

Are We ‘Smarter’ Now? Case Study of Smart School Implementation in a Developing Nation

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Abstract

This study was aimed at investigating ICT adoption at a Smart School in Malaysia. A questionnaire gathering data on the tools and applications used by teachers as well factors affecting teachers' adoption of ICT in teaching was administered to 73 teachers and one administrator while 10 teachers and the administrator were interviewed to gain a deeper understanding of the reasons for the responses given in the questionnaire. Frequencies and percentages were calculated while emerging themes from the interviews were recorded for analysis. The results revealed that the participants were at the Utilisation level of ICT adoption even though most of them have positive attitudes toward ICT adoption which means that they were willing to use ICT, specifically computers, in the classroom. The participants used ICT tools to prepare exam materials, content, worksheets and handouts for their teaching. However, the factors that influenced participants' ICT adoption were: one, using ICT in teaching took up too much time, two, the school management did not provide enough ICT facilities and training to improve ICT skills was needed and three, even though the school management supported ICT adoption they did not put it as a priority. In conclusion, the findings indicated that the participants were positive about the adoption but several factors are barriers which could have affected their progress from lower level to a higher level

adoption. Recommendations include allocation of time to prepare ICT resources and lesson, further training for teachers and increase in the number of computers at the school.

Keywords: Information Communication and Technologies (ICT), Smart School, barriers to adoption

1. Introduction

The rapid growth in Information Communication and Technologies (ICT) has brought remarkable changes in the twenty-first century. It has become increasingly important in our daily lives and our educational system. Realizing the emerging importance of ICT there is a growing demand on educational institutions to use ICT to teach the skills and knowledge students need for the 21st century (Gülbahar, 2007). It is assumed that the integration of ICT into education will have a significant potential to revolutionize an outmoded educational system (Albirini, 2006). As a result, today's educational institutions have tried to restructure their educational curricula and classroom facilities (Baek et al., 2008). This requires effective adoption of technologies into an existing environment in order to provide learners with knowledge of specific subject areas, promote meaningful learning and enhance professional productivity (Tomei, 2005). Malaysia has embarked on several technology initiatives to spearhead the adoption of ICT in schools, particularly at the turn of the 21st century. The initiatives were brought forth with the aim of motivating rapid economic growth and development. With the vision of becoming a developed nation by the year 2020, Malaysian Ministry of Education (MOE) implemented several ICT programs in schools nationwide in an attempt to bring technology into the classrooms such as the Computer Literacy Pilot Project, Computer in Education, Computer Aided Instruction and Learning, National Educational Network, Munsyi Network and Smart schools (Rosnaini & Mohd, 2009).

In July 1997, the Malaysian Smart School Project was launched. The smart school initiative is one of the seven flagship applications that are part of the Malaysian Multimedia Super Corridor (MSC) project. This initiative began with a pilot project with a group of 88 schools in 1999. The schools served as the nucleus for the eventual nationwide smart school concepts, materials, skills and technologies (Bakar & Mohamed, 2008). The introduction of the smart school project saw a change in the educational system; from conventional learning and examination-oriented culture to an electronic learning system or e-learning. In this context, the Malaysian smart school could be defined as a learning institution that has been systematically reinvented in terms of its teaching practices as well as school management in order to prepare Malaysian children for the information age and fulfil vision 2020.

To guarantee the success of the proposed conceptual model, these smart schools required effective and efficient management of the resources as well as the teaching processes. The schools were provided with learning materials, which included interactive courseware and printed materials for Mathematics, Science, English and Malay Language. These enabled students to practice self-paced, self-accessed and self-directed learning (Light, 2011). In addition, professional development programs for new and practicing teachers, administrators, curriculum developers, ICT coordinators, counselors and librarians were also provided (Baek et al., 2008).

1.1 Problem Statement

Andoh (2012) highlights in his study that although ICT is viewed as a golden key in facilitating technology-enhanced, student-centered teaching environments, the current level of ICT implementation has not yet reached a widespread audience. He explains that the gap

between the innovative implementation objectives set down by government initiatives to encourage ICT and the actual adoption of ICT in the classroom need to be investigated further to gain a more informed insight into the current situation. The study cite potential barriers to the adoption of ICT into the classroom, which could include confidence level in using technology, access to facilities, professional development training that lacks focus on pedagogical skills and teachers' reluctance to change their teaching practice. In the case of Malaysia Smart School Project, even though it is a nationwide initiative garnering a huge budget from the taxpayers' money research is still lacking (UNESCO, 2002).

It is thus proposed that by investigating teachers' use of ICT and identifying factors that contribute toward their use of ICT in the classroom could reflect the level of ICT adoption for teaching. The findings may provide some insights as to what extent the usage of ICT has been embraced at smart schools. Conclusions and recommendations could then be put forth to facilitate enhancement or improvement of the adoption. While it appears that a number of research studies have been undertaken to explore the different aspects of ICT use in the schools, there is very limited data available relating to Malaysian smart schools. For these reasons the researcher conclude that this area warrants further investigation. The following research questions are formulated to guide this study:

1. What are the ICT tools available at the school and to what extent do the teachers use ICT in teaching and learning?
2. What are the factors that contribute to the teachers' use of ICT in teaching?

2. Literature Review

This review focuses on issues, which are on ICT adoption for teaching and the Malaysian smart school project.

2.1 ICT Adoption in Education

The growth of the knowledge society and the pervasiveness of technology represent not only a major challenge but also opportunity for education (Liu, 2010). Lim and Chai (2008) report on the positive pedagogical opportunities of incorporating the World Wide Web into the classroom as a source for up-to-date information. At the same time, encouraging independent thinking as well as learning amongst learners. Lawless and Pellegrino (2007) also observe the huge potential of ICT in supporting and enhancing home schooling and provides opportunity for collaborative online learning. Zailin (2010) concur that ICT, in particular student involvement in online communities through the use of wikis and blogs can be successful in encouraging students who are reluctant to participate in normal classroom discussions. This active online involvement has also been reported to improve students' writing skills (Zailin, 2010). These studies show that the benefits of using ICT in education provide an abundance of resources, support home schooling, encourage students to participate, sharing resources or ideas and improve writing skills. As a result, educational institutions have started adopting ICT in the classroom (Albrini, 2006; Gulbahar, 2007).

2.2 Framework for ICT Adoption in Teaching and Learning

The Organization for Economic Co-operation and Development (Liu, 2010) report that ICT was not envisaged as part of the school curriculum but has arisen from external ICT developments and the perceived need for ICT to be incorporated into the teaching environment. For this reason it has been difficult for researchers to assess ICT adoption in schools. The difficulty arises when researchers have different ways of defining levels of adoption or integration. Gülbahar (2007) refers to it as having computer hardware or software while other studies view ICT adoption as teachers using ICT in the classroom or schools using ICT for administrative purposes. Eteokleous (2008) describes adoption as the decisions that individuals make each time they consider taking up an innovation. Pac (2008) argues that the process of adoption starts with initial hearing about an innovation to final adoption. At another level is the definition that links ICT adoption with the concept of wholeness, when all elements of the system are connected together to become a whole. For instance, the two important elements of teaching which are content and pedagogy must be integrated when technology is used in a lesson. However, if students are only offered a series of websites or ICT tools (e.g. CD ROMs, multimedia) without other learning activities then the teacher is not integrating ICT into teaching and is not tackling the pedagogical issues. Similarly, Wozney et al (2006) described ICT integration as the means of using any ICT tool (Internet, e-learning technologies, CD ROMs) to assist teaching. However, these definitions are in isolation of the teaching application and context. A more comprehensive framework is needed to explain the level of ICT adoption in teaching and learning.

Tondeur et al. (2008) undertook an extensive study of the educational use of computers in a secondary school and sought to clarify how best to measure adoption through developing a measurement for assessing ICT use in education. ICT uses are identified into three levels:

1. Basic computer skills, for example starting up a computer and related equipment such as printer or scanner
2. Computers as an information tool, for example conducting online search.
3. Computers as a learning tool for education.

Hooper and Rieber (1999) further elaborated on this and suggested five phases or levels of teachers' use of ICT, which are Familiarization, Utilization, Integration, Reorientation, and Evolution. They claim that the full potential of any educational technology could only be realized when educators progress through all the five phases, otherwise, the technology would likely be misused or discarded. In addition, the model explains that the traditional role of technology in education is limited to the first three phases, whereas contemporary views hold the promise to reach the Evolution phase (Hooper and Rieber, 1999). Table 1 elaborates on the criteria for each phase in the model:

Table 1. Hooper and Rieber (1999) Framework of ICT Adoption

STAGE	DESCRIPTION
Familiarization	Teachers participating in an in-service workshop covering the "how to" of a technology and becomes acquainted with technology, such as word processing, and spreadsheets. Once the workshop ends, so too does the teachers' experience and growth with the technology. A great deal of instructional innovation begins and ends with this phase.
Utilization	Teachers try out the technology or innovation in the classroom but there is the inherent danger that they will become prematurely satisfied with their limited use of the technology. The attitude of "At least I gave it a try" will likely interfere with any enduring and long-term adoption of the technology. Teachers who progress only to this phase will probably discard the technology at the first sign of trouble because they have made no commitment to it.
Integration	Represents the "breakthrough" phase in which teachers consciously decides to designate certain tasks and responsibilities to the technology. So, if the technology is suddenly removed or is unavailable, the teacher cannot proceed with the instruction as planned.
Reorientation	Teachers will reconsider and conceptualize the purpose and function of technology in the classroom and is marked by many characteristics such as the focus of the classroom is now centered on a student's learning, as opposed to the teacher's instruction.
Evolution	The classroom-learning environment will constantly change, continue to evolve and adapt to remain effective and meet the challenge and potential provided by new technology.

2.3 Factors Contributing to Teacher's ICT Adoption

Many researchers have labeled the factors affecting ICT uptake as "barriers to change" (Nussbaum et al., 2009). It has been highlighted that not all teachers are willing to incorporate ICT into their teaching. This could be one of the obstacles that may affect the adoption of ICT at secondary schools in Malaysia. Insufficient access to ICT is another problem, which may prevent successful implementation of technology. Teachers have also been asked and note that access and age of computers are also a hindrance to successful integration. For instance, access levels could vary greatly across sites; configurations can include from one or several computers in a classroom as well as, access to a portable laptop cart for classroom use or access to a computer lab in the building.

In addition, Pac (2008) identifies five technological characteristics or attributes that may influence the decision to adopt an innovation that are: knowledge, persuasion, decision, implementation and confirmation. This means that the teachers not only must have knowledge to use the technology but must be persuaded to accept the adoption and implement it. The school management has to play an essential role in this. This suggestion is

confounded by Laurillard (2007), who identifies the following factors as influencing ICT adoption into teaching: user characteristics, content characteristics, technological considerations and organizational capacity. Other researchers identify the following factors that influence teachers' integration of ICT in the classroom: organizational factors, attitude toward technology, technological factors, individual factors and institutional factors (Tondeur et al., 2008). Other factors affecting adoption include lack of training in adopting ICT (Nut, 2010). It would appear from the list that there are many factors that could affect a teachers' use of ICT in their teaching environment. In this study, these factors that may affect ICT adoption and the implementation of the smart school initiative will be identified.

2.4 ICT Adoption at Malaysian Smart Schools

The Malaysian government has launched a project to develop smart schools. The smart school project has five main goals which are to: develop the individual child covering the intellectual, physical, emotional and spiritual domain, provide opportunities for the individual to develop their special strengths of abilities, produce a thinking work force that is technically literate, provide equal access to students to learn with computers and involve parents of the children, private sector, and the community in ICT education process (UNESCO, 2002). The Malaysian smart school flagship project was launched in July 1997 and comprises four phases:

Table 2. The Malaysian smart school flagship project

Phase	Activities
1 Pilot Project (1999 – 2002)	Eighty-eight, pilot schools were involved in which three models of technology was introduced: a computer laboratory model (Level B), a limited classroom model (Level B+), and a full classroom model (Level A). In this phase too, strategies and guidelines were prepared, and the basic amenities to schools according to their individual needs were provided. The pilot project activities consisted of: <ol style="list-style-type: none"> 1. Preparing computer materials for teaching of four subjects (i.e. Bahasa Malaysia, English language, Science and Mathematics). 2. Preparing assessments to give accurate and comprehensive feedback of students' process in ICT enabled education. 3. Integrating management systems to improve school administration was also included.
2 Post Pilot (2003 – 2005)	This phase was to continue and improve the first phase. The monitoring and corrective measures were critical that negligence in addressing constraints highlighted in the various studies would have jeopardized the successful implementation of the smart school initiative.
3 Making All Schools Smart (2006 – 2010)	The primary objectives of this stage were to: <ol style="list-style-type: none"> 1. produce a knowledge society that is critical, creative and innovative. 2. produce technology savvy individuals. 3. bridge the digital divide and to cultivate life-long learning based on ICT.
4 Consolidate And Stabilize (2011 – 2020)	This phase is currently in progress till 2020. The main objective for this stage is to consolidate and stabilize all the schools that are already smart schools. This stage is very important because some of the schools that just got the status of smart school may have their problems such as how to manage the school, lack of equipment, and teachers' lack of knowledge in using the technology.

3. Methodology

3.1 Context of the Study

This case study was conducted at a school in the east coast of Malaysia. There were one

hundred and five teachers and one thousand two hundred and seventy six students in the school at the time this study was carried out. The school is selected to become a smart school in Phase 1. The school has two computer labs whereby in each computer lab there were 18 computers. The operating system Window 7, with Microsoft Office is installed. Each computer has internet access, and one data projector, scanner and printer in each computer lab. Outside the computer labs there are four extra computers for general use of the students at the end of the day when they were waiting for their parents.

In terms of the teaching process at the school, the teachers did not plan their own teaching when using computers. They have a special website that was set up by the ICT Head of Department for the teachers. Each teacher has a private access to the teaching plan that is already set by each subject Head of Department for the whole year. In addition, the principal could review each teacher's teaching progress using ICT each week. This is to ensure the teachers are following the plan accordingly. As for training, selected teachers are sent for training when they are required to. In the training the teachers' will be taught how to use ICT in the teaching process. They will also gain vital skills to stay current with new techniques. Usually, the teachers have three training courses yearly and each course's duration is usually for two days. Teachers and staff would attend the ICT training courses at whichever time convenient to them. The school also provides laptops to the more senior Science and English teachers who have more knowledge and experience in using ICT because they were the first trained when the government introduced the Science and Mathematics in English initiative.

3.2 Participants of the Study

The study focused on 73 teachers at the smart school of whom 65 are female and 8 male teachers. The demography of the participants of this study is presented in Tables 3 and 4 and includes information on; age, gender, subject taught and teaching experience.

Table 3. Demography of the Survey Questionnaire Participants by Age Group

AGE GROUP	FEMALE	MALE	TOTAL
20-30yrs	12 (16.5%)	2 (2.7%)	14 (19.2%)
31-40yrs	25 (34.2%)	2.7% (n = 2)	27 (37%)
41-50yrs	21 (28.8%)	3 (4.1%)	24 (32.9%)
51-65yrs	7 (9.6%)	1 (1.4%)	8 (11%)
Total	65 (89%)	8 (11%)	73 (100%)

Table 4. Demography of the Survey Questionnaire Participants by Level of Computer Training

LEVEL OF COMPUTER TRAINING	FEMALE	MALE	TOTAL
No formal training	10 (13.8%)	2 (2.7%)	12 (16.5%)
Basic introduction course	25 (34.2%)	5 (6.9%)	30 (41.1%)
Intermediate course	18 (24.7%)	3 (4.1%)	21 (28.8%)
ECDL(EuropeanComputer Driving License)	7 (9.6%)	3 (4.1%)	10 (13.9%)
Total	60 (82.1%)	13 (17.9%)	73 (100%)

Most of participants in this study are female teachers, aged between 31 to 40 years old, 34.2% (n = 25). In terms of computer training, the highest level of training was at Intermediate course, 21 (28.8%). A majority only have basic training, 30 (41.1%). Interestingly, 12 (16.5%) of the participants have no training at all, 12 (16.5%) (Table 4). Ten of the teachers, who consented, were interviewed as key participants.

3.3 Data Collection Instruments & Analysis

Two data collection instruments were used in this study, which were survey questionnaire and interview. A survey questionnaire was used to collect data to answer the two research questions. The questions in the questionnaire focused on two areas:

1. Teachers' adoption of ICT, including use of specific ICT tools and application software, ICT tasks undertaken, and access to computers.
2. Factors that contribute to teachers' adoption of ICT in the classroom such as issues on school administrator support, ICT facilities and training for teachers.

The reliability of the questionnaire was calculated using SPSS version 19. The reliability was found to be at Cronbach $\alpha = 0.735$. This shows an acceptable reliability and internal

consistency (Cronk, 2012). In addition, semi-structured interviews were administered with the aim of collecting more in-depth information to triangulate with the data from the survey (Cohen et al., 2007). Data from the survey was analyzed descriptively for frequencies and percentages while that from the interview were coded according to emerging themes. The data were then matched to answer the research questions.

4. Findings & Discussion

4.1 Findings

The findings are reported according to the two research questions.

4.1.1 What are the ICT tools available at the school and to what extent do the teachers use ICT in teaching?

The ICT tools that were available at the school were computers, internet, printer, data projector, digital camera, digital video camera, scanner, interactive whiteboard, digital photo editing and digital video editing. The participants identified the ICT tools that they used in the classroom (Table 5).

Table 5. Participants' use of ICT Tools in Teaching

ICT Tools	Very often	Often	Sometimes	Almost never	Never
Computer	39.7% (n=29)	21.9% (n=16)	30.1% (n=22)	2.7% (n=2)	5.5% (n=4)
Printer	17.8% (n=13)	23.3% (n=17)	35.6% (n=26)	4.1% (n=3)	19.2% (n=14)
Data projector	15.1% (n= 11)	20.5% (n=15)	32.9% (n=24)	9.6% (n=7)	21.9% (n=16)
Digital camera	4.1% (n=3)	5.5% (n=4)	16.4% (n=12)	11% (n=8)	63% (n=46)
Digital video camera	1.4% (n=1)	1.4% (n=1)	11% (n=8)	15.1% (n=11)	71.2% (n=52)
Scanner	6.8% (n=5)	5.5% (n=4)	39.7% (n=29)	15.1% (n=11)	32.9% (n=24)
Interactive whiteboard	13.7% (n=10)	9.6% (n=7)	24.7% (n=18)	8.2% (n=6)	43.8% (n=32)
Digital photo editing	5.5% (n=4)	1.4% (n=1)	17.8% (n=13)	13.7% (n=10)	61.6% (n=45)
Digital video editing	1.4% (n=1)	1.4% (n=1)	11% (n=8)	15.1% (n=11)	71.2% (n=52)

Table 5 shows that most of the participants very often used the computer, 39.7% ($n = 29$),

followed by the printer, 17.8 % ($n= 13$) and data projector, 15.1 % ($n= 11$). Majority claimed that they have never used the digital video editing, and digital video camera, 71.2% ($n= 52$) respectively and the digital photo editing tools, 61.6 % ($n= 45$). One of the ICT tools, which were frequently used by the participants in their classroom, was the computer because the smart schools were provided software to use by the Ministry of Education. Most of the participants stated that they had access to the computers each day. The only difference was the duration in which they were given access to it because it would depend on the computer labs timetables (Figure 2).

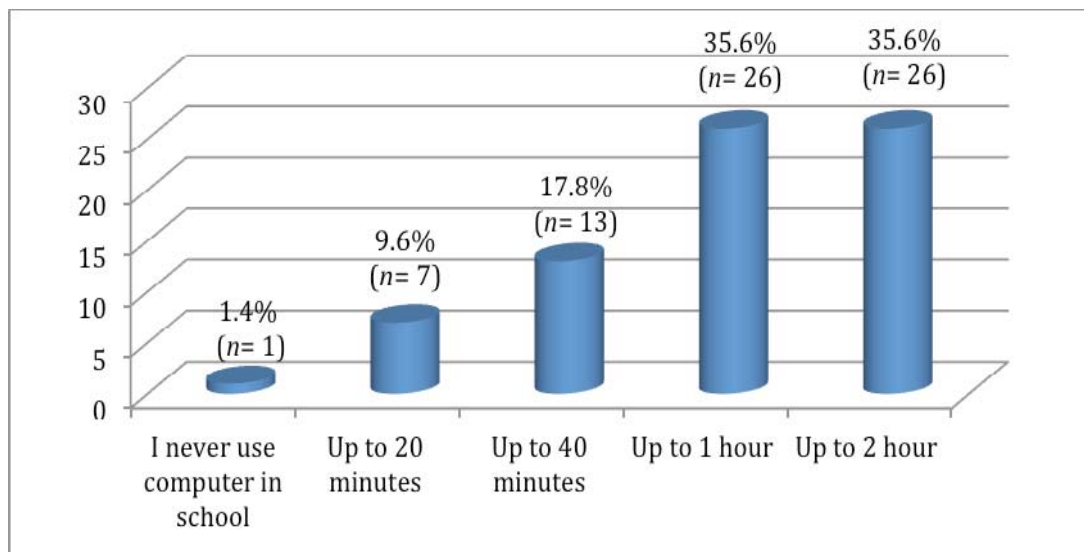


Figure 2. Time allocated to access computer each day

Figure 2 indicates that more than one third of the participants accessed computers for up to one hour a day at school, 35.6% ($n= 26$), and another 35.6% ($n= 26$) had up to two hours access a day. Some of the participants only had about 40 minutes access (17.8%; $n= 13$), while 9.6% ($n= 7$) had 20 minutes access to computers each day and the rest, 1.4% ($n= 1$) claimed that they had never used the computers in school.

In line with the participants' frequent use of the computers in comparison to other ICT tools, the participants were asked how often they used Microsoft Office applications in their teaching since this was the most common application used for teaching. The results showed that the three applications most frequently used were the Microsoft Word, Excel and PowerPoint (Table 6).

Table 6. Use of Microsoft Office applications in teaching

The Applications	Very often	Often	Sometimes	Almost Never	Never
Microsoft Word	38.4% (<i>n</i> = 28)	35.6% (<i>n</i> = 26)	20.5% (<i>n</i> = 15)	0% (<i>n</i> = 0)	5.5% (<i>n</i> = 4)
Microsoft Excel	15.1% (<i>n</i> = 11)	38.4% (<i>n</i> = 28)	34.2% (<i>n</i> = 25)	5.5% (<i>n</i> = 4)	6.8% (<i>n</i> = 5)
Microsoft PowerPoint	34.2% (<i>n</i> = 25)	31.5% (<i>n</i> = 23)	26% (<i>n</i> = 19)	0% (<i>n</i> = 0)	8.2% (<i>n</i> = 6)

Microsoft Word was the most popular among the three, 38.4% (*n*= 28), followed by Microsoft PowerPoint, 34.2% (*n*= 25) and Microsoft Excel, 15.1% (*n*= 11). Apart from that, the participants said that they used computers to do various tasks and activities (Table 7).

Table 7. Use of ICT for preparation of activities or tasks for teaching and learning

Activities or Tasks	Very Often	Often	Sometimes	Almost never	Never
Use of ICT to create quizzes	8.2% (n= 6)	17.8% (n= 13)	52.1% (n= 38)	4.1% (n= 3)	17.8% (n= 13)
Use of ICT for word search in teaching	9.6% (n= 7)	12.3% (n= 9)	43.8% (n= 32)	6.8% (n= 5)	27.4% (n= 20)
Usage of ICT to create PowerPoint presentation in teaching	27.4% (n= 20)	28.8% (n= 21)	32.9% (n= 24)	5.5% (n= 4)	5.5% (n= 4)
Use of ICT to download video clips for teaching	8.2% (n= 6)	13.7% (n= 10)	35.6% (n= 26)	11% (n= 8)	31.5% (n= 23)
Use ICT to prepare exam materials	49.3% (n= 36)	28.8% (n= 21)	13.7% (n= 10)	4.1% (n= 3)	4.1% (n= 3)
Use of ICT to maintain students' records in teaching	20.5% (n= 15)	37% (n= 27)	21.9% (n=16)	2.7% (n= 2)	17.8% (n= 13)
Use of ICT for completing projects in teaching	8.2% (n= 6)	15.1% (n= 11)	37% (n= 27)	13.7% (n= 10)	26% (n= 19)
Use of ICT for online translators in their teaching	5.5% (n= 4)	2.7% (n= 2)	41.1% (n= 30)	12.3% (n= 9)	38.4% (n= 28)
Use of ICT to prepare content for classes in their teaching	30.1% (n= 22)	30.1% (n= 22)	21.9% (n= 16)	6.8% (n= 5)	11% (n= 8)
Use of ICT to prepare worksheet/handouts in their teaching	39.7% (n= 29)	32.9% (n= 24)	20.5% (n= 15)	0% (n= 0)	6.8% (n= 5)

Table 7 illustrates clearly that the tasks in which the participants most frequently used computers for: preparing exam materials, 49.3% (36), worksheets or handouts, 39.7% (n= 29), content for classes, 30.1% (n= 22), preparing PowerPoint presentations, 27.4% (n= 20) and maintaining students' records, 20.5% (n= 15). Additionally the participants sometimes used ICT to conduct word search for teaching purposes, online translators, create quizzes and download video clips. The participants also used ICT to communicate with colleagues in other schools and also with the top management of the school in regards to teaching or to review available online resources prepared by the ministry for them (Table 8).

Table 8. Use of ICT for communication and research

Communication activities	Very often	Often	Some times	Almost never	Never
Use of ICT to send and receive emails for teaching.	19.2% (n= 14)	19.2% (n= 14)	41.1% (n= 30)	5.5% (n= 4)	15.1% (n= 11)
Use of ICT to review subject associated online resources for teaching.	23.3% (n= 17)	24.7% (n= 18)	28.8% (n= 21)	12.3% (n=9)	11% (n= 8)
Use of ICT for teacher-sharing ideas resources in teaching.	8.2% (n= 6)	20.5% (n= 15)	42.5% (n= 31)	6.8% (n= 5)	21.9% (n= 16)

One of the most frequent uses was to review subject associated online resources, 23.3% (n=17), send and receive emails, 19.2 % (n=14), and share resources for teaching, 8.2%. In sum, the participants' adoption of ICT could be summed through the interview responses. The key participants said that they utilized Microsoft Office and computer as well as the internet in the classroom:

Internet, Microsoft PowerPoint and Microsoft word. (Teacher 5)

However, most of the key participants stated that they also used subject specific software provided by the Ministry of Education. As teacher 4 said:

Yes, we use the CD provided by KPM. (Teacher 4)

The participants' attitudes toward ICT adoption were also assessed through several Likert-scale questions (Table 9).

Table 9. Teachers' attitude towards adoption of ICT in teaching

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I have a positive attitude towards using ICT in the classroom.	37% (n= 27)	56.2% (n= 41)	4.1% (n= 3)	2.7% (n= 2)	0% (n= 0)
I feel competent and confident using ICT in teaching and learning.	27.4% (n= 20)	54.8% (n= 40)	16.4% (n= 12)	1.4% (n= 1)	0% (n= 0)
I think that my use of ICT has increased since commencing employment in the school	20.6% (n = 15)	34.2% (n = 25)	23.2% (n = 17)	20.6 % (n = 15)	1.4% (n = 1)

Table 8 illustrates that a majority of the participants, 56.2% (n= 41) agreed that they had a

positive attitude toward using ICT in the classroom, and they felt that they were competent and confident in using ICT, 54.8% ($n=40$). One of the participants stated that:

Yes because [we] know that even the students can help the teacher in using the ICT equipment.

(Teacher 4)

The participants' confidence could be due to their willingness to change and use ICT in their teaching. The answers from the key participants in the interviews showed that some of the key participants believed that teachers should change for their own benefit:

The teacher realises the importance of changing. They will change by their own way.

(Teacher 2)

Another factor that they felt should propel teachers' adoption of ICT was their students' ability to use ICT:

The students have been exposed to technology at an early age. The teacher had to be skillful in ICT technology in order to get through to them. (Teacher 4)

And change was inevitable:

Yes it is necessary to use ICT nowadays; you have to go with it. (Teacher 10)

In addition, 34.2% ($n=25$) thought that their use of ICT had increased since working at the school. In fact, six of the teachers interviewed said that their ICT use has improved and changed since joining the school. One of the participants said that:

Yes, I have been using it throughout my teaching. (Teacher 5)

Thus, it could be concluded that the participants' attitudes toward using ICT in their teaching was generally positive. However, they emphasized that the teacher must have the skills to use ICT so that they could keep abreast with students who were sometimes more skilled than they were.

4.1.2 What are the factors that contribute to the teachers' use of ICT in teaching?

The aim of this question was to find out the factors that contributed to the participants' adoption of ICT and the variables explored were: time allocated for ICT use, training, management stance on ICT integration and access to ICT tools and applications.

More than half of the participants claimed that they were not given enough time to use ICT (Table 10).

Table 10: Time allocated for ICT related activities

You feel that time allocated:	No	Yes
to learn to use ICT is enough.	57.5% (<i>n</i> = 42)	42.5% (<i>n</i> = 31)
for preparing ICT resources for teaching is enough.	79.5% (<i>n</i> = 58)	20.5% (<i>n</i> = 15)
for resource discussion and sharing is enough.	60.3% (<i>n</i> = 44)	39.7% (<i>n</i> = 29)
for ICT training is enough	68.5% (<i>n</i> = 50)	31.5% (<i>n</i> = 23)

The participants felt that there was insufficient time allocated: to prepare ICT resources for teaching, 79.5% (*n*= 58), for ICT training, 68.5% (*n*= 50), to share and discuss resources, 60.3% (*n*= 44), or to learn to use ICT in the classroom 57.5% (*n*= 42).

Another factor, which could influence the participants' use of ICT was difficulties in using it (Table 11).

Table 11. Teachers' reaction toward using ICT in the classroom

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I get frustrated using ICT in the classroom.	4.1% (<i>n</i> = 3)	20.5% (<i>n</i> = 15)	23.3% (<i>n</i> = 17)	32.9% (<i>n</i> = 24)	19.2% (<i>n</i> = 14)
Using ICT in the classroom takes up too much time.	5.5% (<i>n</i> = 4)	37% (<i>n</i> = 27)	27.4% (<i>n</i> = 20)	24.7 (<i>n</i> = 18)	5.5% (<i>n</i> = 4)

From the participants' responses it did not appear that they were frustrated using ICT, 24.6% (18), nor did they think that it took too much classroom time 42.5% (31).

School management support was also a detrimental factor to the successful adoption of ICT (Table 12).

Table 12. School management support for ICT adoption

You feel that	No	Yes
The priority put by the management on ICT is adequate.	72.6% (n= 53)	27.4% (n= 20)
There was lack of support when using ICT in the classroom.	50.7% (n= 37)	49.3% (n= 36)

The participants thought that there was lack of priority given by the management on ICT adoption, 72.6% ($n= 53$), and of the support given when teachers used ICT in the classroom, 50.7% ($n= 37$). However, in the interviews with the school administrators they claimed that the school supported ICT adoption and encouraged teachers to attend workshops to improve their skills. They also said that they maintained the ICT facilities. When asked if they thought that ICT adoption in the school was beneficial, the administrators showed positive attitudes toward ICT adoption:

We encouraged ICT demands and like if the teachers requested to attend workshops and localized budget for the maintenance of ICT equipment. (School administrator 1)

The school principal also highlighted a problem which could be considered as barrier to adoption which was access to computer labs. Firstly, they did not have enough computers for each student to use during class; the students had to share computers. Usually during class, two students would share one computer in the computer lab. Secondly, there were not enough computer labs to satisfy the demands of all teachers. It was hard for the administrators to arrange the timetable among classes when at times two classes needed to use the lab at the same time. A key participant said that the ICT facilities at the school were insufficient to cater for all to use at the same time:

Yes, not many computers in working condition. (Teacher 6)

Finally, the participants were asked if they felt that further ICT training should be provided for teachers because lack of training could be a factor affecting successful ICT adoption. A majority of the participants agreed that they needed further training, 57.5% ($n= 42$). Thus, basically participants felt that the school had somewhat provided good support for the adoption of ICT in teaching and that the school management supported the adoption of ICT in the school. However, factors such as time constraints, access to as well as condition of computers and computer labs were some of those highlighted by the participants of this study.

4.2 Discussion

4.2.1 Research Question 1

Upon initial observation, the available ICT infrastructure suggests that the school provided relevant ICT tools for teaching. However, in terms of adoption of ICT in the classroom, the types of ICT tools, computer application software used by the participants in their teaching processes indicate that their use of ICT was still very traditional. This is seen through the

types of activities and tasks the participants performed using ICT. Hooper and Rieber (1999) highlighted that the traditional role of ICT is confined to three phases: Familiarization, Utilization and Integration (see Table 1). In these phases, the teacher is still the one who shapes how and when ICT is used in the classroom. Students have no real voice and teaching processes are still similar to face-to-face classes. The participants in this study were observed to be at the Utilization phase. This is clearly shown by the tools the participants mainly used which were computers, printer and data projector. They also used ICT to do basic teaching tasks such as to create quizzes, conduct word search or to download video clips for teaching. This suggests that the participants were trying out the technology without actually integrating them in their teaching because these activities could be considered as class preparation tasks rather than using ICT for activities in the classroom. In addition, very few of the participants used other ICT tools made available to them at the school. Essentially, a teacher who has reached this phase have progressed further than the Familiarization phase as this is clear in the ICT tools the participants were using in the classroom. However, being only at Utilization phase, there is an inherent danger that the participants would become prematurely satisfied with their limited use of the technology and have not achieved the breakthrough phase of Integration (Hooper & Rieber, 1999). In that phase, the participants would have used ICT tools for classroom activities such as asking students to conduct research on the internet, type their work on Microsoft Word and email it to the teacher.

In spite of being at the Utilization stage, the participants were mostly positive toward the adoption of ICT in teaching and learning. The majority of the teachers felt competent and confident using ICT in the classroom. Findings from several studies showed that feelings of competence and confidence in using ICT are crucial factors affecting ICT adoption. With the teachers' positive attitudes, adoption of ICT at the school should not be difficult. In addition, the participants also believed that they were willing to change to accommodate ICT in their teaching, and this is a factor that could also contribute to effective adoption of ICT. Studies have shown that professional teachers were at the forefront of ICT adoption in education when they are willing to embrace change (Pac, 2008, Tondeur et al, 2008, Nussbaum et al, 2009). Even though this study has suggested that the participants had positive attitudes toward ICT adoption, but because the ICT facilities were not enough to cater for all teachers and students it could have affected their adoption process. Thus, granting of financial support to the school to equip it with more computers is recommended.

In addition, most of the participants asked for further training, which could illustrate that there was room for improvement in the process of continuous professional development for the teachers because training and professional development are essential to ICT adoption (Nut, 2010). Thus, upon reflection on the findings of Research Question 1 whereby most of the participants was at Utilization stage, perhaps training could boost their usage to the subsequent levels. This is because the teachers already had positive attitudes and perhaps they only needed more training to improve their ICT skills to move further than the current stage to proceed to Integration, Reorientation and Evolution levels. The findings from this research question is surprising because the smart school implementation should have reached Phase 4 whereby it was projected that all schools in Malaysia would become smart schools (see

Figure 1). At this stage the schools only had to consolidate and stabilize the smart school initiative. Instead, the teacher's use of ICT at the school, which is part of the Smart School Pilot project, has not gone beyond the Utilization stage. This is similar to findings in the Smart School Roadmap 2005 to 2009 report, which highlighted that ICT tools were under utilized in most smart schools in Malaysia resulting in low level adoption of ICT by teachers. (Multimedia Development Corporation, 2005). This could be because the training that had been provided to most of the teachers was either at basic or intermediate level courses, which did not help teachers to integrate technology and transform their teaching practices (Redecker, 2009).

4.1.2 Research Question 2

Majority of the participants responded that using ICT in their teaching took up too much time, which is similar to the findings from other studies which indicate that one of the factors affecting ICT adoption is time constraints (Redecker, 2009). The participants felt that they did not have enough time to discuss and share ideas, or to learn to use ICT resources. These could become barriers to the adoption of ICT at the school. Another factor that participants highlighted as a barrier was not being given enough time for training. This is consolidated by the fact that most of the teachers had only basic computer training. This could be a strong justification why the participants were still at the Utilization phase (Hooper & Rieber, 1999).

Support from the school management also plays an important role in the adoption of ICT in schools and should not be underestimated. Many studies have reported on the importance of management opinions and attitudes toward ICT directly affecting ICT use in the school. The school support was clearly lacking in the time allocated to discuss or share resources and learn to adequately use ICT. The teachers also said they lacked appropriate training and time to explore the ICT facilities. Thus, even though the teachers in this study were positive as well as confident about their ICT use and adoption, they were not given time to explore, be adequately trained and have easy accessibility to ICT, specifically computers, in the classroom, then their motivation would be affected.

More than half of the participants felt that the school management did not put ICT adoption as a priority in the school teaching agenda. Even though the school has ICT facilities and support system, provision of ICT training at the school has not been satisfactory. Perhaps, the school supported the ICT implementation because of the Ministry of Education agenda, but there was lack of significance put on it. This could be seen from the lack of computers made accessible to teachers and students at the school. As a result, the participants believed that they lacked support in terms of the number of computers accessible to teachers and students. This would affect teachers' ICT adoption because the main ICT tools they used in the classroom was the computer.

5. Conclusion of This Study

In conclusion, this study has shown that in spite of being a smart school for the past 15 years, the participants' ICT adoption was still at a low level. This could be due to the fact that extended training was not provided regularly. In addition, the participants felt that the school

management did not put ICT adoption as a priority and that the time allocated to use and explore ICT tools as well as prepare the resources was not enough. Even though the participants' attitudes were positive and ICT infrastructure was in place, it was still not sufficient to cater to the needs of the teachers and students. In addition, teachers have to be allocated time to explore and use ICT effectively and efficiently in the classroom which in this school was limited by the lack of computers at the school. Therefore, the level of ICT adoption in the smart school in this study was still at a basic level, which is the Utilization phase perhaps due to the barriers that the participants highlighted. Directly, this clearly reflects that the school has not yet achieved the smart school status as projected.

6. Recommendation

Implications of this study are that; a few points could be improved to bring up the level of ICT adoption in the school. Firstly, there needs to be an increase in the number and type of training programs provided to the teachers as this will be very important to improve and encourage the teachers' adoption. Furthermore, since the school is a smart school it is essential to increase the number of computers in the school and it would be better if each teacher and student have access to a computer when they need to use it. To be familiar with and explore ICT tools, the school management must take action to overcome this shortcoming by providing more time and reduce the task for other activities.

In terms of the research process itself, for future studies researchers could consider the following recommendations. Firstly, is to increase the number of participants in the survey and interviews to obtain superior findings. Secondly, a more extended length of time could afford more data on the level of ICT adoption. Involving the students in the interview could also provide a holistic view of the situation. Furthermore, increasing the number of smart schools involved in the study could show the true level of ICT adoption in the smart schools in Malaysia. This would allow for comparisons on the level of ICT adoption between the smart schools and between smart with ordinary schools. This could offer an overview of how successful the smart school program is after more than a decade of its implementation.

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