CHAPTER 1

INTRODUCTION

Background to the Study

The computer has been used as a tool in education since the early 1960s. It was initially used as a management tool by school administrators and later by teachers in the computer laboratories to teach computer literacy courses and also in the classroom as a teaching aid. In the late 1970s, inexpensive computers were introduced to schools in North America, which led to the use of a large number of computer-assisted-instruction (CAI) programs which were used for concept attainment and application, as well as remedial instruction. Subsequently, CAI was used as a technique to enhance thinking skills.

As computers became more widely used in schools and institutions of higher learning, research comparing computer-based learning and conventional teaching methods was conducted extensively. A series of meta-analysis carried out by the Kuliks (Kulik, Kulik and Bangert-Downs, 1985; Kulik, 1983 & 1986) found that students enjoy and learn more through CAI. CAI also promoted positive attitude towards learning and it saved 10-35% of instructional time as compared to non-computer based environments. Similarly, Roblyer (1989) in another meta-analysis, reported that computers had significant effects at all grade levels in student achievement, attitudes, dropout rate, and learning time. Robyler also discovered that computer use had the highest effect especially for science based content and was also effective for all other content areas except English as a Second Language.

The 1990s saw rapid technological advancements in computer hardware and software. Computers were running at a more powerful speed and storage

capabilities increased tremendously. It was not uncommon for computer software and hardware to become obsolete within a year of its introduction to the market. The capability of computers was further enhanced with the rise of interactive multimedia, telecommunications and the Internet. Educators who were aware of the power of the computer began experimenting with various ways in which it could be used in the classroom to affect different forms of learning. Interactive multimedia-based learning packages, advanced simulations and databases with search facilities were created to affect learner-centered learning principles. Thus the computer which was previously seen as another tool that could support what was taught in the classroom now played a more prominent role in the teaching-learning process.

In this regard, research on computer-based instruction began to examine the components or attributes of multimedia such as screen design, audio and animation. Szabo (1998) conducted an analysis of studies on the effect of audio, screen design and animation and found that generally, these elements did not improve learning significantly.

Presently, educators are being faced with increasing options and challenges for the delivery of learning materials using the computer such as providing learners with opportunities to create their own multimedia applications, collaborate with other students, explore interests and search for information from the Internet as well as to work with software application tools that make lessons more relevant and meaningful to them. The onset of the Information Age has laid various demands on the types of learning that should occur in the classroom. Concept attainment is no longer seen as a sufficient outcome of the learning process. Students should receive an education that emphasizes both depth of knowledge as well as thinking and reasoning. There is a growing belief that learners learn by constructing their own

knowledge, rather than receiving knowledge directly from teachers. Instruction based on this belief leads students to discover concepts and solve problems, instead of merely reading facts and then answering textbook questions or completing workbook exercises. Furthermore, according to Kadel (1992), this approach encourages thinking and not memorization, and cooperation rather than competition.

There is growing emphasis that schools should foster thinking. As thinking is closely related to how information is manipulated by students, the computer is seen as a tool that can benefit students. As a consequence, the last decade saw various research studies (Stuve, 1997; Polman, 1997; Cooperman, 1998) examining issues related to the active exploration and representation of knowledge, cooperative and collaborative learning, team-teaching, and how teacher beliefs affects teaching in an open networked system.

In Malaysia, early research efforts related to computers and teacher education and the effectiveness of computer-based instruction on students were mostly carried out by academics, graduate students and officials of the Ministry of Education. Among the studies related to teacher education include the design of multimedia applications to improve teacher's knowledge and attitudes regarding use of information technology (Aris, Abu, Ellington and Dhamotharan, 1998), training teachers to use software to build vocabulary for teaching of English as a Second Language (Gan, 1996), and use of e-mail as a resource for a teacher-education course (Maarof, 1998). More empirical studies were carried out at the school level to determine the impact of computers on learning. In one of the studies, Chan (1993) found that learners using a computer based learning package had higher posttest scores. In a more extensive study conducted by the Ministry of Education in 1992 with 15 primary schools, computers which were used in a pilot project

aimed at improving students' learning of mathematical concepts, showed an improvement in pretest and posttest scores over the six-month period (Mohamad, 1996).

Improving student thinking has been a recognized goal of Malaysian education since the introduction of the Integrated Secondary School Curriculum (KBSM) and the Integrated Primary School Curriculum (KBSR) in the mid 80s. Realizing the importance of developing thinking skills among students for the information age and the possible impact of computers on student thinking, the Ministry of Education of Malaysia initiated *The Smart School* project. The project is aimed at developing individuals who are knowledgeable, and have the capacity for dynamic, critical, and innovative thinking (Smart School Conceptual Blueprint, 1997). The most distinctive feature of the Smart School is teaching and learning which involves restructuring of the curriculum, pedagogy, assessment and materials. The curriculum is holistic in nature, enabling learners to progress at their own pace, fostering the skills and attitudes of reflection and encouraging the active construction of meaning. Emphasis is given to effective communication using Bahasa Malaysia as the first language and English as a second language. Also given prominence is the development of cooperative and collaborative learning and promotion of religious and universal moral values.

The pedagogy seeks to make learning more stimulating, motivating and meaningful by actively involving learners in the learning process. It is intended that learners will construct meaning individually, or by interacting with their peers. To accommodate the pedagogy, the teaching-learning materials are aimed to be "cognitively challenging and motivating by combining the best of network-based, teacher-based and courseware materials" (Smart School Blueprint, 1997, p. 21).

Assessment will be more criterion based and authentic to include anecdotal records, checklists, work examples and projects. It is envisaged that the computer and telecommunications technology will play an important role in the classroom wherein students will have access to the Internet and a variety of courseware.

While initial implementation of the Smart School pilot project is underway, it is still not clear how technology is to be integrated in the classrooms. There is a need for deeper understanding of how activities can be designed to allow children to think and learn in technology-rich environments. The present study is an attempt to provide some insights into how the ideas outlined in the Smart School Blueprint can be implemented. Specifically, the study explores the role of a web-based constructivist learning environment in enhancing higher-order thinking skills and the acquisition of content by students working cooperatively and collaboratively.

Rationale for the Study

The rationale for conducting this study is as follows: first, despite the theoretical ideals of a technology-based learning environment, the processes by which learners interact within these environments remain unclear. On the one hand, a web-based learning environment assumes a constructivist position on learning whereby learners construct their own understanding of information, concepts and facts by building upon existing knowledge available to themselves (Jonassen, 1991b). On the other hand, research initiatives in Malaysia have concentrated on comparing the use of the computer with traditional methods of teaching. Although the results of such research have been encouraging, it is imperative to investigate learners' interactions and communication within a web-based learning environment in order to determine its efficacy. It is also important to study the types of higher-

order thinking skills that can be enhanced in a web-based learning environment. Such investigations will enable educators to source effective ways of utilizing a web-based learning environment and to provide learners with appropriate and effective tools to enhance thinking and learning.

Second, within the structure of a web-based learning environment, learners are not isolated from their peers or teachers. Due to the fact that the computer provides a natural environment for communication among peers and between students and teachers, effective networks of teaching and learning may be developed within the classroom. It follows that the need to examine the nature of cooperative and collaborative interaction within a web-based learning environment cannot be overemphasized. One may be able to design tasks and instructional programs that will allow learners to communicate and learn from one another. Further, such investigations give practitioners insights into the types of learners who will benefit most from such programs.

Third, a major challenge for all educators is the implementation of programs that present the successful transfer or translation of theory to practice. The current study represents one such program, whereby the ideals of a technology-based learning environment and particular elements of constructivism are incorporated into a geo-science curriculum for primary school learners. The program has been designed to evolve over a four-week period so that a more practical model may emerge for implementation in other Malaysian classrooms. As this is an initial attempt to involve technology, constructivism, cooperative and collaborative learning in a primary school classroom in Malaysia, the study may serve to concretize various procedural and design facets of the program. In short, the study is aimed at procuring a more effective and practical model for teaching and learning within a web-based learning environment.

Purpose of the Study

The web-based learning environment was designed to provide opportunities for students to work cooperatively and collaboratively in solving various problems that required them to employ a variety of cognitive processes. This study examined the extent to which a web-based learning environment enhances the thinking and content acquisition of primary school children. The study first examined whether learners of different abilities improved in terms of content knowledge and higher-order thinking skills as a result of a web-based learning environment. Second, the study explored how the said environment supports cooperative and collaborative learning among learners of different ability. Third, the study sought to evaluate the design of a technology-based program with respect to teacher role. Fourth, the study sought to determine learners' perceptions of a web-based learning environment. Specifically, the study aimed to answer the following research questions:

1. To what extent did the various activities of the Web-based Constructivist Learning Environment encourage higher order thinking and enhance content acquisition among primary school learners?
2. What characteristics of cooperative and collaborative learning were evident in a Web-based Constructivist Learning Environment?
3. What was the role played by the teacher in the Web-based Constructivist Learning Environment?
4. What were learner perceptions of the Web-based Constructivist Learning Environment?

Significance of the Study

The study will provide a model for redesigning curriculum, instruction and teacher training in a computer related environment. Traditionally, the computer has been viewed as a tool for the mastery of information and skills. However, the current study will inform educators on how the computer may be used as a "mind tool" (Jonassen, 1996). In other words, the study will reveal ways in which learners' cognitive functions can be enhanced with the aid of a computer and thereby develop an appropriate model for instructional design, classroom management and teacher training.

Findings from the study will serve to inform educators about children's learning processes, particularly those related to cooperative and collaborative learning. The findings will outline how the different interactions with technology, peers, teacher and other subject experts affect learning. Consistent with the Vygotskian perspective, the role of social interaction in developing higher-order thinking skills (Vygotsky, 1978) may become more evident. In other words, the way learners interact with their peers and knowledgeable adults to advance their mental functions will serve to inform educators about the use of a web-based learning environment. In addition, the study will provide information on how learners of different abilities interact to perform the tasks that they have been assigned. Such information is crucial in the planning of lessons in large classes and where learners of heterogeneous abilities are found.

The study will reveal the ways in which teacher education procedures ought to be adapted, changed or maintained. In particular, the findings of the study will redefine the role of the teacher so that concepts such as "facilitator," "guide at the

side" and "advisor" may become more apparent. Further, teacher education with respect to design and creation of teaching-learning materials, will benefit from a program that has been implemented and reviewed.

Finally, the study will provide some insights on the role of assessment in a technology-based learning environment. The findings of the study may indicate how this approach to assessing learning is to be conducted and also other product-based assessment procedures.

Definitions of Terms Used in the Study

Higher-order thinking skills

Higher-order thinking skills in the current study include the skills to analyze, mainly by extracting main points as well as comparing and contrasting; the skills to synthesize, that is by summarizing and paraphrasing information; and the ability to evaluate, mainly by giving valued judgements. Apart from that, higher-order thinking also include thinking skills such as classification skills, that is the ability of learners to recognize similar patterns in concepts and classify them; analogical reasoning, that is the ability of the learner to discern various types of relationships among pairs of words; deductive reasoning, that is the ability to draw conclusion from deductive statements; spatial thinking, that is the ability to spatially place objects in perspective and mechanical comprehension, that is ability to think mechanically.

Web-based Learning

Web-based learning refers to the use of networked systems for the learning of content and achievement of cognitive and information seeking skills based on

active participation by learners who work with information obtained from WWW links or through peer and expert cooperation and collaboration to solve a learning need.

Cooperative Learning

As defined by Slavin (1982), cooperative learning is an instructional method whereby students of all ability levels work together in small groups towards a common goal. In this study, cooperative learning is taken to mean having three students of either homogeneous or heterogeneous ability learn together to complete a given activity according to their learning needs.

Collaborative Learning

In this study, collaborative learning is seen as an instructional method whereby cooperative groups interact with one another or an expert using an online facility to seek support in clarifying their ideas to reach their group goals.

Constructivism

Constructivism is a process of learning whereby the learner personally constructs and interprets a given set of information based on his or her experiences. In this study constructivism includes learning by doing, learning through interaction, learning in rich environments, learning at higher order thinking levels and learning in a teacher-supported environment.

Learning

Learning can be described as a process whereby the learner internally constructs meaning by building and reshaping personal knowledge through interactions with the world. It is not a process of knowledge transfer from expert to novice.

Learning environment

A learning environment is a design specially created for learning interactions to occur without constraints to acquisition of knowledge, access to resources, peers and experts. The design is aimed at engaging students continuously in purposeful thinking within the context of culture.