Chapter Five

DISCUSSION AND CONCLUSION

Several observations may be made regarding the various aspects of IT introduction in schools. These include (i) the current status of technology available in schools, (ii) the mode of computer introduction to schools, (iii) the problems faced and (iv) the factors affecting IT implementation in the schools under study. This chapter will identify and categorise the main factors that either impede or enhance the IT implementation process. This is achieved through the analysis of the sections D and E of the questionnaire. Those factors are discussed as follows.

Obstacles to the Implementation of IT in Schools

This section discusses the factors that were perceived by respondents as obstacles to the successful implementation of IT in schools.

Budget for IT

When respondents were asked to choose and rank five factors they perceived as obstacles to the successful implementation and use of IT in schools from a list provided, budgetary constraints topped the ranking. Respondents felt that sufficient monetary funds were required for purchase and maintenance of

hardware and software, providing telecommunications and other infrastructure such as a secure computer laboratory/class and training for teachers.

From informal interviews held with media teachers, some current practices amongst schools in overcoming the lack of funds were noted. These included soliciting donations from individual members of the PTA, sponsorships from the private sector, corporate bodies such as Telekom Malaysia Berhad (TMB) and public figures such as politicians and businessmen, fees collected from computer classes and fund-raising projects such as canteen day, walkathon, etc. This is reflected in the ways in which computers were introduced in schools (See **Figure 11** on page 72).

Lack of Training and the Role of the School's Leadership

The level of technical training/skills of teachers and administrators was ranked second. An analysis of the 58% respondents to the open-ended questions, indicated that a majority of 70% (n=58) expressed concern for the existing lack of trained personnel, teachers, support staff, maintenance staff and technicians. 48% (n=58) of respondents pointed out that the lack of courses for heads of schools and schoolteachers was a contributing factor to the low level of skills of teachers and administrators, 50% (n=140) of whom claim to have average understanding of IT and its implications

From an analysis of section A of the questionnaire, it was found that less than 50% (n=70) of principals or assistant principals had attended any course pertaining to IT (See **Figure 7** on page 66). Despite the lack in training and

exposure to IT, **Figure 13** indicates that 60% of respondents (both principals and media/library teachers) said that their schools' leadership played an active and encouraging role in IT implementation. This is a positive step in the right direction. The researcher's review of related literature supported the vital role of the schools' leadership for the successful implementation of IT.

A principal who is well trained and a user of IT would be an added plus for a school in its IT implementation process. Hence the question of training and provision of relevant courses for the heads of schools should be addressed.

Accessibility

Insufficient instruments for students in the classroom, or lack of equipment, was ranked third amongst factors most likely to impede the effective implementation of IT. This is supported by the analysis of the current status of technology in respondent schools.

The survey analysis showed that apart from the TV monitor and VCR, computers were also available in all the schools under study. This is a positive sign toward the introduction of IT in schools as computers form part of the technological aspect of IT (Tengku Azzman 1994). However, the number and status of equipment available varied within and between schools. For instance, only 40% (n=70) of the respondent schools with 486IBM/IBM compatibles or the pentium series had multimedia PCs with CD-ROM features. The diversity in equipment status is also portrayed in the percentage of schools with networked PCs (3%), Internet connection (21%) and electronic mail (21%) facilities.

exposure to IT, **Figure 13** indicates that 60% of respondents (both principals and media/library teachers) said that their schools' leadership played an active and encouraging role in IT implementation. This is a positive step in the right direction. The researcher's review of related literature supported the vital role of the schools' leadership for the successful implementation of IT.

A principal who is well trained and a user of IT would be an added plus for a school in its IT implementation process. Hence the question of training and provision of relevant courses for the heads of schools should be addressed.

Accessibility

Insufficient instruments for students in the classroom, or lack of equipment, was ranked third amongst factors most likely to impede the effective implementation of IT. This is supported by the analysis of the current status of technology in respondent schools.

The survey analysis showed that apart from the TV monitor and VCR, computers were also available in all the schools under study. This is a positive sign toward the introduction of IT in schools as computers form part of the technological aspect of IT (Tengku Azzman 1994). However, the number and status of equipment available varied within and between schools. For instance, only 40% (n=70) of the respondent schools with 486IBM/IBM compatibles or the pentium series had multimedia PCs with CD-ROM features. The diversity in equipment status is also portrayed in the percentage of schools with networked PCs (3%), Internet connection (21%) and electronic mail (21%) facilities.

The absence of standards for both hardware and software acquisition as confirmed by reliable sources in the MOE is a contributing factor to this phenomenon. Once a standard for hardware and software acquisition has been set aside for all schools to adopt then only can the authorities concerned be in a position to capitalise on the standardisation of computer platforms available and concentrate on the curriculum (Russell 1995).

Respondents perceived that student's limited access to computers was due to the large number of pupils per class. The existence of red tape and tight restrictions in the use of school computers and the fact that poor student have no PCs at home also determined the degree of accessibility for students. The question of accessibility for teachers was not mentioned.

Availability of Software

The lack of suitable educational software suited to the National Curriculum was ranked fourth. Currently, software available in the market is mostly in the English medium. This poses a problem for a majority of teachers whose fluency in the English language is somewhat limited. Newly developed software by local private companies is now available but has yet to be extensively tested for suitability in terms of content and approach.

The problem of finding suitable software can be overcome if schools have access to the Internet. There are numerous resources available on the Internet for use in teaching. Unfortunately, of the 101 schools surveyed, only 21% had access

to the Internet. Among the reasons cited for this was the expensive cost of telecommunications coupled with the lack of funds.

Incentives /Compensation for Educators

The lack of incentives/compensation for educators ranked fifth amongst the factors perceived as obstacles to the IT implementation process. Teachers fear that with the introduction of computers into the school system, their workload will inevitably increase. They strongly feel that time is needed on their part to learn the technology before the task of integrating that technology into the curriculum is put on their shoulders.

The red tape put on the existing government loan for purchase of computers too is also seen as a factor to be addressed. The number of government computer loans is limited with priority given to those teachers whose work directly deal with computer use. Though other computer loans are available, the repayment rate is too high.

Security

Respondents ranked security as the sixth factor. The security of persons and school property is vital for successful IT implementation. This is related in the literature review. As a large amount of money is spent on purchasing hardware and software, it is only befitting that stringent measures be taken to ensure their safety. Hence in the planning process, guidelines for ensuring such security must be outlined.

The problem of computer virus causing frequent downtime on computer use must also be addressed. Respondents felt that there should be adequate and suitable space such as a specialised computer room to ensure the safety of equipment.

Student Issues

The lack of student motivation to develop technical skills, and student behavioural problems were ranked last. Student issues such as anxiety, attitude, and self-efficacy must be dealt with for effective instruction in a computer-skills course (Houle 1996). About 40% (n=58) of respondents supported this, as indicated in their response to the open-ended question.

Respondents also cited the different levels of IT knowledge of students to be an obstacle to the implementation process. The lack of parental support especially from poor parents and uneducated parents who are ignorant about IT can contribute to this.

Planning

About 56% (n=58) of respondents also noted that there was no systematic planning for IT implementation in their schools. To add on, no guidelines for IT implementation was available, be it from the school administrators, at the district level or even at the state level. This issue is confirmed by reliable sources from the MOE.

Most if not all of the literature reviewed, cited planning as a key factor to the successful implementation of IT in schools. Numerous case studies from all over the world was carried out and their findings assert the importance of good technology planning before implementation. In fact, it can be summarised that planning encompasses all the various aspects mentioned above, i.e. budget, time to train teachers, support staff, equipment availability, software and hardware choices, accessibility, security and other infrastructures. It should not be taken for granted that all schools have the basic infrastructure such as electricity supply. About 2% (n=58) of respondents cited that the unstable electricity supply in their school would be a major obstacle to the successful implementation process. Thus, measures to undertake in overcoming this particular problem must be dealt with at the planning stage.

The findings of this study noted that 50% (n=140) of respondents claimed to have gone through some form of planning for the introduction of IT in their respective schools. As noted in **Figure 12** on page 73, 39% of respondents had no planning done whilst only 11% planned very well for IT introduction. However, the success or failure of IT implementation in these schools have yet to be seen. Respondents' perceptions of factors that determine the successful implementation and use of IT in schools was surveyed. It was found that 100% strongly agreed with all the factors listed (See **Table 9** on page 84).

The burden of implementing educational innovations falls on the teacher. Hence, it is imperative that they be allowed time to learn the technology and develop a positive attitude toward its use in the classroom. This can be achieved

through the reduction of non-teaching requirements of teachers to facilitate the learning and the deployment of IT.

Tagg (1995) listed various reasons for going against the introduction of a National Curriculum in the UK. One of the reasons cited was that "a National Curriculum makes changes more difficult. Unplanned initiatives cannot happen. It was precisely because in the early days when we did not have a national curriculum and when IT education was emerging, that we made more rapid progress than the rest of the world." For the successful implementation of IT, it is inevitable that a revision of the National Curriculum take place. The question of whether technology should be used to suit the curriculum or whether the curriculum should be changed to adopt the technology must be addressed.

Incentives/Requirements for the Implementation of IT in Education

This section deals with respondents' perceptions of incentives that will accelerate the implementation and utilisation of IT in schools. The respondents were required to rank from a given list, the factors they perceived as incentives.

Training of Educators

The training of educators in the use, availability and applications of IT was ranked first. Respondents felt that continuous in-service courses to enhance teachers' confidence on the use of IT should be made available to all. Furthermore, 35% (n=56) respondents wanted encouragement from education authorities for teachers to visit schools/institutions of higher learning that have IT facilities

It is undisputed that there will be a change in the nature of classrooms and the role teachers play when technology is introduced. The introduction of technology has the capability of changing the fundamental nature of the classroom from a teacher-directed to a learner-centered environment. Responsibility for learning shifts more toward the learner, with teachers exerting less direct control. The teacher becomes a facilitator of learning, coach, or mentor, rather than the transmitter of information. These changes are career altering patterns of performance for some teachers, whereas for others they are thoroughly threatening. Some teachers are willing and able to make changes in deeply entrenched pedagogical behaviour; others are unwilling or unable (Mandinach and Cline 1996). Hence encouragement and coaxing from the relevant authorities for teachers that fall in this category is vital before any form of training can be levied upon them.

Government Grants and Subsidies

Respondents ranked government grants/subsidies to implement IT in education as second. About 78% (n=56) respondents felt that an increase in government grants for the purpose of IT implementation in schools was vital. This would also include provision of computer loans for all teachers.

Teacher Issues

The reduction in non-technical teaching requirement/workload of educators was ranked as a third incentive. About 86% (n=56) of respondents cited the availability of technical support or a computer assistant to be crucial for IT implementation. Establishing a unit or department that closely monitors and advises teachers on IT development in schools at the district or zone levels would be an added incentive.

Availability and Affordability

Greater availability and affordability of educational software programs ranked as the fourth incentive. Much of the educational software currently available are imported. Their importation are by specialised vendors who normally stock them in small quantities. This means that they are not widely available in ordinary stores and even when they are available, their prices are at a premium. Rich schools located in the urban centre of the cities will have greater accessibility and affordability as opposed to the poorer schools located away in the suburbs. Moderating these factors will ensure equal opportunity for all schools.

Telecommunication Access

Inexpensive telecommunication access is ranked as the fifth incentive. A special scheme, similar to that initiated by the Clinton administration in America, could be made available for schools in Malaysia. The reduction in

telecommunication rates for schools would encourage more connectivity to the World Wide Web (WWW).

IT as a Public Priority

Making educational technology, in particular IT, a greater public priority ranked sixth among the incentives. Respondents indicated that IT awareness and public IT literacy was necessary. For this, the role of the mass media in disseminating information regarding the benefits and uses of IT is required. Co-operation from the private sector through donations of state-of-the-art computers to schools is also seen as an incentive for IT implementation.

Pilot Programs

Not much confidence was placed for the establishment of pilot programs in select schools to serve as technical models as this incentive was ranked seventh. In fact, 20% (n=58) of respondents felt that money spent on these select schools should be redistributed to other schools so as to enable more schools to participate in the IT implementation program

Availability of On-line Information.

The availability of on-line information ranked last amongst initiatives. This could be due to several factors. For one, few schools have access to on-line information such as the Internet. Hence the importance of such information is not

appreciated or acknowledged. Increasing the number of schools with Internet connection can overcome this matter.

Other Perceived Incentives

There are other incentives perceived by respondents. They felt that exposing students to IT at a younger age, a smaller class enrolment, classrooms that are secure and well equipped with state-of-the-art computers and a special curriculum for teaching IT in schools are forms of incentives to accelerate the implementation of IT.

Three pressures and three waves

The introduction of computers in respondents' schools have clearly indicated that other than procurement of computers through computer classes (69%) or purchased with government grants (49%), the three pressures as reiterated by Cerych (1985) does exist whereby PTA contributions and donations form 40% of the mode in which computers were acquired. It is thus apparent that government, as well as parents, want schools to produce computer literate school leavers with sufficient IT skills to gain a foothold in the increasingly computerised work place (Chalkley and Nicholas 1997). The existence of a standard for hardware and software acquisition can facilitate a quicker realisation of this aspiration as a significant majority (46%, n=101) of schools can afford to increase the number of computers in schools under their own initiative.

The software applications/functions in respondent schools indicate only a 17% (n=140) presence of educational drill and practice software as compared to a 100% word-processing and spreadsheet applications. How and when these software are being used was not made clear in the responses. However, Chalkley and Nicholas (1997) states that there is considerable agreement amongst researchers that computers are not being used widely or effectively in many classrooms and that this picture holds true for several different countries. According to them, it appears that where computers are being used, it is in ways which will not interfere with conventional teaching methods and which make as few demands on teachers as possible. Hence it is difficult to determine the three waves of Sendov (1986) in each of the respondent schools.

Perhaps there are various factors that contribute to the lack of use of the software application/functions available in the respondent schools. Among them, the incompatibility existing between software available and hardware platform to work on as pointed out by Russell (1995) to be one of the four contributing factors which have militated against the successful integration of IT in schools.

A Summary of Factors Affecting IT Implementation in Schools

From the research conducted, an attempt to summarise the main factors affecting IT implementation in schools, both positively or negatively, is portrayed in Diagram 2 below.

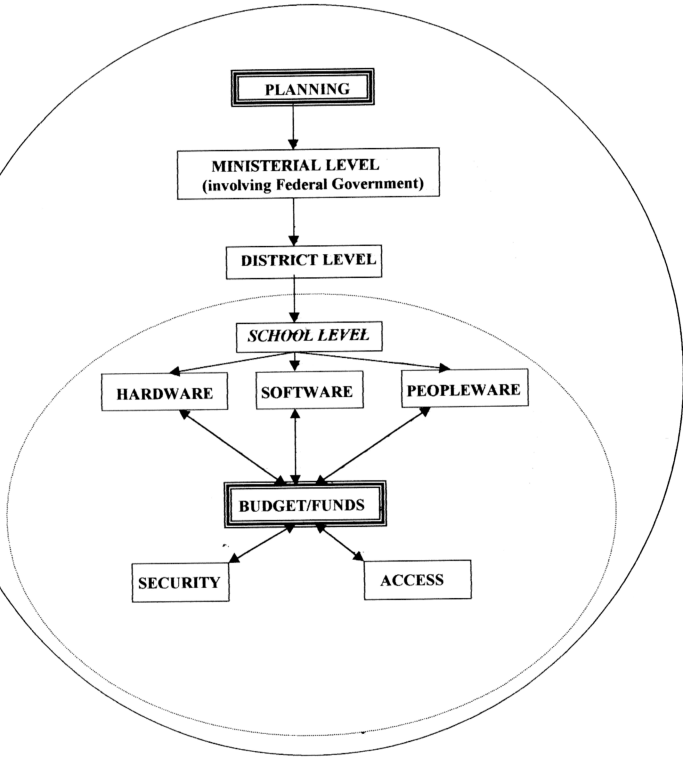
The review of related literature indicated that there exist various levels of planning. In the Malaysian context, the levels would include (i) ministerial, (ii)

district and (iii) school. In this study, however, the researcher only dealt with planning done at the school level. The diagram also indicates that all the factors at the school level are important variables that will affect the planning at the higher level. In other words, it is important that planners do not overlook the variables and feedback from the schools. Their importance can never be underestimated since the school is the centre-stage of the implementation of IT in education.

The diagram also illustrates that budget/funds is an important factor to consider in the planning process. Particularly the budget made available to each school. This will determine the degree of resources that will be at the disposal of the school and the extent that the school will have to acquire additional resources for itself. This in turn will influence all other decisions on hardware, software, peopleware, security and access.

Diagram 2

Main Factors Affecting the Implementation of Information Technology (IT) in Schools



Suggestions and Recommendations

To date, many initiatives are undertaken by the government and non-government organisations (NGO) to ensure the success and widespread use of IT in the country. These include seminars, conferences, expositions and even patriotic songs to educate and inculcate public awareness with regard to the importance of IT.

The NITC has set up a five-man Technical Review Committee for the Demonstrator Application Programme, one of the three key initiatives to drive the National IT Agenda. This committee headed by NITC's permanent secretary Datuk Dr. Tengku Mohd. Azzman was launched by the Prime Minister on April 24, 1997 (Computimes, April 28, 1997). The demonstrator applications are small, focused and short-term projects aimed at creating, developing and promoting new applications using IT and multimedia technology. These bottom-up driven innovations will be localised and customised in terms of local languages and cultural relevancy to the Malaysian community.

The NITC sees the Demonstrator Applications Programme as a key initiative to create IT awareness among the public and to promote its development in the country. It will enable more people, especially those outside the geography of the Multimedia Super Corridor (MSC), to participate in the multimedia development of the country as all are encouraged to take part, be they local individual entrepreneurs, local private enterprises, public sector agencies, academia, non-profit as well as non-Governmental organisations.

The two other initiatives of the National IT Agenda are the IT programmes as well as the MSC and its flagship applications – the smart schools, multipurpose smartcard, research and development or R&D cluster, electronic Government, world-wide manufacturing Web, borderless marketing and telemedicine.

The use of IT in schools should not be viewed as a panacea but instead as a tool that is capable of changing the ways in which schools operate. It could be used to remould curricula and teaching methods. The technology is expensive and complex, and it is seldom easy to see how to integrate it into an existing curriculum. Some issues, related to IT integration in schools that should be considered to ensure success in the implementation process include:

1.Hardware resources	- Purchase of equipment (standards)
	- Placement (who gets what)
	- How to keep current with rapid changes
	- Security at school level
2. Software resources	- Matching courseware to curriculum
	- Evaluation, quality control
	- Acquisitions, setting priorities
	- Security, placement
3. Teachers	- Professional development goals
	- Changing teaching roles
	- Professional needs, in-service training

4. Students	- Types of students
	- Proficiencies
	- Interests
	- Special needs
5. District-wide	- Broad goals
	- Curriculum to implement goals
	- Curriculum objectives related to IT use
	- Instructional procedures using computers
	- In-service training for computer integration
	- Teaching with computers
	- Teaching about computers
6. Community	- Computer literacy
	- Computer literacy for vocational use
	- Needs versus resources (willingness to pay)
7. Nation	- International technological competition
	- International commercial competition
	- Need for computer literacy of public
	- Military needs
8. World-wide	- International telecommunication networks
	from classroom to classroom

Foreign initiatives and programs are important to local planners for two major reasons. They provide working models and a ready database of experience. It is certainly not wise to uncritically accept any of them without

proper study. Planners, for instance, should avoid any tendency to emulate blindly the K-12 program in the U.S.A.; even if the argument that they have been absolutely successful. If anything, their real value would be in providing our policy makers in the MOE a list of lessons that we could learn and costly mistakes to avoid. Notably, the "Seven Sins of Technology Planning" as reiterated by Sibley and Kimball (1998) should be avoided to meet the "Five Challenges" which are critical factors determining the success of technology planning. The three major phases of technology planning process (Silbey and Kimball 1988), include (i) the assessment phase, (ii) the formulation phase, and (iii) the implementation phase all of which should be collectively taken into account in the context of technological progress (Moursund 1977). This is particularly evident in the steps undertaken in the United Kingdom, where the Government Department for Education and Science created an IT in Schools Division which specially oversee that adequate funding was available to schools in tandem with the development of technology.

It has been noted that the intervention from the government in IT planning is important. For instance, in terms of providing encouragement and incentives for NGOs to participate in the process. A good model of such initiative is as seen in the New Horizons training program. The program focuses on the training of teachers in IT. One of the benefits of such training programs was that it could assist in facilitating and speeding up the adoption of IT into the mainstream curriculum. It has been suggested that the role of the government in providing such incentives, especially the MOE, could be more effective by making IT as a "Core Value" (Kwalewski 1997). However, the core value approach can only be

established by each school district if the monetary resources, staff availability, or educational philosophy, are in line with standards set aside by the MOE. In other words, each school irrespective of locality and accessibility is ensured to have the same standard of resources at all levels.

Government intervention in getting co-operation from the private sectors and NGOs are essential. Such local initiatives as in the case of TMB providing subsidised rates for Internet connections in schools is a step in the right direction. This has been the standard practice in nearly all the industrialised countries in America and Europe. For example a local telephone company in Maidenhead, England sponsored schools within its locality with free telecommunications infrastructure. This has been a tremendous help to the schools. In addition to the basic infrastructure they also assisted in obtaining sponsorships for hardware and software from other local companies operating in that area. In short, it is like "prospering from the people and giving them back."

Non governmental organisations such as the Malaysian Council for Computers in Education (MCCE) could also draw upon its resources to help train teachers to be proficient in IT. They can also serve in the advisory committee for schools seeking information on IT implementation. The expertise of members of the MCCE or other similar organisations could be harnessed to conduct studies to help set standards, particularly with regard to hardware platform and suitable software to be adopted by schools. They could also recruit members proficient in IT to serve as a maintenance advisory team or virtual help-line to whom teachers can call for assistance.

Recommendations for Further Study

In this study, the researcher had attempted to list both the positive or negative factors that affect IT implementation in schools using schools in the Klang Valley as a sample. The findings of this study were largely based on the responses received from the survey instrument used and the review of related literature. The researcher wishes to stress that the accuracy of these findings is dependent upon the honesty of the respondents in answering the questionnaire.

The study concentrated on an area within the hub of the MSC. Perhaps further studies could be conducted in other parts of the country to investigate if the factors affecting the IT implementation in schools observed in the study are repeated elsewhere. This should be complemented by a critical study of the various pilot projects, such as the *Rangkaian Munsyi*. The findings from such studies would give policy makers invaluable insight with respect to the IT implementation in schools of Malaysia.

Conclusion

The findings of this study, based on responses from the sample taken were somewhat as anticipated by the researcher. Each respondent school highlighted their problems in isolation i.e. without considering the whole perspective of the process involved in IT implementation. This includes the issues of the stages of planning, and execution. The major contributing factors that either enhance or impede the IT implementation process have been noted and discussed. For

example, the question of teacher training, lack of maintenance staff and technical assistance, lack of sufficient and adequate hardware, lack of appropriate software and lack of funds for equipment purchase, security and accessibility have been highly rated as factors that impede the IT implementation process.

The majority of the school administrators, namely the Principals and the Senior Assistants 1, lack exposure to IT related courses. However, it is interesting to note that the school administrators generally gave strong support to the process of implementing IT in their respective school. Their support might be related to other reasons, for instance, implementing an executive order. Occasionally the support did come in the form of personal encouragement for both teachers and students to use IT in classroom and schoolwork.

It is imperative that the relevant authorities maintain a high level of vigilance and realism in their planning for IT in schools. A prerequisite towards this is by keeping in mind that the success of introducing any educational technology in the schools of Malaysia, lies in the availability of basic infrastructures, such as electricity supply and telephone lines. By ensuring their equitable accessibility, a step towards equitable access to IT or any other advanced technology has been put in place.