Chapter Two

REVIEW OF RELATED LITERATURE

An Overview of the Local Scenario

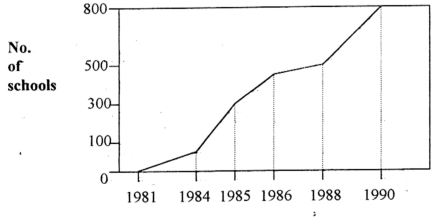
The fast-moving nature of information technology (IT) and its considerable implications for society and education have been the subject of extensive discussion (Matthews 1992, Tweddle 1993). Subsequently, there is a need for greater understanding of the technology, especially computer technology and the Internet, available in schools and the utilisation of that technology for teaching and learning (Fisher 1996). With the increasing technology changes taking place in schools, Fisher (1996) emphasises that there is a growing responsibility being placed on teachers to become computer literate. Hence, the implementation of IT in education is synonymous to the use of computers and telecommunication (the technology aspect of IT) in the school environment for the teaching and learning of information previously derived from textbooks.

The introduction of computers in Malaysian schools can be traced back to as early as 1981, when SM LaSalle in Petaling Jaya set up its computer club. Since then the number of schools with computer clubs has increased tremendously (See **Figure 3**). They were introduced in an *ad hoc* manner and not in any way associated with formal teaching or mainstream curriculum. The first step towards formally introducing the computer in schools started by the Ministry of Education

was the Computer Literacy Pilot Project (CLPP) which was launched in April 1986. Under this project, twenty schools received five personal computers with application software and a printer each. This was followed by the introduction of a course called *"Pengenalan kepada Komputer"* (Introduction to the Computers). However, this pilot project was discontinued after a year trial run owing to the lack of funds ("Why low priority," 1987). It was also discovered that the project duplicated many computer club activities.

Figure 3

Number of Computer Clubs in Malaysian Schools (Source: Ministry of Education; "Program to Boost", Computimes June 15 1994 ("Vital Statistics").



In December 1986, a joint committee between the Ministry of Education and the Malaysian Institute of Microelectronic Systems (MIMOS) was established to study the development of computers in education in Malaysian schools. Among its findings and suggestions for a comprehensive computer education programme were for Malaysian schools to have (Tengku Mohd Azzman 1991a):

(a) a national policy on application of computers in education;

(b) an integrated plan for computerisation;

(c) a national educational computer network;

(d) a national educational database system;

(e) a new division for computers in education in Ministry of Education; and

(f) employ information technology across the curriculum for teaching and learning in all primary and secondary schools.

As an effort to further develop programmes for computers in education (CIE), a Computer-Integrated Learning System (Sistem ComIL) was designed. This system incorporated the following uses of the computers in education: Computer–Assisted Instruction (including Computer-Managed Instruction), Computer Integrated Instruction, and automation of administrative work (Zoraini 1991). This system is currently being used by undergraduates of two faculties at the University Putra Malaysia (UPM) in their course work. However, its implementation at the school level is still uncertain due to several factors - resources, hardware, support etc. Sistem ComIL is being developed further by a team of researchers and software developers at MIMOS BERHAD and has been expanded for use in the Internet environment.

"Sistem ComIL" was specifically designed and developed as an indigenous authoring system that provided three different types of software: an authoring tool, a database program and networking application. In 1991, sixty secondary schools throughout the country were each presented with 20 Atom-1 PCs networked to an 80386-SX server. Training was provided by Makmal Teknologi Komputer (MTK),

a division of the MOE, for teachers of these selected schools on using the ComIL authoring tool and aiding them in designing educational courseware to cater to their students' needs.

Recent initiatives to promote the integration of IT into the education environment at the tertiary level have been undertaken by Universiti Putra Malaysia (UPM) when it embarked on a project designed to help its students to own a computer. This is to enable them to fully utilise the on-line facilities provided via the university's campus-wide network infrastructure, UPMNet (Computimes, April 14 1997). Its one-student-one-PC project is to provide a convenient avenue for students to purchase a desktop or notebook PC. With the current emphasis of the project on its first-year students, UPM expects all students to have a personal computer (PC) each in three years' time. The loan scheme is another initiative by UPM to help students make the most of information technology (IT) in teaching and learning.

The Benefits of IT Use in Schools

It is accepted that the use of IT in education has the potential to bring about many benefits (Tagg 1991). The majority of research into technology in education in the United States has focused on computer-based education (Barron and Orwig 1993). Bialo and Sivin (1990) analysed the results of sixty-one studies of uses of computer-related technology with students from preschool through college. They found applications in problem-solving skills, reading, writing,

science, mathematics, and development of higher-order thinking skills. They also reported that students found these technologies to be:

1. More motivational than instructional;
2. More enjoyable because students are actively engaged and able to make mistakes without embarrassment;
3. More empowering because students feel in control;
4. Easier to "stick with" through difficult problem solving;
5. Less anxiety-provoking in mathematics than traditional methods.

Collins (1991, 29-30) goes further to identify eight major trends in schools that make extensive use of computers:

1. There is a trend for whole-class instruction by the teacher to decline and small-group instruction to increase.
2. The teacher's role is shifting from lecturing to coaching. The computer becomes a third party in the relationship of teacher with students, often allowing the teacher to observe and guide as the students work directly with the computer.
3. There is a trend for the teacher to work with weaker students instead of focusing on better students.
4. There is a trend for students to be more engaged in what is happening in the classroom.
5. Evaluation or assessment shifts from test results to assessment based on products, progress, and effort. Some of this shift is based on the process of evaluation built into computer software.

6. Cooperative social structures emerge in the classroom.
7. Students tend to learn different things at the same time instead of everyone learning the same thing at the same time.
8. There is a trend toward integrating verbal and visual thinking.

The views put forth above were in cognisance to that of Eisenberg and Ely (1993), Nolden and Moss (1993), Zoraini (1994),and Nolan and Martin (1994).

Reasons for IT Introduction in Education

Ashley (1997) cited various reasons for the infiltration of IT in education. Firstly, that computers should be in schools to reflect the real world. This view is in coherent with Bigum and Green (1992) that said, "students are bombarded with a range of attractively delivered information formats, in their extra-school life". Today's schoolchildren have grown up immersed in a world of computers and other information technologies. They play video games; they listen to music on digital compact disks; they help their families program the computerised controls of videocassette players. Indeed,

> "The technology gap between schools and the rest of the world is real and it is growing. Whether we like it or not, the increasing pervasiveness and vitality of this technology are changing the expectations of our children and their worldview. Schools of the future could look dramatically different from those we attended, if we plan carefully, if we bring teachers along with us and implement new technology (Press 1997)".

Secondly, students will be using technology in the workplace; hence exposure at school seems desirable to prepare them for the future. The local employment scene has seen a shortage of skilled manpower with IT background as highlighted in the analysis of the Sixth Malaysia Plan. The need for people in business who are competent managers of information is important at all levels, and the realities of the Information Age require serious rethinking of how business should be conducted. Furthermore, information systems can only be created, maintained and enhanced if there are skilled and knowledgeable human resources in both technical aspects of IT as well as in the specific subject areas of interest (Tengku Azzman 1994). For example, the need for creation of databases in specific disciplines that are important for the national development programme, their maintenance and continued enhancement require experts in the disciplines concerned as well as in IT.

The scenario discussed above corresponds to one of the three pressures related by Cerych (1985). To add on, educators argue that "schools have the responsibility to give students – and especially students from low-income homes – the confidence and skills in using technology that they will need after graduation" (Reasons for Bringing Technology Into Schools, 1996). This view was strongly put forth by President Clinton, in a visit to the Bay Area last fall when he said, "Preparing our children for a lifetime of computer use is now just as essential as teaching them to read and write" (Slonaker and Schmitt 1996).

Thirdly, IT is an important life skill. On a daily basis, problems are more difficult to solve when people lack access to meaningful information vital to good

decision making. Many poorly informed people are vulnerable to opportunists when selecting nursing care for a parent or facing a major expense such as purchasing, financing, or insuring a new home or car. Other information-dependent decisions can affect one's entire lifetime. For example, what information do young people have available to them when they consider which college to attend or whether to become sexually active? Even in areas where one can achieve expertise, constantly changing and expanding information bases necessitate an ongoing struggle for individuals to keep up-to-date and in control of their daily information environment as well as with information from other fields which can affect the outcomes of their decisions. To summarise, Tagg (1996) states that there is no use planning for the future of education without considering the future of society as a whole.

Fourthly, computers can enhance student learning experiences. Learning is more important than teaching, but the variations in learning styles between pupils are complex and are largely forgotten in today's curriculum debate (Tagg 1996). What is more worrying is that the impositions of the National Curriculum are such that there is less time (and probably less motivation) for teachers to watch children at work – which according to Tagg is one of the most important ways of finding out how children think. IT can certainly help exploit this variety of learning styles because good software always puts the user in charge and usually provides alternative ways of achieving the same ends. The use of multimedia sparks great excitement among technology advocates. They say that learning comes alive in vivid ways that paper and pencil cannot match. This is further supported by the

reports of the National Education Association (1989) when it stressed the importance of putting the faculty at the centre of school restructuring with IT as one of many ways to enhance teaching and learning.

Fifthly, that there is evidence to support IT's contribution to a child's cognitive and skills development, as itemised in the findings of Bialo and Sivin (1990) mentioned earlier.

Recent curricular changes in the United Kingdom with the emphasis on developing pupil autonomy through investigation, problem solving approaches and communications skills, have put IT use as a cross-curricular issue (Morrison 1989). This meant the integration of technology and associated technological resources in every lesson taught. The responsibility of organising and keeping tab on these valued resources to enable easy access for educators, according to Wright (1993), lie upon the media teacher/media specialist and the school resource centre (SRC).

Presently, in our country we are working toward making technology use a cross-curricular issue as our goal but unfortunately at a slow pace (Gan 1997). If we are to achieve this goal, then it is inevitable that the school resource centre (SRC) play a significant role in providing students with IT facilities.

The Role of the School Resource Centre and Media Teachers.

A review of literature by Gan (1997), Zoraini (1994) and based on conversations with reliable sources from the Ministry of Education, it was found that fourteen selected secondary schools throughout the country had their Pusat

Sumber networked and linked to the Internet in a pilot project under the auspices of the Ministry of Education (MOE) with the cooperation from Mimos Berhad and Telekoms Malaysia Berhad. The network, more popularly known as the *Rangkaian Munsyi*, basically involved setting up an Electronic Resource Centre (*Pusat Sumber Elektronik*) in each of the chosen schools. Each of these schools was given locally developed software (PRIMA) to automate their library collection. To date, the process of keying data from catalogue cards is still going on. The Internet connection in these schools was slow and mostly used for e-mail purposes. The teachers were not given exposure or training on IT capabilities that could be employed in their classrooms to enhance the teaching-learning process. A majority of them did not know how to tap valuable information and resources from the Internet that could be used in their classroom lessons. Those who knew were not trained on how to teach using these resources. Telekoms Malaysia Berhad recently terminated the Internet connection for these schools. This meant that the schools have to find alternative measures to get connected to the net.

Woody (1996), in her article entitled "The do's and don'ts of technology planning" strongly states that teachers should be educated on how to use technology effectively. She further suggests that provision for teacher education and time for that education be incorporated into the planning stage of IT implementation. Her views are strongly supported by Ely (1995) and Plotnick (1995) when they outlined that "teachers must become technologically literate" as one of the trends in educational technology.

The situation in the United States with regard to the role of the school library media centres (SLMC) and the media teachers in IT implementation is somewhat different. Wright (1993) stated that if computer-related technologies are to be used effectively and efficiently, teachers must know what resources exist, must have some examples of how to use those resources, and must have time to experiment and develop their own confidence in using resources with their students and their curriculum. On this note, Wright suggests that school library media specialists play a concerted role with school administrators, teachers and students in finding creative ways to integrate computer-related technologies into the administrative and instructional programs of the school. In the Information Age students need to have basic cognitive skills that involve application, comparing and contrasting, and problem solving. Simpson (1996) also shares this view in her work entitled "The school librarian's role in the electronic age". The school resource centre needs to be a safe place where teachers, students and administrators may develop skills in the use of computer-related technologies. The importance of the library media specialist in the process of technology integration is portrayed in *Information Power* (American Association of School Librarians 1988) where the three roles of the school library media specialists are defined, namely as information specialist, teacher, and instructional consultant.

IT literacy and information literacy has to be taught in order for pupils to effectively use these facilities. For this, the role of the media teacher is called for. Staff-development activities, aided by a trained media teacher, should explore the use of IT within the context of individual subjects as it has been argued that IT has

the power of transforming the learning activity into a more enjoyable experience for pupils (Moore 1985; Trotman-Dickenson 1986; Galbreath 1994).

The Need for Planning

It would be unprecedented to delve into the factors that affect the implementation of IT in schools without prior investigation into the various questions that brought about it's being, in particular the planning involved. In the United States of America, microcomputer use is often driven by the purchase of hardware. In the U.K. too, funding for IT in education has been for the acquisition of hardware (the technology) and not the software (the curriculum application). For one reason or another, computers appear in a school and the school is supposed to make appropriate use of them. The move to obtain computers was either directed by the district administration or through the initiative of individual teachers or departments. Unfortunately, regardless of where the impetus comes from, the "hardware first pathway" tends not to lead to successful school-wide computer use since it is seldom accompanied by adequate or appropriate planning (Geisert and. Futrell 1995).

The National School Boards Association reported (Pogrow 1985) that 86% of the public school districts it surveyed in 1984 had no policies or guidelines about what they would do with the computers they were buying. Buying hardware was the major trend, as if some magical event would happen that would integrate that hardware into the school programs. As late as 1987, less than half of the

school districts were spending any money to train the teachers who were to effect change through purchased technology (Editors of Technology & Learning, 1993).

It is a general rule that the most effective planning proceeds from established needs. When schools give priority to acquiring hardware, the value of the new technology seldom becomes sufficiently obvious to the faculty at large and the reality tends to fall far short of the hoped-for results. For school-wide integration to take place, more attention must be given to the "peopleware" than to hardware or software (Geisert and Futrell, 1995). Resources directed towards *planning* can help the school to focus on those who are expected to carry out the change—primarily, the teachers—and to provide for their needs throughout the process. Honan (1996) stressed further the importance for schools to develop long-range technology plans in order to bring the advantages offered by IT to as many students as possible. Teachers and administrators who are the implementers of IT in the education system should be involved in the planning process (Woody 1996). Gan (1997) noted that in the Malaysian context, it is pertinent for the authorities to take cognisance of the fact that without a solid, long-term strategic plan backed by a corps of IT-literate and committed educators to manage and implement IT projects in schools, all the national goals conceived so far to exploit IT in education are unlikely to produce results.

Ken Eastwood, Director of secondary education and instructional technology for the Oswega School District in western New York, pointed out that for successful IT implementation, two paradigms were changed. "First, do not go for a program that was market-driven." Most education relies on software and

hardware providers to provide turnkey solutions. In this case, teachers end up changing their curriculum and teaching style to fit the equipment, rather than the equipment fitting their methodology. "Second, address the question of how to implement the technology." Most school districts go out and buy hundreds of thousands of dollars of equipment with a general assumption that through osmosis it will get absorbed into the curriculum. For the Oswego School District in western New York, a detailed needs analysis was carried out before any hardware or software was put into the district (ABCNews.com, 1997).

Geisert and Futrell (1995) asserted that without school-wide planning involving broad participation of teachers, schools have little reason to expect the magical event (school-wide computer use) to happen. With such planning, however, there is less chance that the enthusiasm for innovation among early proponents will slip away before full-scale integration becomes possible. Lack of immediate results and other frustrations may accompany the change process, and ongoing planning can sustain the momentum.

When hardware is centre stage, curriculum issues and many other important factors critical to a successful integration process gets pushed to the side. To summarise Geisert's and Futrell's focus on planning as the key issue in successful IT implementation – without planning, there are no answers for such critical questions as these:

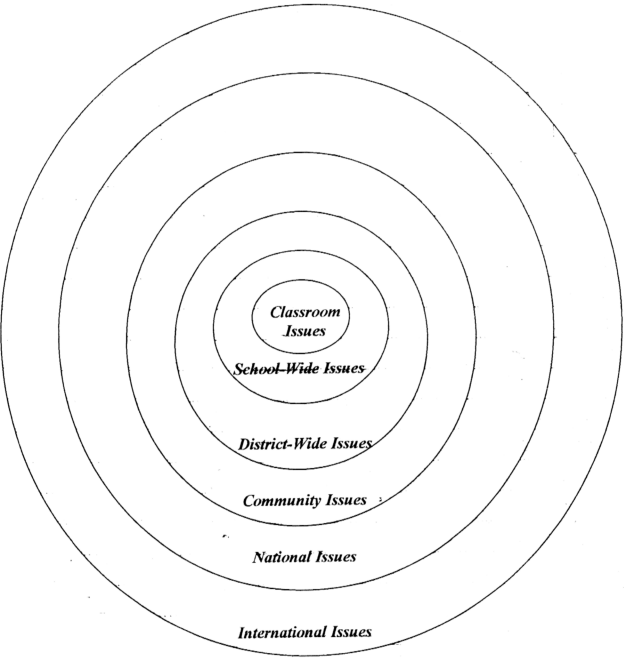
1. What are the school's goals for computers and the priorities toward which efforts are to be directed?

2. How will the school allocate and share available resources, and ensure equitable use of the technology among teachers and students?
3. Where in the curriculum will keyboarding be taught?
4. How will the school secure its hardware and software, and what rules and policies will govern their use?

Planning for the use of technology is not a simple process. The technology is expensive and complex, and it is seldom easy to see how to integrate it into an existing program. Various levels of computer-use issues **(See Diagram 1)** as ascertained by Geisert and Futrell (1995) need to be addressed for proper planning. Certain issues of planning such as that involving curriculum, resource issues, policy on software duplication and sharing procedures, equity to ensure appropriate and fair use and in-service training of teachers would have to be addressed by the higher authorities for example, at the district level. Other issues such as security of hardware and software, rules, policies that govern the computer use, require only school-wide planning.

Diagram 1

The Levels of Computer-use Issues (Adapted from Geisert & Futrell 1995)



Teacher Training and Support Staff

Geisert and Futrell (1995) reiterated that all teachers require a clear understanding of where they are headed (the school's direction). Instead of focusing on hardware first, a school might pay particular attention to meeting the needs of those teachers not initially desirous of, or sufficiently (in their view) knowledgeable about, the new technology.

Studies by Burral (1992), Hignite and Echternacht (1992), Bernavides and Bernavides (1993), and Kraaer (1993) have shown that teacher attitude towards computers can be a barrier. Teachers could be asked to delineate what they felt their learning needs were and how they would like to proceed. Efforts could be directed toward ensuring that teachers who participated in in-servicing experiences would view them as positive, as genuinely meaningful, and as contributing to their own teaching. The focus could be less on what the hardware could do than what they, as teachers, might *want to do* with the computers, and then, how to go about it. Desforges (1995) argues that just as scientists will adhere tenaciously to a theory, ignoring conflicting data unless a new and more encompassing theory evolves, teachers adhere to their current practice, ignoring the research evidence, until or unless that evidence provides a clear practical application into the classroom.

Prior computer literacy of teachers too should be considered, as it directly influences the success of the IT implementation process (Andre and Veldhuis 1991, Cates and McNaull 1993, Sulaiman and Zoraini 1994).

Formal training for teachers, be it in-service or preservice, is a must. Pelgrum and Plomp (1991) have shown from their international study that one of the main reasons for teachers not using computers in the classroom is the lack of knowledge and training in computers. Gan (1993, 1996c) acknowledges that the absence of a well-thought-out and comprehensive long-range plan for teacher training in IT is undoubtedly a contributing factor to the slow uptake of IT in schools as seen in the outcome of the CIE planning and implementation (Gan 1996b).

In the Information Age students need to have basic cognitive skills that involve application, comparing and contrasting, and problem solving. Undoubtedly, the Internet would provide an excellent vehicle for problem solving activities (Gray 1994). On this topic, Kinnaman (1994) stated that:

> "In the information age, students need to do more than just find information - they need to know how to separate the fluff from the substance".

In order to accomplish the task mentioned above, it is clear that a paradigm shift in the education system is needed (Galbreath 1994 and Gan 1996b). Gan (1996b) states that the acquisition of knowledge should no longer be regarded as the sole or main goal of education in schools. The use of computer technology in the learning environment, under the guidance of competent and confident teachers who are ready to relinquish their traditional role of a sage on stage, to learn and explore together with their students, is called for (Gan 1997).

With funding built into the budget and a long- term plan in place, one more hurdle is left: training the teachers to integrate computers into their curriculum. There has to be a level of support staff to help and train the teachers so they can make the best use of the technology. Even after teachers' initial fear of getting involved with technology has been overcome, serious challenges remain in terms of providing enough technical support that teachers will not be discouraged by equipment failures or software behaviour they do not understand. (Challenges and Strategies ... ,1997). At least five kinds of technical assistance are identified in the report as necessary:

1. Helping in planning for technology uses and acquisitions
2. Providing training in how to use new hardware and software
3. Providing demonstrations and advice on how to incorporate technology into instruction
4. Providing on-demand help when software problems or hardware failures arise
5. Performing low-level maintenance on the system

The relative importance of these functions shifts over time; the need for teacher "hand-holding" to get over initial anxieties and lack of knowledge about how to use functioning equipment will tend to be less, but the need for maintenance increases as hardware ages.

To date, the Office of Educational Research and Improvement has awarded five grants for Regional Technology Centres, which will provide technical

assistance to schools in the U.S. (Roberts 1996). However, such support has not been there for the Malaysian scene.

This situation is reminiscent of that potrayed by the QED (Quality Education Data—a Denver-based research firm that tracks the educational field) reports. The report states that spending on training during the 1990s has fluctuated from a high 9 percent of schools' total technology budgets in 1992-1993 to just 3 percent in 1994-1995. It concludes, " while educators frequently comment they want to learn new and better methods of integrating technology into the curriculum, funding for training has not increased to match this interest".

The Role of the School's Leadership

As the instructional leader, the principal is a conflict manager, an administrative decision maker, and a supervisor of instruction (Sewall 1994). Hence, the attitude of the head teacher is the most important factor in influencing attitudes towards computers and information technology in the school (Howlett and Quigley 1993; Watson et al. 1993; "IT Works" 1994). Howlett and Quigley (1993) stated that only if this attitude is positive will it be reflected in a positive attitude in the other teachers and pupils.

The headteacher "has a crucial role in raising the status of IT through:

1. Leadership
2. Monitoring and evaluation
3. Development planning
4. Curriculum planning (Moving forward 1997)".

In the article entitled "Moving Forward"(1997), ways in which the head teacher can promote the value of IT under his leadership is outlined as:

1. being a good role model and making personal use of IT
2. ensuring that the school has a clear policy statement on IT
3. positively encouraging staff and pupils to use IT
4. stimulating discussion about the contribution IT makes to teaching and learning, both formally at staff meetings and informally
5. incorporating IT initiatives into the wider vision of the school's development
6. being explicit about expectations for the use of IT

Such was the case at Robin Hood Primary School in south Birmingham, where the head was an ardent advocate of IT use, with computer:pupil ratio of 1:7 and two network rooms running 7 and 15 machines.

Studies carried out by Jackson (1996) and Jenlink (1994) on the role of the principal in integrating computers in the school instructional program reaffirm the important role of the head teacher and school administrator. Jackson's (1996) findings states that the school's leadership is an indicator of the progress and success of implementing and integrating technology into the curriculum.

The Question of Accessibility

Giving teachers more time to become familiar with software and hardware is essential. Teachers should have easy access to a computer where they can experiment with it in a non-threatening environment (Cox et. al.1988; "IT Works"

1994). However, access to hardware does not necessarily ensure access to instructionally appropriate software (Sewall 1994). Often teachers and schools have some software but do not buy multiple-station licenses so as to make it available to more users simultaneously.

The problem of equitable access to technology for teachers and pupils is of grave importance. Administrative needs such as maintenance of students records as well as instructional uses of computers for teaching must be weighted with due importance by the principal. Data from national surveys suggest that although American schools have more microcomputers than those of any other country, the level of access is still insufficient to support the vision for technology-supported reform-oriented classrooms (Challenges and Strategies ... 1997). Becker (1994), in his study noted that American students used computers on an average of 40 minutes a week. This is mainly attributed to the "lack of funds, equipment, software, and training [for teachers] (Technology Brief No. 9 1997)".

A corollary to the challenge of providing adequate access to technology generally is the concern with making sure that different kinds of students get equal access. In a national survey conducted by Becker and Sterling (1987), it was found that American students from low-income homes and ethnic minorities are less likely to have computers in their homes. Although the differences are smaller than those for ethnicity and socio-economic statues, there is also a gender difference in technology access to computers, with boys having more home access than girls (Sutton 1991; Mark 1992).

To its credit, the Clinton administration has raised the issue of disparities between the information rich and information poor. "Affluent parents are supplementing the information technology education their children receive at school, creating a growing gap between information haves and have-nots (*Multimedia Schools, January/February,* 1995, p.10)". In its 1993 Agenda for Action, the White House called for all schools, libraries, and hospitals to be connected to the national information infrastructure by the year 2000. The idea was to provide equitable access through these institutions, even if it could not be assured for all homes (Montgomery 1996). Some promising projects have emerged, such as California's NetDay, a one-day effort in March 1996, in which volunteers across the state strung miles of wire to connect elementary and secondary schools to the Internet. Montgomery (1996) ascertains that even if more children are able to use the new media through schools and libraries, they will still be at a disadvantage relative to the children with access at home. Niemi and Gooler (1987) and Eidgahy and Shearman (1994) share this view.

The Need for Security of Hardware and Software

This is an important issue to be addressed for school-wide planning of IT. At the school-wide level, plans must be made to keep computers secure, since electronic equipment has ready resale value after theft. These plans will depend on the conditions in a given school. In some schools a locked classroom will be a sufficient deterrent. Failing this, special computer cables can be purchased to lock the body and monitor of the computer to a table, or alarms with movement sensors

attached to the computer's body can be fixed. This view is in cognisant to Stoll (1995) when he stated that:

> "Our schools face serious problems, including overcrowded classrooms, teacher incompetence, and *lack of security*".

Stoll (1995) cited the example of Oakland Unified School District where Apple donated thirty computers a few years ago. Today, perhaps only five are still working. The reason being that all the computers that were not locked down was ripped off. Someone stole the cables and keyboards to systems that were locked to desks.

Then there is the problem of vandalism. Although computers are fairly rugged, vandalism of disk drives and software is easily accomplished. Geisert and Futrell (1995) suggest that some degree of watching the computers during use may help to reduce or eliminate the problem.

Computer hackers in a school can create havoc with software and computers. Hackers (computer-proficient enthusiasts "gone astray") can modify software, steal hardware and software, or place various kinds of viruses into computers. Hackers can also access school computers to communicate with other computers in the school, especially where machine networks are present. This implies that they can possibly get into administrative records in order to view and perhaps change the contents. Geisert and Futrell (1995) stresses that some form of preventive planning to address the problem of software, hardware, and school records security should be incorporated into the master plan for the success of IT implementation in schools.

The Budget Constraint.

President Clinton has championed the Internet as a saviour for the nation's have and have-not education system. Two billion US dollars has been pledged over the next five years to wire schools so that they can be connected to the Internet (ABCNews Jan 23 1996). However, the US Department of Education confirms that in 1995, only 14 percent of American public schools had Internet access in classrooms (ABCNews Jan 23 1996).

With the Telecommunication Act of 1996, Irving (1996) reaffirms President Clinton's stand that "schools, libraries, hospitals and clinics will have affordable access to advanced telecommunications services". The introduction of E-Rate (Education rate) would guarantee a free package of basic telecommunication services to every school and library in America. In addition, schools and libraries would receive advanced services at highly discounted rates, with further discounts for high-cost rural and low-income communities. No such equivalence exits in Malaysia.

Elite schools such as the Dalton School on New York's Upper East side are models for the wired classrooms of tomorrow. The school has been able to spend US$4 million since 1992 on technology alone. This situation is in contrast to that of poorer urban and rural schools, such as the high school in Mabton, Washington, or the Ralph Bunche School in Harlem (Chasing the Internet Dream 1997).

The Office of Technology Assesment (OTA) Report

The National Education Association (NEA) report offers one universal "must" that transcends institutions, resources, and goals. That "must" being: planning the use and implementation of technology. The report stressed that technology planning must occur at all levels: national, state, community, school, and classroom. Planning for technology is thus the most crucial factor that determines the success of an IT implementation process.

The Office of Technology Assessment's (OTA) report entitled, "Power ON! New Tools for Teaching and Learning", completed in 1988 for the U.S. Congress and other federal policy-makers was to provide a base of information for making long-range decisions. This report revealed a number of interesting findings concerning teachers and teaching, children and computers. The OTA report also revealed findings that every school board member, superintendent, and principal ought to consider when planning the implementation of computer technology in an educational program. Consequently, the report relates the other important factors that would affect IT implementation in schools. Those factors being teacher attitude and training support staff for maintenance, pupils' attitude toward computers and the role of the school leadership and administrators.

With reference to teachers and teaching, the OTA Report revealed that:

1. Despite the presence of computers in almost all American public schools, only half of the nation's teachers report ever using computers. The number of teachers who use computers regularly is much smaller.

2. Very few teachers have adequate time for planning and preparing to use technology.
3. The most recent data available indicate that only one-third of K-12 teachers have had as much as ten hours of computer training. Also, much of this training has focused on learning how to use computers, not how to teach with computers.
4. New technologies are making possible imaginative approaches to teaching traditional subjects.
5. One of the most significant impacts of computers has been on teaching style. Teachers can function as facilitators of student learning, rather than in their traditional role as presenters of ready-made information.
6. Educational technologies are not self-implementing, and they do not replace the teacher.

With regard to children and computers, the OTA Report revealed:

1. New technologies are motivating children to try new ways of learning and of gathering information.
2. Although new interactive technologies alone cannot solve the problems of American education, they have already contributed to important improvements in learning.
3. Technologies can help children acquire basic skills as well as endow them with more sophisticated skills so they can acquire and apply knowledge over their lifetimes.

4. At the current rate of allocation of resources, the nation can expect no more than spotty access to technology among children.

OTA findings that every school board member, superintendent, and principal ought to consider are:

1. *Understand the potential.* The appropriate assignment of new technologies within an already effective school can make a big difference in academic performance, motivation, and dedication to learning.
2. *Encourage flexibility.* The varied capabilities of the new technologies are the key to their power. Educators use interactive technologies for many purposes. Some of the most promising uses are:
    i. drill and practice to master basic skills;
    ii. development of writing skills;
    iii. understanding of abstract mathematics and science concepts;
    iv. simulations in science, mathematics, and social studies;
    v. better understanding of concepts through manipulation of databases;
    vi. acquisition of skills for general purposes and for business and vocational training;
    vii. access and communication for teachers and students in remote locations through telecommunications and distance learning;

viii. individualised learning;

ix. co-operative learning;

x. management of classroom activities and record keeping.

3. *Build in a budget line item.* Steady funding is vastly preferable to money that must be spent quickly.

4. *Work toward developing a critical mass of machines.* Although access to computers has increased significantly, the vast majority of schools still do not have enough machines to make the computers a central element of instruction.

5. *Provide adequate teacher training.* Teachers will need continuing in-service programs as technology changes, as more effective uses of technology are developed, and as research provides a better understanding of how children learn.

6. *Pay special attention to the needs of special children.* Special needs populations have demonstrated some of the most impressive learning gains as a result of access to new technologies. Don't forget them in the rush.

Louis Gerstner Jr., Chairman and CEO of IBM affirmed that " The technology in the public schools of America is about as backwards as you can find" on announcing the second phase of IBM's Reinventing Education grant program. He added, "There is no economic future for any U.S. entity if we don't have capable schools producing capable employees" and "Technology is an enabler of all you want to do. You don't buy technology, you use it to make a change."

The latest numbers from Market Data Research show that only 38 percent of K-12 schools have access to the Internet and that most of the connections are in the library or administrative offices. For many reasons—lack of funds, inadequate wiring and infrastructure, lack of expertise—more than 90 percent of the country's K-12 classrooms are not connected to the Web (PCWeek Online Feb.20, 1997). If good technology planning is not centre-stage in our IT implementation process, then it would be inevitable that schools in our country would face the same problems.

Top teachers are using the Internet and the World Wide Web (WWW) to reinvigorate themselves and their classrooms so they can do what top teachers have always done: inspire a new generation of children to love learning (Honan 1996). Hence the question of appropriate and adequate training for all teachers in the use of the Internet and its resources for classroom teaching should take priority in the technology plan so as to increase the number of top teachers in the country.

The implementation of IT in schools would require exposure to the Internet and of course the WWW. The WWW may not be a panacea for American education or any other nation. It may not even be the silver-bullet solution to every classroom challenge, but at a time when the Web is becoming a regular part of the cultural landscape, when an increasing percentage of parents are giving their kids access to the Internet at home, and when teachers are looking for a computer technology that relieves rather than adds to their burdens, access to the Web from within classrooms is a strong step in the right direction. It is therefore imperative

that the question of sufficient numbers of hardware, software, and other infrastructures required for IT implementation in our schools be duly addressed

Successful IT implementation in our schools would result in the increase use of the Internet and the WWW. For teachers, "The Web is bigger and better than a huge repository of facts and figures—it's a common meeting place for teachers, a source of lesson plans, and a forum where teachers can find others willing to discuss the challenges of teaching today" (Panepinto1997). Ultimately, the education scene would be transformed for the benefit of the schoolchildren and the betterment of the country.

Conclusion

From the review of related literature, it is clear that there are various factors to consider before embarking on the implementation of IT in schools. These factors though discussed in isolation in the sections above, are inter-related and should be viewed in total for effective technology planning, and hence successful IT implementation to occur. This study explores the factors in the Malaysian context.

The following chapter describes the methodology used in the study.