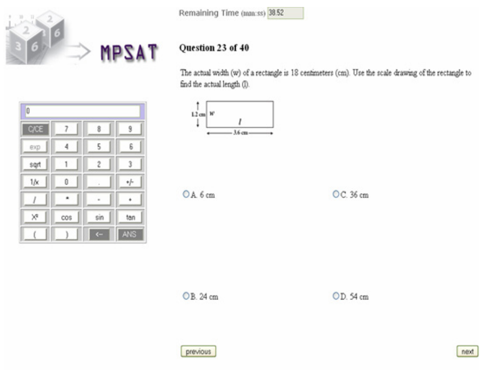

Figure 1: Test Interface

3. DEVELOPMENT OF MPSAT

The development technique is concerned with producing useful MPSAT development technique that are produced economically, implemented in the actual educational environment of Computer Science program and can be used by a large number of students to justify the continuing assessment and learning activities in this field. MPSAT offers several features for student and administrator as the user including registration, password authentication, test generator, result analysis, and question maintenance. Pre test and post test result analysis gives the details of student's pre test result consists of total score for pre test, level and description of mathematics problem solving skills, Percentage of correct answer for each strand. Performance analysis provides detail comparison on post test and pre test results as well as overall mathematics problem solving skills comparison, bar chart of pre test and post test total score, and comparison of correct answer for each strand.

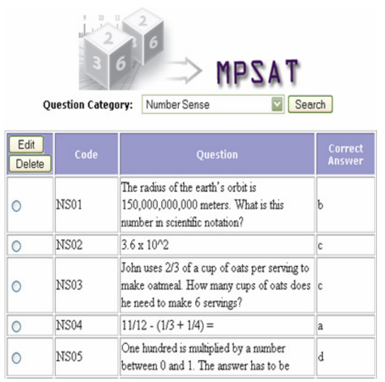

Figure 2: Question Maintenance Page

Administrator can view or search available questions in the database, add new questions and edit or delete existing questions from the database. The example of question maintenance page is shown in Figure 2. MPSAT runs on MYSQL 5.0.24a server. PHP and JavaScript played a major role as programming language used in MPSAT.

4. SUMMARY

MPSAT is a web based mathematics problem solving tool that consists of 40 questions from six strands, which are selected randomly from a set of 164 question from the database. Student is given 30 minutes to answer all questions. For the scoring guide, MPSAT use the combination of CAHSEE Raw Score and Scale Score Conversion and Mathematics Problem Solving Scoring Guide from Northwest Regional Education Laboratory. MPSAT runs on MYSQL 5.0.24a server while PHP and JavaScript played a major role as programming language. MPSAT can be administered to computer science student as a pre test at the early of semester. Then, at the end of semester, student needs to take the post test and MPSAT will compare the results of both tests

5. RECOMMENDATIONS

There are many opportunities for future research in this area. Functional testing should attempts to find errors such as incorrect or missing functions, interface errors or error in data structure. A future study should be conducted to test whether it really meets the actual requirement of introductory programming students in computer science program.

6. CONCLUSION

MPSAT allows lecturer and course coordinator of introductory programming course to rapidly and reliably measure the mathematics problem solving skills of their students as a formative and summative assessment tools. As a result, more effective teaching skills can be apply in order to helps students to develop their mathematics problem solving skills and at the same time gain deeper understanding on how to get excellent result in the programming course.

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EVALUATION OF A WEB-BASED MATHEMATICAL PROBLEM-SOLVING COURSE USING A CONSTRUCTIVIST APPROACH

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ABSTRACT

This study was conducted to investigate the effectiveness of teaching a mathematical problem solving course via the Web using a constructivist approach. A total of 37 teacher trainees at teacher training institution were sampled. The participants were required to solve authentic mathematics problems in small groups of 4-5 participants based on the Polya's Model via e-conferencing in a Web-based course. The findings showed that there were no significant changes in the participants' attitudes toward mathematics, while the participants' skills in problem solving for "understand the problem" and "devise a plan" based on the Polya's Model were significantly enhanced, though no improvement was apparent for "carry out the plan" and "review." The findings also showed that there were significant improvements in the participants' critical thinking skills. Furthermore, participants with higher initial computer skills were also found to show higher performance in mathematical problem solving as compared to those with lower computer skills. However, there were no significant differences in the participants' achievements in the course based on gender.

1. INTRODUCTION

The Web represents the second wave of digital revolution that began with the introduction of personal computers in the 1980s (Wilson and Lowry 2000). Worldwide, educational institutions are increasingly using the Web as tools for teaching and learning (Downing 2001; McIsaac and Gunawardena 2001; McKimm, Jollie and Cantillon 2003). In Web-based learning, computer mediated communication (CMC) is commonly employed to facilitate social constructivist learning. According to Gunawardena, Lowe and Anderson (1997), CMC denotes the exchanges of messages between groups of course participants through the use of computer network with the aim to discuss topics of similar interests. CMC comprises emails, Usenet, e-conferencing, which could be supported with audio and video connections (Adrianson 2001). Seng, Chun, Siew and Wettasinghe (2003) propose that CMC competency is one of the important skills to be mastered by the new generation of teachers. Research on teaching and learning using the Web and e-conferencing are still ongoing. However, most of these studies especially those in the local set ting appear to concentrate more on application than theory (Hong 2002). Hence, more research in teaching and learning using web-based environment and e-conferencing ought to be con ducted. This research endeavors to contribute to the literature, especially in the local context.

2. RESEARCH OBJECTIVES

This study investigated if Web-based constructivist learning environment would enhance mathematical problem solving skills, critical thinking as well as students' attitudes toward mathematics. It also studied the impacts of demographic characteristics such as gender and levels of initial computer skills on achievements in the course. A Web-based course on mathematical problem solving with e-conferencing component was developed using a constructivist approach. This mathematical problem solving course is a requisite for the Bachelor Degree in Primary Education (PISMP) Program for participants with the equivalent of GCE "A" entry-level and the Diploma in Education Program (KPLI) for participants with degree qualification entry-level offered by the Department of Teacher Education, Ministry of Education, Malaysia.

3. LITERATURE REVIEW

Problem solving is an important component of mathematics education. Researching based on Polya's Problem Solving Model (1981), Lau, Hwa, Lau and Limok (2003) reported that students' achievements deteriorated sig nificantly with increase in the difficulty level of the mathematics problems assigned to them. Furthermore, Brown (2003) found that teachers generally possessed positive attitudes toward problem solving but were rather weak in their abilities to solve problems. Kosiak (2004), in his research on the quality of online mathematical communication, reported that collaborative mathematical problem solving has a positive impact on mathematics achievements. Dockrill (2003) found that students perceived interactive teaching and learning approaches as facilitating the acquisition of critical thinking skills. In general, Web-based teaching has shown potentials in promoting thinking skills (Saba 2000). Utsumi and Mendes (2000) demonstrated significant differences in attitudes toward mathematics based on variables such as types of schools, stage of schooling, age, students' understanding of mathematical problems solved in class, and students' achievement in mathematics. Vaughan (2002), on the other hand, reported that cooperative learning methods improved students' attitudes toward mathematics. Carter (2004), however, found that the use of Web-based learning did not result in significant improvement in achievements and attitudes toward mathematics. Hong (2002) obtained similar results in terms of attitudes toward statistics course. However, Kinney, Stottlemyer, Hatfield, and Roberston (2004) came to the opposite conclusion. Hong (2002) concluded that gender was not significantly correlated with Web-based learning, although there are studies that reported otherwise (Fredericksen et al. 2000). Findings on the relationship between computer competency and achievements were likewise contradictory (Wen and Truell 2002; Hong 2002). Orr (2001) also stated that findings on students' achievements with respect to Web-based learning compared to classroom-based learning were inconclusive.

4. RESEARCH METHODOLOGY

The study employed the pre-experimental approach without the utilization of control groups (Creswell 1994). Figure 1 shows the research design of the study.

$$O_1 O_2 O_3 \longrightarrow X \longrightarrow O_4 O_5 O_6$$

Figure 1: Research Design

O_1 O_4 : Mathematics achievements test

O_2 O_5 : Questionnaires on attitudes toward mathematics

O_3 O_6 : Questionnaires on competencies in mathematical problem solving

X : Web-based mathematical problem solving course

Quantitative data were collected using questionnaires and tests. The participants were also interviewed. The quantitative data were analyzed statistically while the qualitative data were analyzed using content analysis.

4.1 Participants

The participants of the course comprised of trainee teachers majoring in mathematics education at the Batu Lintang Teacher Institute. Thirty seven trainee teachers were randomly selected from the July 2004 and January 2005 intakes. Eleven of the participants were female and 26 were male, all of them were between 20-30 years of age.

4.2 Web-based mathematical problem solving course

The course aimed to provide trainee teachers with the skills to solve mathematical problems based on Polya's Model. The participants were required to follow the course via the Web without face-to-face interactions between the facilitator (second author) and the participants. All communications were done through e-conferencing. The course consisted of three units - Unit 1: Introduction to problem solving; Unit 2: Mathematical problem solving process; and Unit 3: Problem solving strategies. Unit 3 is further divided into four subunits encompassing strategies such as using tables, drawing diagrams, elimination and working backward.

The constructivist learning environment in this Web-based course was developed based on Jonassen, Peck, and Wilson's Model (1999) as shown in Figure 2. This model enabled the course participants to be actively involved in meaningful learning and had five characteristics, i.e., active, constructive, intentional, authentic and cooperative. Course materials were uploaded to the Web to allow access at any time. The participants were required to have group discussions for the given assignments and had their works uploaded into a public forum to be discussed by participants from other groups. Assessments were done at the end of the course through a mathematical problem solving test.

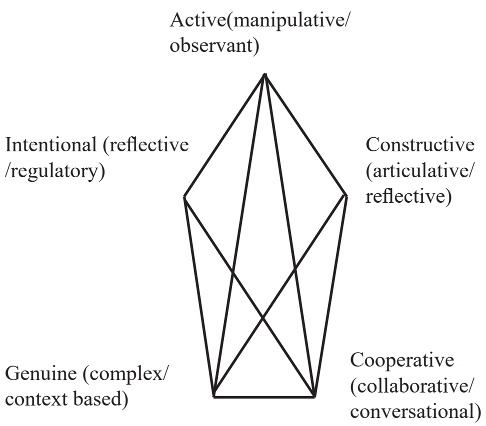

Figure 2: Model for constructivist learning environment

4.3 Research instruments

Collection of data was done through a mathematical problem solving performance test (to measure mathematics achievement, problem solving and critical thinking skills); a questionnaire to determine participants' initial computer and Web skills; a questionnaire on participants' mathematical problem solving skills; and a questionnaire (Aiken Revised Mathematics Attitude Scale) that measures participants' attitudes toward mathematics. The mathematics test and questionnaires were administered to the participants before and after the Web-based course. Follow-up interviews were carried out with the participants at the end of the course.

4.4 Data analysis

The participants' scores and responses to the test and questionnaires were computed and compared using independent and dependent t-tests.

5. RESULTS

5.1 Attitudes toward mathematics

Table 1 shows that there was no significant improvement in attitudes toward mathematics before (pre-test) and after (post-test) completing the Web-based course ($t(36)=1.75$, $p=0.089$). However, the means for the pre-test ($M = 82.65$) and post-test ($M = 84.84$) indicated that the participants had positive attitudes toward mathematics.

Table 1: Dependent t-test results: Attitudes toward mathematics

	M	SD	t-value	df	p-value
Pre-test	82.65	12.33	1.75	36	0.089
Post-test	84.84	10.26			

Note: Scores of 60 to 100 on the Aiken Revised Mathematics Attitude Scale indicate positive attitudes toward mathematics

The participants perceived the course as being able to enhance their confidence and motivation to learn mathematical problem solving as indicated by the following response during the interview:

> *After the course, I am more motivated to solve mathematical problems using the various methods. I am interested in problem solving in mathematics. Indeed, I would be using mathematical problem solving in my daily live.*

5.2 Critical thinking skills

On critical thinking scores, the pre-test mean score was 48.16 from a total score of 79. This showed that the participants' critical thinking skills were generally low. The mean score for the post-test was 55.14 indicating Note: Scores of 60 to 100 on the Aiken Revised Mathematics Attitude Scale indicate positive attitudes toward mathematics

Table 2: Dependent t-test results: Critical thinking skills

	M	SD	t-value	df	p-value
Pre-test	48.16	15.06	5.52	36	<0.0005
Post-test	55.14	13.33			

The interview data also showed that the participants believed that the Web-based mathematics problem solving course created opportunities for them to think logically, systematically and critically:

The e-conference was collaborative in nature. We can discuss and assist each other to understand and solve mathematical problems.

5.3 Mathematical problem solving skills

The results in this section refer to Polya's four-steps of problem solving. As shown in Table 3, the mean scores for "understand the problem" before (M = 8.09) and after (M = 8.47) attending the Web-based course were satisfactory. For "devise a plan", the mean score of the participants before attending the course was 7.68 and this score indicated moderate level of competency. The mean score after attending the course was 8.02 showing that the level of competency improved to satisfactory. Scores for the participants before and after attending the course for "carry out the plan" and "review" were between 7.38-7.86. These scores indicated that the participants' skills in "carry out the plan" and "review" were just at the moderate level. There were significant improvements in the problem solving skills of "understand the problem" (t(36)=2.25 and p=0.031) and "devise a plan" (t(36)=2.30 and p=0.028). However, there were no significant increases in the mathematical problem solving skills for "carry out the plan" and "review".

Table 3: Dependent t-test results: Problem solving skills.

		M	SD	t	df	p-value
Understand the problem	Pre-test	8.09	1.06	2.25	36	0.031
	Post-test	8.47	0.89			
Devise a plan	Pre-test	7.68	1.06	2.30	36	0.028
	Post-test	8.02	1.02			
Carry out the plan	Pre-test	7.38	0.84	1.61	36	0.116
	Post-test	7.68	0.99			
Renew	Pre-test	7.66	0.98	1.18	36	0.244
	Post-test	7.86	1.10			

5.4 Demographic characteristics and course achievements

Table 4 shows the independent t-tests results. There were no significant differences in course achievements based on gender (t(35)=0.41, p=0.686). However, the achievements of the groups which had low and moderate initial computer skills differed (t(35)=3.548, p=0.001).

Table 4: Demographic characteristics and achievements

		M	SD	t	df	p-value
Gender	Male (n=11)	7.18	7.12	0.41	35	0.686
	Female (n=26)	8.35	8.25			
Initial computer skills	Low (n=16)	3.44	3.18	3.548	35	0.001*
	Moderate (n=21)	11.48	8.60			

*Note : * Significant at p < 0.05*

6. DISCUSSIONS

6.1 Attitudes toward mathematics

The findings showed that there was no significant improvement in attitudes toward mathematics. However, findings from the interviews showed that 81.1% of the participants believed that the course was challenging, stimulating and fun for them. The participants also showed positive attitudes toward mathematics. The results of the study indicated that Web-based courses may not necessarily change participants' attitudes toward mathematics; consistent with the results reported by Carter (2004) and Hong (2002).

6.2 Critical Thinking Skills

The outcomes of the study suggested that the course succeeded in enhancing critical thinking skills amongst the participants. The course participants felt that the course gave them the chance to think deeply, logically and systematically, and helped to generate critical thoughts. This finding was consistent with those reported by Lim (2003). The use of authentic problems, e-conferencing and various tools in the Web-based course such as external links to relevant sources enabled the participants to gain new knowledge and they were able to restructure their knowledge scheme. As Chrenka (2001) pointed out, the constructivist framework for learning enables students to restructure their thinking by assisting them to think in increasingly complex ways on the multiple perspectives of a problem and the problem solving process.

6.3 Mathematical problem solving skills

The results showed that there was a significant enhancement in the mathematical problem solving skills of "understand the problem" and "devise a plan" based on the Polya's Model. The participants' skills in "understand the problem" was good before attending the course and it improved further upon completing the course. On "devising a plan", the skills of the participants were at moderate level prior to the course, and they were good at it upon completing the course. There were no significant changes in "carry out the plan" and "review". However, data from the interviews indicated that most participants showed higher interests and motivations toward problem solving in mathematics. Although the participants felt that the problems given were difficult and challenging, they were able to use appropriate strategies to solve them. The participants were able to solve the problems at their own pace and collaborations among participants helped in the problem solving process.

6.4 Demographic characteristics and course achievements

There were no significant differences in achievements in the Web-based course based on gender, consistent with the findings of Hong (2002) and Wang and Newlin (2002). There were, however, significant differences in achievements based on the participants' existing computer skills. The achievements of the participants with moderate computer skills were higher than those with lower computer skills, consistent with the findings of Wang and Newlin (2002), as well as Wen and Truell (2001).

7. CONCLUSIONS

Generally, Web-based courses could successfully enhance participants' course achievements, critical thinking skills and two of the four mathematical problem solving skills (Polya's Model). Participants' existing computer skills could impact on their success in a Web-based course. However, gender is not a factor that could influence success in such courses. The outcomes also suggest that the participants need to be exposed to the use of softwares such as "equation editor", scanner and mathematical graphing software. These computer skills are able to lessen participants' uneasiness in learning through Web-based courses and serve to enhance their confidences as well as motivate them to learn in this new environment. Furthermore, Web-based/ e-conferencing facilitator should ensure that there are interactions among the course participants during the active period of e-conference by giving guidance and moral support to the participants. Additionally, software to monitor participants' involvement in Web-based courses and e-conferencing (such as frequency and length of involvement as well as the web pages accessed by the participants) could be made available to assist facilitators ensure that all participants actively collaborate in the learning activities.

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AN EVALUATION OF A MODEL FOR AUTOMATED ASSESSMENT OF INFORMATION SYSTEM STUDENTS' CONTRIBUTIONS TO INTERNET FORUM

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ABSTRACT

Students collaboration via discussion in an Internet forum when working on a project for Information Systems (IS) courses is common in Malaysia. Assessing students' contributions to Internet forums has become important. However, manually assessing students' contributions to Internet forums is a time consuming task. A model was proposed to help IS educators in assessing students' contributions to an Internet forum. This paper reports on the evaluation of the proposed model incorporated into an Internet forums to generate performance indicator scores for students' contributions. The evaluation was carried out in Malaysia. The evaluation results show that the assessment model can be used to predict IS students' marks for their contributions to Internet forums.

1. INTRODUCTION

In order to obtain degrees especially in IS courses, project or assignment is one of the essential component that students have to complete. Students discussed their learning issues in Internet forums when working on a project or assignment is common for IS courses. Student discussion in an Internet forum is important as it is difficult to schedule for regular project meeting and discussion shall not be limit to project meeting. In an Internet forum, each student can view another student's contributions and providing feedback to one another online. The process of reflection and articulation of content, writing about what they have learned, engages students in an activity-based learning experience. Permanent storage of messages in an Internet forum provides support for reflection. Moreover, educators do not usually provide much feedback for their students to complete their project (Helic et al., 2005). Assessing students' contributions to Internetforums has become important. The two main reasons for assessing students' contributions are that it encourages students' participation, and it allows students to focus on the given topics. Student participation is a key to effective collaborative learning (Hardless et al, 2001). This finding indicates that students need to be active participants in order to succeed. Besides, assessment criteria can served as a clear guide to students for learning outcomes and the expected quality of thinking and work, and as a means of aligning teaching and learning behaviours and goals (Ho, 2002; Jones et al., 2000). There is a number of assessment criteria stated in the literature such as assess students' performance based on total number of students' postings, total message length, timeliness of message, describing and categorizing postings using SCAFFOLD (Scale for Forums/Online Discussion Assessment) (Dringus and Ellis, 2004), content analysis using Henri's Analytical Model (Henri, 1992), and Garrison and Anderson's Practical Inquiry Model of Cognitive Presence (Garrison and Anderson, 2003). However, manually assessing students' contributions to Internet forums is a time consuming task as reported in literature. To reduce the workload of IS educators, a computer generated performance indicator (PI) is proposed.

2. OBJECTIVE

This paper reports on the results of the evaluation of a model for automated assessment of students' contributions to Internet forums for IS courses. The paper also presents the elements of the assessment models, the evaluation procedure and followed by the evaluation results.

3. AN ASSESSMENT MODEL

The objective of PI is to predict students' marks by analyzing the class messages posted by IS students in Internet forums. The PI is generated from four aspects: the quality of their work, the quantity of their efforts, the timeliness and the activeness of their participation. Four measures – message category, message length, message date and number of messages – are derived from the class messages to measure each assessment aspect respectively. The authors assume that quality of learning in Internet forums is revealed by the quality of the messages generated by a student. The category of a message is analyzed along SCAFFOLD to reflect the depth of knowledge of the author, so the message category could be an indicator for the learning quality. SCAFFOLD was adopted (as summarized in Table 1) since it is comprehensive and contains elements of higher order thinking skills, that is, 'analysis', 'synthesis', and 'evaluative', which are also the high levels of the IS knowledge metric. These high level of knowledge is important as IS academic community emphasized the importance of developing students' problem solving and critical thinking abilities as the exit characteristics of its IS. SCAFFOLD is build upon the theoretical foundation established in the literature. Dringus and Ellis summarised a range of participation indicators identified in the literature (including models for analyzing the process of learning in Internet forums such as Garrison, Anderson, and Archer's Practical Inquiry Model of Cognitive Presence, and Jeong's sequential analysis of group interaction and critical thinking in online discussion) and develop a list of 19 participation indicators (Dringus and Ellis, 2004). SCAFFOLD was used by faculty and students to rate the 13 postings contained in a discrete segment of a masters-level discussion forum in a multimedia systems course (Dringus and Ellis, 2005). The results of evaluation shows that SCAFFOLD could be used for developing and conveying feedback on Internet forums as the students and faculty members had a measure of commonality in interpreting the meaning of the 19 indicators and using the SCAFFOLD to describe postings in Internet forums.

Table 1 SCAFFOLD

The Contribution
Acknowledging: responded to another contribution
Analysis: provided analysis of the problem being discussed
Broadened: increased the scope of the discussion
Clarification: supplied or sought clarification as needed in responses
Closure: helped lead to a conclusion on a topic
Comprehensive: was complete, but not overly lengthy
Error Free: contained accurate information
Evaluative: was evaluative, assessing the meaningfulness or validity of ideas being shared
Originality: contained new ideas or approaches to the topic
Problem: identified a worthy problem related to the topic
Questioning: raised thoughtful questions about the
Reflective: interjected personal commentary or experiences
Resolution: promoted cooperation to resolve issues of debate or disagreement
Resources: exchanged useful resources with others such as links or citations
Social: conversational or social in nature
Solutions: suggested meaningful solutions
Summarizing: summarized the topic discussion overall
Synthesis: contained well formed, clear, connected, and synthesized ideas
Topical: was on topic

An approach to resolve the challenges of collecting and coding large data sets might be to directly involve students in a process of categorizing their own discussion in such context. Knowlton (2001) argues that "For the benefits of online discussion to be realized, students must have formal opportunities for self evaluation". Students must practice evaluating their own contributions to an online discussion against a clearly articulated set of criteria. Knowlton (2001) emphasized on the important of giving a minimum length for postings since it takes some length to construct perspectives that can become the basis of knowledge. Therefore, students' effort in the virtual dialogue could be reflected by the amount of words they post to the system. Message length measures a student's effort in the class and is found by counting all the words, no matter duplicated or not, in the student's messages. In terms of timeliness, due dates were best for stimulating the discussion online. It is important that messages are posted or reply on time (Knowlton, 2001; Pendergast, 2006). Student participation is a key to effective collaborative learning (Hardless et al, 2001). If posting a message is considered as one class activity, activeness of participation can be measured by message count, which is the number of messages posted by a student. Combining the assessments from multiple aspects has been proven useful for increasing the forecast accuracy (Winkler and Clemen, 2004). The authors apply the idea of weighting to assign weights to assessment criteria. The four measures are combined to compute a PI score, which is

PI score = a*Total message + b*Total message length + Message category + Timeliness;

Each message has a date. For timeliness, a message's date that fall before a given date (deadline for the discussion as provided by the educator) would be included for the calculation of the PI for each student. Then, the formula is

PI score = a*Tot_Mess + b*Tot_Length + SCAFFOLD;

'Closure', "error free", 'topical', 'solutions', 'comprehensive', 'originality', 'problem', 'reflective' were eliminated from the SCAFFOLD list as these items can be logically grouped and represented by other items in the SCAFFOLD list after the authors take into consideration the result of findings reported in Dringus and Ellis (2005). As a result, after replacing SCAFFOLD with it's elements,

PI score = a*Tot_Mess + b*Tot_Length + c* Count_ Acknowledging + d*Count_ Analysis + e*Count_Broadened + f*Count_Evaluative + g*Count_Clarification + h * Count_Questioning + j*Count_Resolution + k* Count_Resources + m*Count_Social + n*Count_Summarzing + p*Count_Synthesis;

Where
a, b, c, d, e, f, g, h, j, k, m, n, p are coefficients,
Tot_Mess – Total message posted by a member;
Tot_Length – Total message lengths posted by a member;Count_ Acknowledging – total count of 'acknowledging' messages posted by a member;
Count_ Analysis - total count of 'analysis' messages posted by a member;
Count_Broadened - total count of 'broadened' messages posted by a member;
Count_Evaluative - total count of 'evaluative' messages posted by a member;
Count_Clarification - total count of 'clarification' messages posted by a member;
Count_Questioning - total count of 'questioning' messages posted by a member;

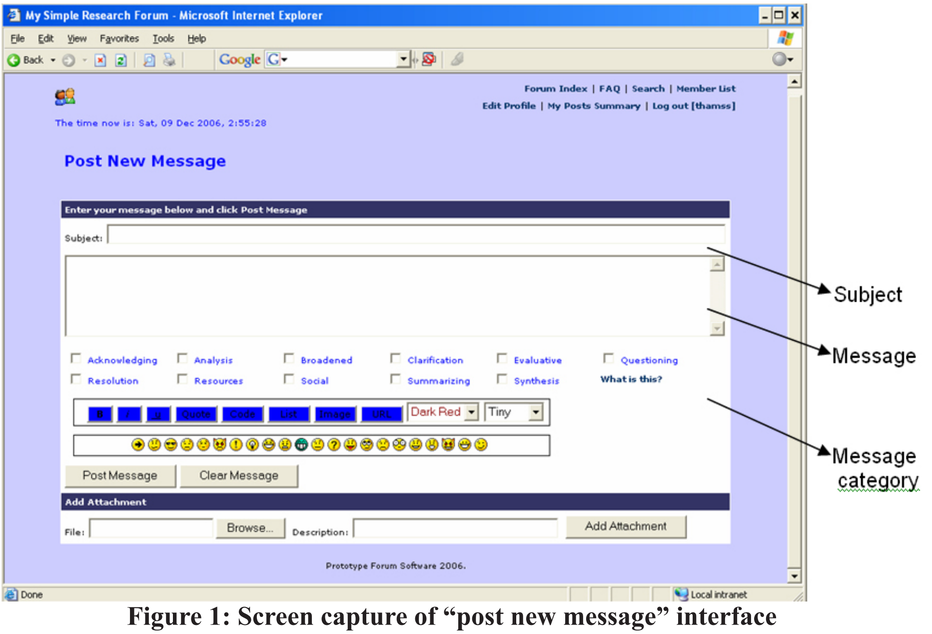

Figure 1: Screen capture of "post new message" interface

Count_Resolution - total count of 'resolution' messages posted by a member;
Count_Resources - total count of 'resources' messages posted by a member;
Count_Social - total count of 'social' messages posted by a member;
Count_Summarzing - total count of 'summarizing' messages posted by a member;
Count_Synthesis - total count of 'synthesis' messages posted by a member;

In order to implement a computer generated PI, open source forum software was adopted. After reviewing the list of forum software (Woolley, 2006), class-1 Forum Software is adopted in this research. class-1 Forum Software is written and distributed under the GNU General Public License which means that its source is freely-distributed and available to the general public. Using OSS approach, the authors do not need to redevelop the basic features available in existing Internet forum. The new feature that added to the forum software was self categorize posts. To implement the proposed features, SCAFFOLD checkbox is developed to allow members to categorize their message before posting as shown in figure 1. The new features that added to administrator interface were set performance indicators, and group performance statistics. To implement the proposed features, the forum software should enable administrator to set the coefficient for the criteria of the PI for each forum. Coefficients that can be set in a PI are total message, total message length, and each category of SCAFFOLD. Each criterion is given a coefficient to be filled in by an administrator. This feature allows the IS educator to select the preferred grading criterion as the criteria in the PI is and will remain, in a large way, a subjective option of the IS respondents. In mathematics, a coefficient is a constant multiplicative factor of a certain object (variable). A zero coefficient for a criterion indicates that the IS educator does not used it as a grading criterion. Criteria that have similar coefficient value means the criteria are equally important. A criterion that is preferred to use as grading criterion by the IS educator could be given a higher coefficient value. Students (members) have to categorize their own message before posting. Students can not edit or delete message after posting. IS educator can perform edition or deletion of messages. The IS educator can change the category of a message if found incorrect.

4. EVALUATION OF THE ASSESSMENT MODEL

The main purpose of the evaluation is to determine the accuracy of the assessment model in predicting student mark for their contributions to Internet forum. To measure the accuracy of the assessment model, Pearson product-moment correlations between the PI scores and the actual grades were calculated. The evalu ation of the forum software was conducted in the second semester of an academic year. Two IS educators from Faculty of Computer Science and Information Technology of the oldest university in Malaysia were agreed to participate in the evaluation of the forum software. Two IS courses (identify using ID = W1 and W2) with a total of sixty four students were involved in the evaluation. The students were taking IS courses that required them to complete a project; hence they had a suitable background for the evaluation. At the end of the project duration, all the IS students' discussions were compiled into tables. Each table contains posts detail such as posts' subjects, time and date of posts, and aggregate contribution of a student in the forum software. The compiled data files were sent to the two IS educators involved for assessment purpose. This is a common approach for manual grading. Three other IS assessors were contacted independently to assess students' contributions for both IS courses. All the assessors have more than six years teaching experience of IS courses. The assessors felt comfortable reviewing the discussion. The IS assessors who participated in the evaluation were considered as a representative sample of IS educators who may potentially use forum software for PBL in IS education. The forum software was available for the IS assessors (a total of five assessors) to view the learning context even though the student discussion was over. The projects' title and description were sent to the three assessors as well. The authors set the coefficients (c, d, e, f, g, h, j, k, m, n, p) of SCAFFOLD to 1, a = 1 (which means 1 post is assessed as 1 point) and b = 0.01(which means 1 word is assessed as 0.01 point). This is because the IS assessors grading preferences were unknown. The criteria in the PI score are equally important in this case since they are given the same coefficient except for total message length. However, when the grad ing preferences are known, it is easy to adjust the coefficients to reflect the grading preferences. The same coefficients were set for the two IS courses throughout the evaluation. The Pearson product-moment correlations between the PI and the actual grades were calculated. Correlations between individual measures (except for timeliness) and the actual grades were also calculated as shown in Table 2 for W1 and Table 3 for W2. The results in the second column of Table 1 and Table 2 demonstrate that there is a high correlation between the PI and the actual grades (0.827 – 0.996). The results in each row of Table 2 and Table 3 demonstrate the correlation between the PI and the actual grades given by different IS assessors. According to a report in the es say grading literature, agreement between computer graders and human judges varies from 0.4 to 0.9 approximately, and that is comparable to or even better than agreement between two human graders. The results also show that, in most cases, PI performs slightly better than any of the three measures, that are total message count, total message length and SCAFFOLD.

Table 2 Correlations for IS course W1

	R(PI-G)	R(TM-G)	R(TL-G)	R(S-G)
Assessor 1	0.988	0.979	0.887	0.980
Assessor 2	0.852	0.806	0.905	0.857
Assessor 3	0.936	0.928	0.758	0.935
Assessor 4	0.885	0.900	0.797	0.863

Table 3 Correlations for IS course W2

	R(PI-G)	R(TM-G)	R(TL-G)	R(S-G)
Assessor 1	0.996	0.993	0.853	0.991
Assessor 2	0.930	0.923	0.905	0.926
Assessor 3	0.942	0.937	0.835	0.939
Assessor 4	0.827	0.789	0.901	0.848

Where
R(PI-G): correlation between the PI and the actual gradesR(TM-G): correlation between the total message count (TM) score and the actual grades R(TL-G): correlation between the total message length and the actual grades R(S-G): correlation between the SCAFFOLD and the actual grade

5. LIMITATIONS

During the evaluation period, the network in the university involved was not reliable towards the end of evaluation. This has caused redundant data (message) appear in the forum and data lost. The forum software evaluated the redundant data more than once. The evaluation only focused on two final year degree-level discussion forum in IS courses and five IS assessors were involved. It would not be prudent to over generalize the evaluation results.

6. CONCLUSION

In the evaluation of the accuracy of the assessment model, the authors found that the PI score generated from the model were highly correlated with the actual grades assigned by the IS assessors. The difference between the judgments of different IS assessors grading the same class independently is also low. It is reasonable to assume that such correlation is comparable to what has been reported in the automatic essay grading literature (Williams, 2001). Thus, the evaluation results suggest that the performance of the assessment model is comparable to, if not better than, that of a human instructor. Therefore, the computer generated PI can be implemented as a teaching tool to help IS educators obtain a reference to students' performance without reading through the huge amount of class messages, which is a tedious and intensive procedure. The tool could be employed as a supplementary grader to help IS educators make better judgments with reduced workload.

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ISSUES FOR COLLABORATIVE DEVELOPMENT OF LEARNING OBJECTS TO SUPPORT E-LEARNING

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ABSTRACT

Learning objects are interactive visualizations of program code which focus on a specific learning goal and have the competence to improve the current E-learning environment radically. By reducing the complexity in learning computer programming these e-modules help the learners to better understand and master, and the teachers to better explain and illustrate the problems connected to the use of basic and advanced structures in computer programming. On the other hand, collaboration is the keyword that summarizes recent trends in information technology, especially in the world of academe. When content is developed in a collaborative environment, its scope and sustainability are simply increased. In addition with the presentation of specialized learning objects, the issues and challenges associated with their development in a collaborative environment have been addressed in this paper.

1. INTRODUCTION

E-Learning has significant impact and invaluable contribution in the area of education and as a whole in human development (Garrison and Anderson. 2003). A learner can avail the opportunities to get enormous help regarding a subject matter with the support of e-learning modules. One of the most important aspects of e-Learning is the content. Content's selection, analysis, designs and presentation creates a comprehensive learning experience. As the e-learning contents can be accessed by a range of learners from various places, different cultural backgrounds, located in different countries, so the content should be selected and developed such that the content possesses appeal to the global community. If a suitable content can be identified, learning objects can be developed more effectively in a collaborative environment (AFLFa, 2004). Quality assurance can be accomplished with relative ease and efficiency. The University, where the authors are affiliated with, has become an active partner in a global e-learning program through the Codewitz Asia-Link Program (Codewitz, 2004). The goal is to plan, produce and evaluate unique illustration, animation and visualization aids for students and teachers of computer programming. Even if the use of visualizations has increased in introductory programming courses, the visualizations are still often not integrated in the teaching, the course content and the learning situations. With the partnership of Tampere Polytechnic of Finland, a four-party collaborative team developed a handsome number of learning objects which have already been integrated to the courseware. Experiments show that performance of the students learned using learning objects are quite better then the students who didn't use them. We organized the paper as follows. First we present the issues of collaborative content development that are identified during the project time which follows an illustration of the learning objects developed under the project. Finally, results of a survey conducted on the usefulness of the learning visuals are explained.

2. ISSUES ON COLLABORATIVE CONTENT DEVELOPMENT

The key issues and challenges associated with content development (Blinco 2004) are – content selection, language selection, technology selection, instigating and managing quality controls, systemizing activities and so forth. There are however particular issues associated with external arrangements and partnerships. Here we are presenting the major issues and challenges experienced in collaborative content development under the Codewitz Asia-link project.

2.1 Choosing the Appropriate Partners

Interactive visualization tool is both expensive and labor-intensive to create, so it makes sense to share the burden and the cost. The same topics are being taught across wide geographical area, which means that duplication of effort is taking place. If generic and reusable learning theme could be identified and produced, much time and effort could be spared. Thus the central issue in the collaborative content development is choosing the right partners. The partners should have the balanced skills and potentials to work in the collaborative environment. The range of skills which might be required includes technical expertise and project management ability. A general guideline (AFLFb 2004), which will describe the project requirement, expectations, deliverables and critical timelines in details can be prepared for all the partners. Project manager should play proper strategic role to achieve the best possible outcome. Project manager should have appropriate leadership ability to establish greater control over the project.

2.2 Content Selection

Relevance of the content is another vital issue. The subject-matter of the content should be timely and relevant so that it makes sense within the context of its environment. In general the content should have certain positive impact to the global community. For example, the problems in teaching and learning programming techniques are prevailing all over the globe. Learning programming logic is really tough without utilizing any visualization material. To improve the learning environment effective e-modules are therefore highly relevant in this age of ever growing development in IT sector. Under Codewitz Asia-link project, teachers of the partners' countries have exchanged visits to partners' countries and exchanged their views on teaching environment which eventually results in the development of learning objects. Learning objects have been incorporated in programming courses which enhanced the overall teaching and learning environment.

2.3 Content Language Selection

Learning in native language is the best way for learning. If the content is mostly technical or the targeted group of learners has prior knowledge on the content then the language issue may not be so crucial. Sometimes the topic is new and the learners are unable to understand the content developed in foreign languages. A more practical approach would then be to design the content with multilingual usability. This can be achieved through proper interface design, effective presentation mechanism based on different lingual perspective. The content must be designed in such a way that it is easy to translate to other languages.

2.4 Technology used to develop the Content

The content should be developed with appropriate tools so that it is effective for online learning. The development tools used to create the contents must be Unicode compliant and must support reading of external structured Unicode files. The content (text), for example, can be represented with XML and presentation can be created with Macromedia Flash, Shockwave or Applet environment. Flash has built in Unicode sup¬port and has rich XML support as well. This independence ensures the real reusability of the learning objects.

2.5 Developing the Contents

Effective content development requires close collaboration of the Instructor and the user Interface designer. If the content has to be interactive, the instructor is the best developer because of his/her familiarity with the content theme. Sufficient space must be kept during presentation design so that it can accommodate the content. Text output is desirable with scrollbars which enables expansion in screen area based on content without overflowing the screen. In case of multilingual interface provision should be kept for changing the font size so that appropriate outlook of the content can be made possible according to language selection. The key contents that should be presented on screen should be decided such that clarity and completeness of the learning objects are achieved. Presentation considerations should support the learners move to independent thinking as they become more familiar with the topic which is very important to do when learners are not in a face-to-face situation. Context sensitive learning support should be provided for students either in the content itself or in documentation.

2.6 Assuring quality in Content Development

It is quality which ultimately ensures the success of an e-learning program. A good e-Learning content should have following key desirable features:

- ✓ Extremely interactive and user-friendly
- ✓ Appropriate to learner type, needs & context
- ✓ Self-containing and self-explanatory visuals
- ✓ Step-wise instructions with animations
- ✓ Supporting audio-video files
- ✓ Troubleshooting made easy
- ✓ Continual Improvement in the above

For collaborative developing environment, quality assurance is somewhat straightforward. Learning objects developed by the individual partners can be uploaded to a common web site. Technical persons from the partners' side can make comments on the learning objects. Based on the comments the developers have the opportunity to improve the quality of the learning objects.

2.7 Evaluating the Performance of the Learning Objects

Instead of using the learning objects as a separate learning environment on a web page, these should be integrated to the actual course materials. This allows the learners to gain the maximum benefit out of learning objects. Teaching using learning objects facilitates the evaluations of the contents where the students are asked to make comments on the appropriateness of the content and presentations. Teachers can the update the contents accordingly. Teachers can also arrange assessments on different group of students with/ without learning objects so that a picture of the content appropriateness can be obtained.

3. A PARADIGM OF COLLABORATIVE CONTENT DEVELOPEMENT

While there are numerous e-Learning solutions available today, the differentiating factors, i.e., the factors which help achieve a superior learning experience and motivation to learners, are the innovative instructional design and content development process. Effective content design should consider the accessibility, clarity, consistency, efficiency, focus, and flexibility of the content (Kheterpal S.). The concept of learning objects introduced in this paper shows clear potential as an e-Learning tool for learning various programming structures. Within the Codewitz network, the learning objects are defined as visual tools for learning that are browser capable, stand-alone, reusable, not linked to any other learning objects or resource and are focused on one specific learning goal (Codewitz, 2004). The developed learning objects are based on visualizing programming logics and suitable for exercising. The learning objects developed so far covered topics including looping, conditional branching, array, string, function, various topics related with data structures, algorithms, operating systems etc. The idea of the visual learning objects resembles with a debugger which shows step-by-step program execution in both forward and backward directions. The program-code is highlighted in each meaningful step of the program execution and the execution of statements is also visualized by arrows when necessary. Windows for console and memory area for illustrating the operations are shown for every step of program execution. An information window is also included for explaining the current step. The memory area is the only part where the layout can be changed according to the subject-matter of the underlying structure. These changes appear, for exam¬ple, in case of array when the structure of the array is visualized. A typical learning object on the use of if-else structure is shown in Figure 1. As can be seen in the figure, in addition to the output window, the learning visuals provide statement

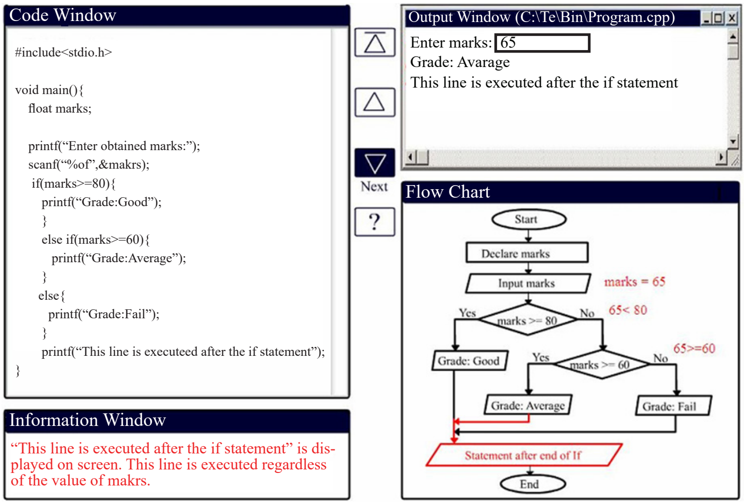
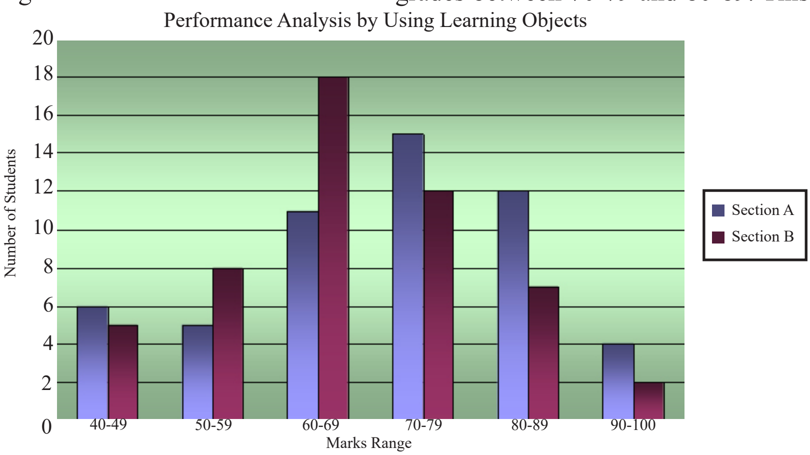


Figure. 1: A typical learning object on selection logic

4. SURVEY ON THE USE OF LEARNING OBJECTS

The study was conducted in Shah Jalal University of Science and Technology for Computer Engineering students who have two programming courses as major. The course "Structured programming language" is conducted in first semester using C language which typically covers the uses of selection logic, loops, arrays, functions, and structures. The course consists of lectures (2 hours/ week) and lab exercises (6 hours/week). Since the course is a first semester course students do not have prior programming experience. To evaluate the performance of learning objects, 105 sensitive information and execution-flow in separate windows. Different set of input can also be exercised by moving the flow of execution back and forth which gives an interactive learning environment to the students. students are grouped into two sections (Section A: 53 students and B: 52 students). The same instructor taught in both the sections. The students of Section A are taught using the aids of visual learning objects while the students of section B are delivered verbal lectures using traditional white board. The program visualization learning objects were also available for the students of Section A when studying at home. The students found the aids interesting as learning tools. The final grades obtained by the students of Sections A and B are shown in Figure 2. From the figure, it is quite clear that students using visual aids performed better than those without using the learning objects. An important insight in the figure is that a big number (30) of Section B students (without using visual aids) got grades between 60-69 and 70-79, whereas 27 of the Section A students got grades between 70-79 and 80-89. This shifting



5. CONCLUSION

This paper has focused on the potential of using visual learning objects for teachers and students of computer programming and on the issues and challenges experienced in a collaborative developing environment. Experiments have shown that of students using program visualization learning objects seem to get better grades than those without using such material. Since the amount of the students is not very large in this survey the next step would be to repeat the study with new groups of students. Finally, this is to say that the project has given an effective outline about handling any logical problems those are usually encountered in teaching and learning. Development of further learning objects can be aimed to other sustainable areas like science education in schools and colleges.

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