

**How Do Learners Respond to Computer Based
Learning Material which has been Designed to Suit
Their Particular Learning Style**

by

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Abbreviation

ADDIE	Analysis, Design, Development, Implementation, Evaluation
Becta	British Educational Communications and Technology Agency
CAI	Computer Aided Instruction
CAL	Computer Aided Language
CAP	Centre for Academic Practices
CBL	Computer Based Learning
CBT	Computer Based Training
DfEE	Department of Educational
ELT PDF	Embedding Learning Technologies Professional Development Framework
HEIs	Higher Education Institutions
ICT	Information Communication Technology
ILS	Integrated Learning Systems
MMP	Modern Mathematics Programme
MMoE	Malaysia Ministry of Education
NGfL	National Grid for Learning
NOF	New Opportunities Fund
NPE	National Philosophy of Education
OFSTED	Office for Standards in Education
PGCE	Post Graduate Certificate of Education
SEDA	Educational Development Association
SSP	Smart School Project
TDA	Teacher Development Agency
TEL	Technology Enhanced Learning
TLTP	Teaching & Learning Technology Programme
UTHM	University Tun Hussein Onn Malaysia
VARK	Visual Aural Reading Kinaesthetic
WELA	Warwick E-Learning Award
WIE	Warwick Institute of Education



Abstract

The development of ICT in education has changed the nature of people's learning. The evolution of Computer Based Learning (CBL) to virtual learning has had a huge effect on learning methodology. Learning theories from behaviourism, cognitivism and constructivism have been re-assessed. This study explored students' feedback and experiences when using CBL material which has been adapted to particular learning styles. Studies show that individuals learn in different ways. They have different preferences in collecting, organizing and delivering information. These differences impact on learning outcomes. The framework in this study concerns itself with modal preferences known as the VARK Model. The study focuses on CBL material which has been designed for learning new software. This learning material was designed with four different learning routes to appeal to those with dominant Visual, Aural, Reading and Kinaesthetic preferences respectively. The learning package was called the MINDs learning system. Respondents involved were student teachers in two Universities in the UK and Malaysia. Sixty two respondents agreed to participate interviews and in trialling courseware. Data was collected through questionnaire, survey, interview and observation. Quantitative and qualitative data was analysed descriptively, triangulation of the findings was carried out and conclusions were drawn. Findings from the study show that learning styles instruments measure general preferences rather than offering an indication of the specific context in which learning takes place. Matching learning material with particular learning styles did not significantly increase motivation, comprehension or have a major impact on learning. However, learners are aware of having learning styles and found that learning with suited learning preferences made them feel more comfortable. Recommendations were put forward for future research to design and develop a 'new type' of CBL material which takes into account individual learning preferences.

CHAPTER 1 INTRODUCTION TO THE THESIS

1.1 Introduction

This study is an investigation into learning material which has been developed to suit particular learning styles. An in-depth iterative approach was followed including production of courseware, pre and post tests of users, questionnaires, interviews and observation. Findings are reported and discussed in relation to learning styles theory and more general learning theory. This chapter discusses the origin of the research and courseware design. Research was carried out at the Institute of Education, Warwick University United Kingdom (WIE/ later called University A) and University Tun Hussein Onn Malaysia (UTHM/ later called University B) in Malaysia, involving trainee teachers learning advanced features of PowerPoint. The chapter also presents the aims of the research, the research questions pursued in this thesis and the importance of the research. The last section presents an overview of the thesis.

1.2 The origin of this research

This section explains my interest in carrying out this research. I began my career as a secondary school teacher in 1984 in Malaysia. I started without any experience of teaching except limited 'practice' during my teacher training. Most of the time, I applied the traditional teaching methods in my classroom, which had been taught to me in Training College. I was expected

to deliver teaching content based on a curriculum provided by a curriculum development centre. Malaysia implemented the first computer systems in 1966 (Mae 2002). Since then the Government has introduced various initiatives to facilitate the greater adoption and diffusion of ICT to improve capacities in every field including computers in education. In 1984 there were only a few schools which had started to use computer based learning material. Slowly computer based material began to be used more widely with multimedia products being developed for schools and in Higher institutions in Malaysia. I found that multimedia could make presentations more exciting with the use of animations in colours, small video clips and iterative exercises. Multimedia presentations encourage learners to engage in learning by representing and making connections between pictorial and verbal representations (Harun & Tasir 2003; Clark & Mayer 2002).

I realised that there were advantages in using computers in education which had been exploited in other countries such as United Kingdom and United States. Colleges and universities in United States have embraced distance learning, doubling the number of courses offered and enrolment (Okamoto *et al.* 2001). Through my observation and studies related to computers in education, I could see that teachers could vary their role when they used computer based learning material in their teaching activities. I could also observe that learners behaved differently and that some students learnt better by watching movies/animations and listening to audio instead of following my presentation backup up with written exercises.

Jabers (1997) argued that when computer based technology is used in teaching and learning, the teacher can move from dispenser of knowledge to facilitator or coach. By using computers, teachers may expect more from students, may present more complex material and provide more opportunity for individualised instruction and less time lecturing to the whole class. There may be more opportunities for small-group activities, team teaching, and interdisciplinary project-based instruction. However, none of this can be achieved quickly and like others, Jabers called for change to take place across five phases to show how computer based technology can impact to an increasing extent on ways of teaching. The phases were: entry, adoption, adaptation, appropriation, and invention.

1.2.1 My role in education

My role in education developed when I had an opportunity to teach information and communications technology (ICT) applications to trainee teachers. I was responsible for enabling them to produce computer based learning material. The purpose was also to provide them with exposure to the instructional design process. All the material needed to be based on course content and related to computer applications. I decided to train these trainee teachers to produce multimedia learning courseware, which they might use in their future work.

Moving on, I was selected as a member of the e-learning committee and responsible for preparing and evaluating learning material for general courses at University level. We found that Computer Based Learning (CBL)

was popular with students when it was introduced as part of a teaching methodology case study within the e-learning programme. However, learning material was being evaluated using the instructional design model and seen from the developers', rather than the learners', point of view. Evaluation focused on interface design, reliability testing and subject content. Learning style was not included as a part of courseware evaluation. This seemed to me to be a cause of concern, as it did to others serving on the e-learning committee, as I felt that students would lose interest and become de-motivated when using learning material which did not suit them. Educators were assigned to prepare learning material but they were not taking into consideration differentiated styles and abilities. This concern was clearly one motivation for undertaking this research.

1.2.2 CBL in Smart Schools

I still believe CBL is an appropriate means to develop differentiation in teaching. It is something I can see as having particular relevance to me as a teacher. In Malaysia, e-learning has been implemented in schools through the Smart School Programme (MMoE 1997a, 1997b). A Smart School is a learning institution where teaching-learning practices and school management are undergoing a process of reinvention. Within the Smart School system, teachers aim to play the role of facilitator - organising and preparing a conducive and stimulating learning environment for students (MMoE 2003). Students have the responsibility of charting out their own path in learning, in short, taking charge of their own learning process. The use of ICT in the Malaysian education system is described later in chapter two.

However, from my experience I found that ICT was perhaps not having the impact on student learning which had been desired. In my own institution this was due to lack of training provided by the supplier and also to the fact that initiatives came from above. There was an emphasis on advanced computer technology systems (e.g. 'High tech' narration machines) and the need for highly motivated people to produce and use these applications. Hence lecturers were not making much use of the facilities often because they were not well trained, not confident and experienced great and too sudden changes in technology (Ahmad 2002). However, the pedagogy issue would not go away, namely were we designing with users' learning styles in mind? Notwithstanding these and other widely expressed reservations, ICT is continuously developing in education systems around the world. Teachers are increasingly using ICT to improve their own skills and their teaching. In addition, technology is making many administrative and assessment tasks easier.

Nevertheless, I am still concerned that educators are not preparing learning material to take into consideration individual differences. This has become clearer through personal experience. I have two sons with different ways of thinking and learning. For example, I notice that one of them does not like to learn when people are making a noise around him, while the other one remains relatively unaffected by this, suggesting that one is more sensitive to audio input than the other. In terms of thinking styles, one of them is gifted at mathematics but the other does not like numerical thinking; rather he enjoys kinaesthetic activities, such as sport and also enjoys visual stimuli.

This has alerted me further to the importance of thinking and learning styles. According to Jonassen and Grabowski (1993), individuals are different in terms of their learning, they differ in their general skills, aptitudes, and preferences for processing information, constructing meaning from it and applying it to new situations. I tried to look into this situation and to relate it to some learning theory and to work already done by others in the field. This brings me to the theory of multiple intelligences (Gardner 1983).

Gardner (1983) argued that individuals differ in term of their 'intelligence'. Sternberg (1999) showed individual differences in thinking styles. Riding and Rayner (1998) defined cognitive style as the way the individual thinks and saw preferences as the habitual approach to organising and representing information. Fleming (1995) and Mayer (2001) found that there are different ways of processing information based on preferred sensory modalities.

In 2003, I had the opportunity to study abroad. I wanted to acquire experience of how students in different countries learn. I was certain that there would be big differences due to individual background and learning culture. I was interested in carrying out comparative studies between two countries (Malaysia and the UK) in ICT. This would include students' attitude towards computer usage in education, ICT facilities provided, training exposed and students' feedback from the training given to them. Based on my background and working experience, I was interested in concentrating my research study on trainee teachers. I believed that trainee teachers should be trained with the use of ICT in mind.

1.3 Courseware design

In developing the thesis, I spent plenty of time in my first year designing and producing a CBL courseware system. This is described in detailed in chapter five. I focused my work on designing and piloting the courseware with colleagues. After discussion with my colleagues and the e-learning committee from University B in Malaysia I decided to bring a new idea to Instructional Design by introducing personal learning approaches. I wanted to develop the idea of creating learning materials which would suit different groups of learners. In other words, learners would be able to learn by means of their preferred learning styles. This I hoped would stimulate learners and motivate them to use these materials. Based on the theory of multiple intelligences (Gardner 1983), individuals perform better if the learning material suits their dominant intelligences.

I had to go through many iterations in producing this courseware and this process is delineated in chapter five. The focus was on learning more advanced features of the software PowerPoint. This program was used extensively by trainee teachers in both countries (University A and B).

In looking at existing tutorial material I found that most was generic and not differentiated by learning style. It took me more than six months to produce my courseware and I needed an audience or test group or trial this with. I put up a notice up in the Multimedia Centre inviting participation and waited to see who would come along. This proved a false start and I decided to carry out trials with students embedded within a particular programme. This is

described in chapter five and led me to work with PGCE primary students at University A. This work alerted me to many further issues and difficulties which are described in the findings chapter 6. Reflecting on my findings, I needed a further context in which to evaluate the learners' experience of the programme. This led me to undertake a further study in Malaysia (University B).

1.4 The aim of the research

The courseware I produced offers learners an opportunity to learn through their strongest intelligences. This is also known as the preference learning method based on individual difference (Ford & Chen 2001; Kelly & Tangney 2004). This research draws on work in the fields of computers in education and educational psychology in order to:

- develop and test a prototype for "Intelligent Courseware" based on learning styles and intelligences suitable to an 'anyone, anyhow' approach in an e-learning environment;
- probe relationships between learning styles, types of learning activity, and learning outcomes;
- make a contribution to educational research, especially in the design of learning material adapted to different learning styles;

- make a contribution to the field of Educational Technology by developing a prototype of learning material based on multiple intelligences adaptive learning materials.

1.4.1 Research questions

The key research question pursued in this thesis is as follows: "How do learners respond to Computer Based Learning material which allows them to follow specially designed routes suited to their learning style, in particular visual, aural, reading and kinaesthetic modes?" This key question inevitably poses sub-questions that address:

- what are learner attitudes to Computer Based Learning in general?
- do learners find the notion of learning styles appropriate or useful?
- how do learners evaluate a particular route they take through the material?

This thesis therefore has many strands: it discusses the design of CBL, it looks at e-learning as a concept, it takes some account of the context of teacher education, it focuses on both Multiple Intelligences and learning styles.

1.5 The importance of the research

This research aims to contribute to both the practice and theory of e-learning and has outcomes which are potentially valuable for students in schools,

higher institutions, teachers, and lecturers and education administrators. For students, it offers the potential of working with learning material which suits their learning styles. This will help them in developing strategies for learning. Students will also be given experience of CBL material in a new and relevant context. For educators, the study will help to show the importance or not of learning styles when producing learning material. On a wider level the tool developed in this study might serve as an exemplar of an approach to CBL which might be adopted by institutions in different contexts. At the least it will provide heightened awareness of, and attention to, the issue of differentiation.

1.6 Overview of the thesis

This thesis is organised in nine chapters. In chapter one the research context is explained. Chapter two explores previous work related to the research topic. It also provides some introduction to CBL and relevant experiences of using CBL, the strengths and weaknesses of using Computer Assisted Learning (CAL), and the relationship between CAL and learning styles. The next chapter gives an explanation of learning styles, multiple intelligence and the idea of individual difference. Criticisms of these ideas are discussed. This is followed by an introduction to the VARK model (Fleming, 1995). Chapter four presents an exploration of the concept and development of learning styles which later provides the conceptual framework to answer research questions. Chapter five discusses the research design and methodology. This chapter also explains how the prototype courseware has been developed. Chapters six and seven report

the findings using both quantitative and qualitative methods. Chapter six reports the results from the students in University A, while chapter seven presents the results from those in University B. Chapter eight provides a comparison between universities A and B, and presents a discussion alongside a modelling of the use of CBL. The final chapter reports on conclusions.

1.7 Summary

In this chapter, the aims of the research and its context were defined and an overview of the thesis provided. The background has highlighted my interest in instructional design, learning styles and the ways people think. The reasons for undertaking the research were also presented. As a final part of the introduction, the significance of the research was discussed. The following chapter examines learning theory and instructional design in producing CBL material. Also the background of the study and of learning styles will be explained.

CHAPTER 2 RESEARCH BACKGROUND

2.1 Introduction

This chapter discusses the background to the research being carried out. It begins with a definition of the concepts of e-learning and CBL. It, also explores how e-learning developed in Malaysia. Explanation begins with the history of e-learning, the Smart school flagship policy, IT implementation, higher education, teachers' training, issues and challenges of e-learning in Malaysia. This is followed by an explanation of e-learning development in UK, teachers' education and ICT implementation. A background to the respective education systems in Malaysia and the UK is given in the chapter along with some key projects and a chapter summary will be drawn out.

2.2 E-learning and CBL

2.2.1 Definition of e-learning in research context

In this thesis, the term e-learning is used to describe the use of ICT either in face to face or virtual contexts. Tavangarian *et al.* (2004, p. 274) defined e-learning as "all forms of electronically supported learning and teaching, which are procedural character, and aim to effect the construction of knowledge with reference to the individual experiences, practice and knowledge of the learner. Information and communication systems, whether networked or not, serve as a specific media."

Stockley (2003) defined e-learning as the delivery of learning, training or education programmes by electronic means. E-learning relates to all training activities that are delivered with the assistance of a computer. Delivery of e-learning can be via CDs, the Internet, or shared files on a network. The term e-learning evolved from the term Computer Based Training (CBT) with the maturation of the Internet, CDs, and DVDs. E-learning also includes Internet-based Learning, Web-based Learning, and Online Learning. In this thesis, the branch of e-learning being discussed is the process of delivering learning material to learners using ICT.

2.2.2 Computer Based Learning

Computer-Based Learning (CBL) is defined as "using the computer for training and instruction". CBL programmes are called "courseware" and provide interactive learning sessions for all disciplines. Multimedia CBL uses graphics extensively. Multimedia CBL was originally introduced on laser discs, then on CD-ROMs and recently in online formats. CBL courseware is typically developed by using authoring languages that are designed to create interactive question and answer sessions (Harun & Tasir 2003).

Rist and Hwer (1999) saw CBL as drill and practice packages which offer structured reinforcement of previously learned concepts. They are based on question and answer interactions and should give the student appropriate feedback. They also include tutorials which are used to teach new concepts and processes. Tutorial courseware usually includes worked examples and gives the learner the opportunity to assess their understanding with

questions. Intelligent Tutoring systems are capable of corrective feedback and adapt their presentations to suit the learner, based on the actions of the learner. According to Coall (2002), students are motivated when using a quiz-featured programmed type where they value instant feedback rather than the delayed feedback associated with pen and paper testing. A key factor in the value of CBL concerns the students' attitudes to technology and their degree of comfort working with the machine, factors which largely lie outside control of the designer.

2.2.3 History of CBL

The history of CBL began in the early 1960's, when the third generation of digital computers were introduced (Bowles 2005). These systems were cheaper and more reliable than earlier models. Benyon *et al.* (1997, p. 198) suggested that researchers started to find new applications for these computers and CBL was one of those; for example lecturers at the Open University in UK (established in 1969) started to use CBL for their teaching. In 1970's, CBL systems were developed. However, their development rate was slow due to technical and cost limitations, especially concerning hardware and lack of adequate multimedia features. The National Development Programme in computer assisted learning was founded in 1973 in the UK. However, there were still prevalent issues such as:

- low quality of graphic displays (e.g. monochrome monitors);
- handling problems of random access audio tapes;
- cost of terminal per hour.

During the 1980's and 1990's these and other CBL problems were addressed by the 'Digital Revolution'. Low quality, monochrome graphics displays were substituted by video quality and 16 million colour displays. Nowadays, computing and processing speeds of a typical computer are much faster than those of the most advanced computer of the 1970's. Compact discs (CDs and DVDs) and real sound/video peripherals brought multi-media facilities into the personal computer world. CBL system designers could develop their ideas in multimedia format. One result is that CAL systems are available to every learner with a PC.

2.2.4 Advantages of CBL

Although CBL has to some extent been superseded by e-learning, which makes use of the internet, it is worthwhile to revisit the opportunities which CBL provided. According to Harp *et al.* (1998), "Adult learning theory postulates that adult learners prefer a high degree of learner control. Computer-based training provides more learner control than other forms of training because it allows the learner to select the appropriate time to engage in learning and which topics will be covered" (p. 271 - 283). Montgomery (1995) argued that multimedia and computer software in general can go a long way to filling in the gaps caused by a mismatch of learning and teaching styles. In addition, an awareness of the pedagogical needs of various learning styles can result in more effective multimedia software use. Tait (1998) used CBL as a learning tool to enhance learning activities. He applied CBL as part of the tutoring role to replace conventional teaching methods.

CBL enables learners to work at their own pace, experience good interactive features and to be provided with unlimited repetition in practising new skills. In addition, computer based learning can improve staff-student ratios and be cost effective by saving on training courses/assistants if designed for a sufficiently large user base. CBL can be used anytime and from anywhere given access to machines. The relative isolation can be an advantage too as learners can pace themselves and are not distracted by peers and do not feel classroom pressure (Ian *et al.* 1995; Rist & Hower 1999; Clarke 2001; Kington *et al.* 2002)

CBL is about self-paced learning using multimedia components. Learners have potentially high levels of control over learning material and may make decisions relating to choice of routes through the learning material. For these reasons, CBL can be thought of more as self-directed learning. Ross and Schulz (1999, p. 8) stated learners' profiles suited to using CBL include those who have the ability to quietly concentrate, who are able to pay attention to detail, who have an affinity for memorizing facts, and who can stay on track until completion.

Ian *et al.* (1995) mentioned eight strengths of the computer-based education and training. These can be summarised as:

- learners improve motivation when they are able to work on a course at a time convenient for them;

- the 'patience' of the computer when a learner works through drill and knowledge practices;
- providing simulations prior to real-world experience saves expensive equipment and consumables;
- the structured nature of CBL materials give learners a view of the content as a professional would view the content;
- segments of a course offered on computer provide variety, may stimulate learners and promote positive attitudes to learning;
- a course originating from a central source means that quality is controllable, and reporting, evaluation and record-keeping may be facilitated;
- individualized instruction is highly possible particularly if a learner is able to navigate the content; and
- CBL is able to provide almost instant feedback if properly constructed.

2.2.5 Problems and challenges in learning CBL

Despite the strengths discussed above, there are disadvantages in using CAL in teaching and learning. For example, standalone materials are unlikely to ensure depth ((Wild & Quinn 1998). Materials may be pitched at an inappropriate level and loss of interaction between learners and tutors is a significant weakness. CBL needs to be designed well or users will find it

unfriendly, lacking in interaction, unattractive and boring. It is very costly to develop attractive courseware. Some CAL is just electronic page turning.

According to Horton (2000), most of these negative aspects can be overcome with good design but only if they are fully acknowledged and understood. Referring back to reviews of the TLTP programme, Allen *et al.* (1996) indicated that tutors play a key role in ensuring that CBL materials are used by students. Teachers are especially required in:-

- booking specific times in computer facilities;
- ensuring that support is available at these times;
- providing the students with "road maps" that relate the CAL material to the course;
- where possible using examples of the CAL material in lectures (e.g. using an interactive component that allows the lecturer to change various parameters in a model and lets the students see the results).

Forster (1998) claimed that CAL modules can be customised to the individual learner with particular needs. Clearly one size does not fit all. There are different learning styles, and they propose different responses. This will be discussed in detail in chapter 3.

2.3 How has E-Learning developed in Malaysia?

E-learning implementation depends on levels of readiness in terms of the budget, infrastructure and human resources such as experience, skills,

knowledge and attitude (Karim & Hashim 2004). Most public and private universities in Malaysia have practised e-learning without networking (Konting *et al.* 2003). Therefore, most computer learning material has been delivered as stand-alone such as the CD-ROMs, CAI/CAL courseware and other locally produced courseware.

In Malaysia, there have been some attempts to incorporate e-learning' into the educational system. E-learning is used in most schools. Abtar *et al.* (2005) observed that all schools in Malaysia will be networked by the end of 2005. At present, most primary and secondary schools in Malaysia are equipped with computer laboratories with ICT and internet facilities which are also provided in the classroom. The Malaysian government intends to make ICT-enhanced teaching and learning, distance learning, video conferencing and Internet-links common features in schools. Schools will have unlimited access to an extremely large source of information and students will be able to use the internet to exchange or share ideas.

The Malaysian government's aim in utilising ICT in school is to encourage social constructivist learning and collaboration to make classrooms more meaningful. This, it is argued, will help students to develop self confidence and knowledge (Mae 2002). Kim (2001) sees social constructivist approaches as including reciprocal teaching, peer collaboration, cognitive apprenticeships, problem-based instructions, anchored instructions and other methods that involve learning with others. Students will be able to learn from materials which have been provided by the government and make

use of those to collaborate with other parties. The development plan for the utilization of technology proposes developing the ICT infrastructure; expanding access to and providing equity for ICT facilities; expanding ICT-based curriculum; and improving the assessment and evaluation systems using ICT. This builds on the experiences of the Malaysian Smart School Project (SSP).

2.3.1 History of ICT in Malaysian schools

In 1996, the government of Malaysia launched the Multimedia Super Corridor Project (MSC Malaysia) which set out to develop Malaysia as part of a global information and communication technology (ICT) industry. Implementation of the MSC Malaysia was divided into three phases from 1996-2020 (Mohammad, 1999). The aim was to transform Malaysia into knowledge based society. Seven flagship applications were engineered: Electronic Government, Multipurpose Card, Smart School, Telehealth, Research & Development Clusters, E-Business and Technopreneur Development (MSC 2005).

2.3.2 Smart School Flagship (SSP)

The Smart School Project (SSP) was one among seven flagship applications. This was premised on the strongly-held belief that information and communication technology is a key enabler of learning for all. The Smart School flagship attempted to reinvent teaching-learning processes. Asirvatham *et al.* (2004) reported that SSP had been implemented in 87 schools in the country at a cost of about USD78 million (RM300 million) with

the aim of making all schools SMART schools by 2010. Smart schools were provided with learning materials which included interactive courseware and printed materials for Mathematics, Science, English and Bahasa Melayu. These would enable students to practise self-paced, self-accessed and self-directed learning (Mae 2002). Teachers and related personnel were trained for the Smart School expansion. Educator Preparation and Development Programs for new and practising teachers, administrators, curriculum developers, ICT coordinators, counsellors and librarians were put in place. Razak (1999) urged all trainee teachers should be trained in all aspects as teachers in the future will not function as providers of information but rather as facilitators of teaching via computers.

2.3.3 Policy of E-learning

Mae (2002) suggested there are three aims of ICT policy in education. First, it aims to provide ICT for all students to reduce the digital gap. Second, it emphasises the role and function of ICT as teaching and learning tools, as part of a subject in itself. Third, it emphasises using ICT to increase productivity, efficiency and effectiveness of management systems in schools. ICT will be extensively used for the automation of clerical work, teaching preparation and students' management.

2.3.4 IT implementation from school to tertiary level

The Smart School Conceptual Blueprint (MMoE 1997a) reported that the SSP project's framework was rooted in research based on theories of multiple intelligence and social constructivism. This argued not for a totally

IT based but rather a 'blended' IT support for classroom teaching and a mix of tutorial work with more exploratory use of IT. This is not a whole hearted 'student - centred' pedagogical approach but more a mixed method strategy. Strategies in using ICT in SSP focus more on utilising browser-based teaching and learning materials in four core subjects, namely; Bahasa Malaysia, English Language, Science and Mathematics. The concept RFP For Smart School Teaching-Learning Materials (1997) also described a template for learning material (MMoE 1997). Learning material should be designed to accommodate different needs and abilities and allow children to take greater responsibility in managing their own learning. The materials should take into account the different abilities of students, for example, their learning styles, multiple intelligences, and learning models. The SSP also encouraged the development of teaching and learning courseware for classroom use. The courseware was designed to be incorporated into the Smart School Integrated System (SSIS). All courseware was to be launched either through the networked computer system provided or through stand alone systems to all Smart Schools.

Mae (2002) reported that 2400 schools were selected to start teaching IT in school. Implementation of IT in education as one of the subjects in school arose as a result of launching the National IT Agenda and MSC project. The main aim was to ensure that students were IT literate. Only some schools offer IT as an examination subject due to a lack of IT facilities. However, each year the government seeks to improve IT infrastructure to address this problem. IT skills and knowledge was to be developed in higher education

level (Maznah 2002). There are 623 higher education institutions in Malaysia including public and private (MMoE 2006).

2.3.5 Higher Education Systems in Malaysia

The IT agenda in Higher Education (HE) was initially driven by technological and scientific forces and with awareness that new marketing and entrepreneurship skills needed to be inculcated with students. Formal and informal programmes were offered using e-Learning portals. E-learning in higher education in Malaysia was pioneered by Open University Malaysia (OUM) and University of Tun Abdul Razak (UNITAR) when they started using an e-learning portal in 1998.

Apart from OUM, other institutions that embraced e-learning include the Multimedia University, the National University, the University of Malaya, University Putra Malaysia and University Tun Hussein Onn Malaysia. However, there are some general issues and challenges in such e-learning initiatives. Aziz *et al.* (2006) suggested three factors that contribute to the readiness of organisations to embrace e-learning: people, place and resources. He noted that learning material, software programmers, multimedia experts, graphics experts, and others, including information systems experts are required to develop e-learning programmes.

2.3.6 Issues and challenges in implementing E-learning in Malaysia

Ali (2003) raised some issues in implementing e-learning in Malaysia. These include awareness of its use and benefits. Another issue to be addressed is slow uptake by Higher Institutions. Most are eager to become involved with e-learning but problems persist. E-learning requires a rich combination of multimedia components. However, due to bandwidth and connectivity limitations, downloading of engaging content to the learners is slow. This creates frustration among learners and affects learning. There is a digital divide in Malaysia; a large segment of the population remains computer illiterate. This is especially true in the rural areas. This hinders the introduction and implementation of e-learning.

Currently, there is a lack of quality e-learning content (Konting *et al.* 2003). This is due to the lack of expertise as well as to the fact that huge financial resources are required to develop the content which is suitable for use. As a result, most e-learning content has low interactivity and this reduces its impact on learners. Online learning requires a very high degree of self-motivation which is found to be lacking among some learners. Learners find it difficult to make a paradigm shift from the traditional learning modes to the new e-learning mode and the extensive use of English in e-learning applications further hinders. Many, who would like to enrol in e-learning programmes, are discouraged from doing so as they are not confident in using them in English (Ali 2003).

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