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Identifying Hardware, Electronic Services and Supporting Equipment for Implementing Mobile Learning in Secondary School: A Delphi Technique

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Abstract

The research objective was to identify experts' consensus on hardware, electronic services and supporting hardware for implementing mobile learning in school. This research used the Delphi three-round technique. The sample included 16 mobile local and foreign learning experts. The instrument used in round 1 was a questionnaire contained both structured and open-ended questions. For rounds 2 and 3, only structured questionnaires were used as the instrument. The questionnaires used in this research were based on the literature review. The findings showed the hardware items that surpassed the experts' consensus were laptops, regular mobile phones, 3G mobile phones, PDA and webcams. The electronic services items consisted of web pages, e-mails, MMS, GPRS, broadband, SMS, Bluetooth and blogs while the supporting equipment in school comprised computer labs, server, router, wireless network, access point, wireless LAN and WAN network.

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Introduction

The emergence of a diversity of hardware and electronic services has simultaneously opened up the space for mobile learning opportunity to expand. Each day there would be new hardware, software and electronic service innovation emerge contributing to the desirable technology expansion. Many of the researchers today in the academic and industry fields start to explore the potential of technology and mobile devices to support learning. (Sharples, 2000; Sharples, 2002; Liu et al, 2003).

Electronic services expansions such as wireless technology can provide a significant effect in supporting teaching and learning (Perry, 2003; Zurita & Nussbaum, 2004). Meanwhile Wood (2003) said that the use of wireless technology in education can play a role to reduce the digital gap among the developing countries because techology devices such as mobile phone and PDA were generally cheaper than a desktop computer.

All over the world today the mobile technology has replaced the traditional online system. For instance, from e-commerce to m-commerce, m-bussiness to e-bussiness and e-banking to m-banking (Keegan, 2005; Mashkuri, 2003; Shim & Shim, 2003). WiFi has been the choice of technology for local wireless network in the bussiness environment or at home. (Henry & Luo, 2002). In fact, WiFi is currently installed in public areas to enable users to access broadband Internet (Henry & Luo, 2002).

In accordance with the current changes and the importance of education curriculum in Malaysia in the future, developing a curriculum that suits with the changes of technology is essential.

Mobile Learning Hardware and Technology

The handling of both Mobile Learning hardware and technology are interrelated. The researcher tested a variety of technological tools to accommodate the mobile hardware for the purpose of education. One of the Mobile Learning projects that tested the practice of WAP technology in higher learning institutions involved was "UniWap" (Sariola et al, 2001). This particular team tried to investigate the process of designing a learning operational environment via smart phones and WAP phones. The higher learning institutions needed to give their support for the participants' mobility in the learning process (students and teachers). One of the project's phases was to form a course module and study the problems and values of the courses. This research produced positive results (easy to develop, acceptable and diverse

usage of the module) that encouraged them to proceed with research about the emergence of new technologies such as 3G technology. Another study by Goh & Chen (2002) on the development of *Mobile Information Service*, better known as *mobile GP booking system* used WAP technology too. The objective of GP booking system was to enable the users making appointments with doctors using mobile phones that support WAP technology like Ericsson R380s. This system enabled users to log in, make their appointments, and check their appointments or even cancel appointments. The research result showed the trial was successful but needed more room for improvement.

Chen and Kinshuk (2005) developed a Mobile Learning prototype system using WAP technology. The assessment result of the prototype showed that the Mobile Learning system built was fruitful and complemented the existing desktop system. Through Mobile Learning, teachers and students gain benefits as access to educational resources would be easier and faster.

Meanwhile Chen et al (2003) conducted a study on PDA and Wi-Fi (IEEE 802,11b) technology. The PDA was used for bird watching. The research was carried out to identify; 1) how far could a mobile gadget help in the bird watching study; and 2) whether students would benefit from the mobility habit, portable and individual portable learning gadget. The findings showed that PDA and Wi-Fi were very helpful and useful to the students to carry out their activities. This research also showed that Mobile Learning was able to be utilised outside the classroom effectively.

At the University of Tennessee, USA (Burke et al, 2005) a project known as Wireless Instructional Initiatives (WII) had been conducted. In this project, Food Science, Animal Science and Environmental Science (GIS) students were provided with Pocket-PC for field activities. The portable technology applied was IEEE 802.11b/g. The results of the study showed: (1) the WII activities and gadgets provided were suitable to the course requirement; (2) there was an increment of wanting to integrate technology in the curriculum; (3) students often helped each other. The responsibilities of sharing towards the process and output from vast financial investment increased as well; and (4) the students' skills in manipulating the technology besides the cooperation with the groups increased from a semester to another semester.

The "Ultralab" Mobile Learning project research team (Collet & Stead, 2002; Traxler, 2002) produced aids to students who had reading and writing disabilities. The result showed that new technology gave a very positive impact on certain subjects.

Mobile technology such as IEEE 802.11b/g, Bluetooth and GPRS were used in instant classrooms (ad hoc) and eSchoolbag system in the University Aletheia, Taiwan (Chang and Sheu, 2002). The system was also known as paperless education. Traditional classrooms were replaced with new educational gadgets such as electronic blackboard, eraser, coloured chalks and etc. The students were encouraged to communicate and learn in groups.

In Multimedia University, Malaysia another study was conducted to test the PDA's capability as a gadget that would be able to increase students' achievement. On the contrary, the ability of students to own a PDA was limited due to the cost of owning one (Keat et al, 2003).

Other than that, according to Al-khamayseh et al (2007), mobile gadgets like iPod video, 3G telephones and PDA had the potential to revolutionize the 21st century students' learning experience. Merging the use of mobile gadgets like iPod and podcasting would provide new and interesting learning opportunities in Mobile Learning. It was because iPod was easy to handle and the teacher only needed to know basic ICT skills to handle it (Haaparanta et al, 2007).

Mobile Learning Electronic Service and Software

Certain use of software is important in Mobile Learning. Mobile gadgets such as portable telephones and PDA need suitable software to carry out learning contents. "From eLearning to mLearning" (Keegan, 2005) project, the researcher has developed a courseware for mobile telephones, smart phones and PDA. The most essential part of this project was about solving the major pedagogical problem to develop Mobile Learning for PDA. Comfortable learning environment was successfully invented using Microsoft Reader Works. Each student used the Microsoft Reader software to access the content, and from the outcomes of the questionnaire conducted, students were satisfied participating in the courses via Mobile Learning

using PDA. This project succeeded in developing course software for mobile telephones. An outcome of the survey also revealed that students from Norway, Germany and Italy were extremely satisfied with the Mobile Learning course conducted (Keegan, 2005).

While in the project "Mobile Learning: The Next generation of Learning (Keegan, 2005) research had been carried out to produce a courseware for smart phones. Among the activities done were setting up software to build webpage such as Macromedia Dreamweaver MX Version 1.0 for webpage code, setting up search engine software such as Opera 6.3, using XHTML 1.0 Transitional using Cascading Style Sheets (CSS) to separate presentation style from the document content, arranging course content pages in vertical form with 208 pixel, to design an interface so that the limited screen surface would be utilised to full capacity and using Adobe Photoshop to produce suitable GIFs for mobile gadgets.

Technology such as location exploration using GPS and radio frequency are able to benefit Mobile Learning. One of the research examples is a project called "LAND" (Location Activated Nomadic Discovery). "LAND" is a database accessible by mobile gadget. Static data, like mapping, is kept in a PDA while dynamic data like destination management information is sent using wireless service. This system is to identify the physical location of the GPS user. Information is used to give the user a smart guide user manual. 3D mapping of the surrounding would be shown on the PDA screen hence giving the user to engage the directions according to their preferences using the GPS (Taylor et al, n.d).

B "Electronic Guide Book" project (Hsi, 2002) was a web content which was designed for exploration (science interactive museum) in San Francisco. Teachers felt that the mobile Webpage contents were designed so that they would be more useful as learning activities before and after visiting the museum. However, a majority of the users were more concerned about the portable computer limited screen and gave positive feedbacks towards the Web mobile contents.

Whereas a museum in Japan (Kusunoki et al, 2002) conducted a trial by inventing an interactive guide system for children in order for them to get used to exhibitions and at the same time to attract the interest of other users. With this system, users were able to interact with a virtual museum on the sensor screen, and provide them information. The sensor board in the system was able to identify the shape and location of various objects using RFID (Radio Frequency Identification) and invent a magnificent surrounding by providing the users with picture and voice feedbacks to their manipulation of the sensor board. After an analysis was conducted on the response of the system, the team discovered that students, children as well as parents were thrilled using the system and felt it was very useful.

The Ecotourism students in Tshwane University of Technology, Pretoria, South Africa (de Crom & de Jager, 2005) received an extensive training in a Biology area using the PDA while visiting nature parks. The research was conducted as an alternative to traditional method of using note books and etc. The objective of the research was to identify how mobile gadgets were able to support and increase students' learning on excursion. During the outing, students would take notes and participate in activities provided in the PDA. The outcome of the research found that there was an increase in their motivation level. The Coursework assessment method was also easier and could be done faster. As a consequence of the PDA and Learning Management System (LMS) integration and mobile technology, the students were able to receive and send their coursework easily and fast.

Researchers have been carrying out several of research in different areas with the purpose of finding the best way to apply mobile gadgets in education area. One of the areas that have caught the attention of researchers was language. At Stamford Learning, an exploration on Mobile Learning was carried out to develop a prototype for foreign language Mobile Learning. The prototype developed enabled users to practice new words, answer quizzes, access word and phrase translations and connect with coaches directly and save vocabularies in the notebook. The study produced a few useful findings. Students discovered that the Mobile Learning was a different kind of experience. It needed high concentration and attention. Learning was a personal and emotional process. Personal interaction in the environment was helpful and safe which was important to increase the ability of a student. Learning is a sensitive process and language learning requires a helpful and safe surrounding (http://acmop.stamford.edu/acpubs/SOC/Back_ Issues/SOC55/#3).

This research also found that students were upset with the technology level. Weak and noisy cellular lines interrupted learning sessions. Also, those wrong responses such as the quiz session interaction were a letdown and resulted in a lack of confidence in the ongoing system. This situation made them uninterested to continue with the classes. Stamford realised this and made attempt to improve the system in the near future.

Other projects that are undergoing development are designing and evaluating teaching modules of Mobile Learning for secondary schools (Saedah Siraj, 2008), inventing teaching aids for PDA (Bull & Reid, 2003; Colley & Stead, 2004) and WAP including developing other special programmes like organiser, time table, etc. to help and support learning using mobile gadgets.

Problem Statement

Hardware, electronic service and supporting equipment are the most important elements of mobile learning implementation in schools. Most of the studies in Europe and Asia focused on the digital functions of a mobile equipment (Pownell & Bailey, 2001; Savill-Smith & Kent, 2003; Vahey & Crawford, 2002) and carried out by the giant telecommunications companies such as Ericsson, Apple, Intel and Sun for the purpose of trading and commercial competition. There are also studies that focus on the effectiveness of a tool in providing learning activities (Colley & Stead, 2003; Ketamo, 2002; Waycott, 2001) and online training courses for professionals (Burke et al, 2005). There are also researchers who focused their studies on the use of a certain device only such as a laptop computer (M-Learning Project, 2005; MOBIlearn Project, 2005, Chen et al, 2003; Becta Report, 2005: Megan Fox, 2005). However, studies focusing on the hardware, electronic servicer and supporting equipment for implementing Mobile Learning in school were much less. Therefore the focus of this research was to identify which hardware electronic service and supporting equipment could be used in the implementation of mobile learning in school according to experts.

The findings of this study would help teachers in the teaching and learning process using the Mobile Learning technology. The findings could also help the Malaysia Ministry of Education to enhance the technology infrastructure in schools by supplying more mobile devices to schools and implementing training skills to the teachers.

Objective

The main objective of this study was to identify the types of hardware, electronic services and school supporting equipment for implementing mobile learning in secondary schools in accordance with the views of experts.

Research Question

Based on the objectives above, this research would answer the following questions:

1. What types of hardware are suitable to use for the implementation of mobile learning in school according to experts' view?
2. What types of electronic services are suitable to use for the implementation of mobile leaning in school according to experts' view?
3. What types of school supporting equipment that can be used in the implementation of mobile learning in school according to experts' view?

Methodology

This research was implemented using the Delphi Technique in three rounds. The Delphi technique was used for the research because it was found that the Delphi technique was the best method to obtain the consensus of experts in determining hardware, electronic service and school supporting equipment for implementing mobile learning in secondary school . According to Helmer (1968) The Delphi method was a systematic way of combining the individual results to obtain a conclusion together. Dalkey (1972) also said that Delphi was a method to find and filter the opinion of a panel consisting experts in a certain field.

In the first round, respondents were given a structured questionnaire, combined with open ended questions to obtain information about the hardware, electronic services and school supporting equipment for implementing mobile learning in secondary schools.

After all data of the first round were obtained, they were analyzed to be used for the second round. The items were developed based on the opinions of the experts in the first round. For the second and third round, questionnaires were sent by post or e-mail. Data obtained from the second round were analyzed. Once analyzed, for the third round the researcher sent the analysis of the findings and the questionnaire items by including additional views of the experts. In this round, experts were given the opportunity to reconsider any feedback or to support their original opinions.

Expert consensus on the items in this research was drawn up in accordance with the highest median score and the smallest values of Interquartile Range (IQR). The level of consensus in this research is derived from the study of Kaseem Boonan (1979) and Ibrahim Narongsakhet (2003).

High consensus = Interquartile Range (IQR) 0 to 1.00
Moderate consensus = Interquartile Range 1.01 hingga 1.99
No consensus = Interquartile Range 2.00 and above.

Sampling

The research sampling was a panel of local and foreign experts in the field of Information Technology and education. There were 16 experts involved in this research. The size of 16 people in the panel was considered appropriate in accordance with the guidelines proposed for a Delphi research. Helmer and Dalkey used a panel of seven people in their original study in 1953 (Helmer, 1983). Turoff (1975) suggested a panel of between 10 to 15 people.

Research Instrument

The research instrument consisted of a structured questionnaire designed by the researcher based on literature review. The research instrument was modified based on the example of the Delphi research (Clark & Wenig, 1999; Feridah Mohd Nazar, 2002; Meyer & Booker, 1990; Volk, 1993). In the first round, the respondents were provided with a structured questionnaire, combined with open-ended questions to obtain information about hardware, electronic services and school supporting equipment for implementing Mobile Learning in secondary schools. For the second and third round of the research, these were done by using survey methods. The second and third round comprised a questionnaire designed based on the results of the first round.

Findings

Here are the results of the first, second and third round based on a questionnaire submitted to the experts. Tables 1, 2 and 3 show the Delphi technique analysis results for round 1. Whereas Tables 4, 5 and 6 show the Delphi technique analysis results for round 2 and round 3.

Table 1 The type of Hardware Useable in the Implementation of Mobile Learning in Secondary School

Hardware	Not Agree	Neutral	Agree
Laptop	6.3% (1)	0.0 % (0)	93.8% (15)
Desktop	25.0% (4)	6.3% (1)	68.8% (11)
PDA	6.3% (1)	31.3% (5)	62.5% (10)
Ordinary mobile telephone	31.3% (5)	18.8% (3)	50.0% (8)
3G mobile telephone	6.3% (1)	31.3% (5)	62.5% (10)
Tablet Computer	6.3% (1)	12.5% (2)	81.3 % (13)
Additional suggestions from expert panel: a. printer; b.scanner; c. web cameras			

Table 1 shows that all of the items obtained between 50% and 94% consensus from the expert panel to add in as hardware items to implement Mobile Learning in secondary schools. Meanwhile the expert panel suggested that three new items to be added which were printer, scanner and web camera.

Table 2 The Type of Electronic Services which could be used in the implementation of Mobile Learning in Secondary School.

Electronic services	Not Agree	Neutral	Agree
WWW (Websites)	0.0%(0)	0.0 %(0)	100 %(16)
e-mail	0.0%(0)	0.0 %(0)	100 %(16)
SMS	6.3 %(1)	12.5%(2)	81.3 %(13)
MMS	12.5 %(2)	12.5 %(2)	75.0%(12)
WAP	6.3 % (1)	18.8 %(3)	75.0 %(12)
GPRS	12.5 %(2)	12.5 %(2)	75.0 %(12)
Additional suggestions from expert panel: a. High speed internet services (3G) b. Bluetooth c. Web Blog			

Table 2 shows that all of the items obtained consensus of between 75% and 100% from the expert panel to be added as electronic services items to implement Mobile Learning in secondary schools. The expert panel also suggested that three new items to be added in which were high speed internet (3G), Bluetooth and Web Blog.

Table 3 *School Supporting Equipment to implement Mobile Learning in Secondary Schools*

School Supporting Equipment	Not Agree	Neutral	Agree
Access point	0.0 %(0)	6.3 %(1)	93.8%(15)
Broadband Internet	0.0 %(0)	0.0 %(0)	100.0%(16)
Computer Laboratory	6.3%(1)	6.3%(1)	87.5%(14)
Server	0.0 %(0)	0.0 %(0)	100.0%(16)
Router	0.0 %(0	12.5%(2)	87.5%(14)
Wireless network	0.0 %(0)	6.3%(1)	93.8%(15)
LAN network	0.0 %(0)	6.3 %(1)	93.8%(15)
WAN network	0.0 %(0)	12.5%(2)	87.5%(14)
Expert Panel's additional suggestion a. Firewall			

Table 3 indicates that all of the items obtained consensus of between 88% and 100% from the expert panel to add as the school supporting equipment items that would be used in implementing Mobile Learning in secondary school.

Table 4 shows that laptop, ordinary mobile phone, 3G mobile phone and tablet computer reached the highest consensus with IQR of between 0 and 0.75 while PDA, printer and web camera show an average consensus of IQR of 1. Desktop computer and scanner did not meet the expert's consensus with the IQR of 2.

Table 4 Expert's Consensus Analysis Round 3 and 4 towards Types of Hardware that could be used in the Implementation of Mobile Learning in secondary schools

Hardware	Round 2			Round 3			
	Q1	Q3	IQR	Q1	Q3	IQR	M
Laptop	5	5	0	5	5	0	5
Desktop	3	5	2	3	5	2	4
Personal Digital Assistant	4	5	1	4	5	1	4.5
Ordinary mobile phone	4	4.75	0.75	4	4.75	0.75	4
3G mobile phone	4	4.75	0.75	3.25	4	0.75	4
Tablet computer	4	5	1	5	5	0	5
Printer	4	5	1	4	5	1	4
Scanner	3	5	2	3	5	2	4
Webcam	4	5	1	4	5	1	4

These results indicate that the experts considered laptop computers, PDA, ordinary mobile phones, 3 mobile phones, tablet computer, printer and web camera as the hardware items in order to implement Mobile Learning in the secondary school.

Table 5 Analysis of Expert's Consensus towards the Types of Electronic Services that could be used to Implement Mobile Learning in Secondary School

Electronic Services	Round 2			Round 3			
	Q1	**Q3**	**IQR**	**Q1**	**Q3**	**IQR**	**M**
Web pages	5	5	0	5	5	0	5
e-mel	4.25	5	0.75	5	5	0	5
SMS	4	4	0	4	5	1	4
MMS	4	4	0	4	4	0	4
WAP	4	4	0	4	5	1	4
GPRS	4	4	0	4	4	1	4
Broadband Internet	5	5	0	5	5	0	5
Bluetooth	4	5	1	4	5	1	4.5
Blog	4.25	5	0.75	4	5	1	5

Table 5 shows that web pages, e-mails, MMS and Broadband Internet met the expert's high consensus with an IQR of 0 though for the items of SMS, WAP, GPRS, Bluetooth and Blog had a medium consensus with the IQR of 1.

The results indicated that the experts accepted web pages, e-mails, MMS and broadband Internet, SMS, WAP, GPRS, Bluetooth and Blog.

Table 6 shows the items of access point, broadband Internet, computer laboratory, server and firewall obtained a very high consensus from the expert with IQR of 0 whereas router, Local Area Network (LAN), Wireless Area Network (WAN) only show a medium consensus with an IQR of 1. The results showed that the experts have received Access Point (AP), Broadband Internet, Computer Laboratory, Server, and router, Wireless Network, Local Area Network (LAN), Wireless Area Network (WAN) and Firewall.

Table 6 Analysis of Expert's Consensus towards the types of School Supporting Equipment for the implementation of Mobile Learning in Secondary School.

School Supporting Equipment	Round 2			Round 3			
	Q1	Q3	IQR	Q1	Q3	IQR	M
Access point (AP)	5	5	0	5	5	0	5
Broadband Internet	5	5	0	5	5	0	5
Computer Laboratory	5	5	0	5	5	0	5
Sever	5	5	0	5	5	0	5
Router	4.25	5	0.75	4	5	1	5
Wireless Network	5	5	0	5	5	0	5
Local Area Network (LAN)	4	5	1	4	5	1	5
Wireless Area Network (WAN)	4	5	1	4	5	1	5
Firewall	5	5	0	5	5	0	5

Discussion

The research findings showed that the expert panel agreed with the six hardware items which could be used to implement mobile learning in school. The items concerned were laptop computers, regular mobile phones, 3G mobile phones, PDA and Web cameras.

The findings correspond with past studies regarding mobile gadgets such as laptops (Devinder Singh & Zaitun Abu Bakar, 2006; Efaw et al, 2004), mobile phones (Strohlein, 2005; McNeal & Van Hooft, 2006), PDA (Chen et al, 2003), tablet computer (Corlet & Sharples, 2004) and web cameras in Mobile Learning Research and the research done by Devinder Singh and Zaitun Abu Bakar (2006) on hardware like Pocket PC, notebooks and mobile phones. Besides that, the use of mobile gadgets like portable computers could provide a space to support constructive learning and in collaborative manner towards a formation of new knowledge (Zurita & Nussbaum, 2004). The research findings also concurred with the research conducted by Mohamed Ally (2004) that found mobile gadgets could be used to provide students with learning aids by alterations of design adapted to the size of mobile gadgets mini sized screen. At the same time, Benta Cremene & Padurean (2004) found that learning using multimedia via mobile phones was more appealing to students and mobile phones were better learning gadgets.

This research finding also showed that the expert panel agreed on the six types of electronic services that could be used to implement mobile learning in schools. The electronic services were web pages, e-mails, MMS, GPRS, Broadband Internet, SMS, Bluetooth and Blogs. The electronic services as stated in the findings above become an important communication medium for students to interact, discuss and access for information. The Electronic services such as web pages are an essential medium for students to search for information. Also, there were many studies carried out on web-based learning (Agarwal & Day, 1998; Dwyer et al, 1995; Sculman & Sim, 1999). Web pages are only used by students to search for existing information that has relationship with their learning. Other electronic services such as e-mails, SMS, MMS as indicated in this research findings could be used by students to interact with peers or teachers. Moreover, through e-mails or Bluetooth, students would be able to send files (a small capacity of not more than 10MB) to friends. The Bluetooth not only functions as a file and item sending medium, it also encourages collaborative learning (Voong, n.d.). Wireless environment learning could improve communication and collaboration in the classroom and enhance involvement among students inside and outside of the classrooms (Liu et al, 2003).

The most highly and popular used electronic service is the SMS. According to Communication and Multimedia Commission of Malaysia report (2006), until the second quarter of 2006, about 7 600 million of SMS's were sent. The breakthrough rate of cellular telephone in Malaysia for the year 2005 was 74.1% and was expected to reach 82.6% in 2006. The figure and facts showed that joint cellular phones and SMS have high potential to be utilised in the educational area. Ngambi (2005), in his research indicated the use

of SMS services in teaching and learning had produced positive effects on student's learning. Among the effects were; 1) increasing students' understanding towards learning; 2) creating a safe environment and encouraging them to ask and respond to questions; 3) enabling students to monitor their learning development and improvement; and 4) enabling teachers to respond promptly to students' difficulties and needs.

The broadband Internet is an important networking service for accessing the Internet. The speed of downloading information is better than the normal line. The Communication and Multimedia Commission (2006) estimated that the broadband Internet breakthrough rate would reach 25% in 2006. The increase of the breakthrough is a positive growth towards producing a well-informed community.

Another electronic service which is growing in popularity is the Blog. A finding of the research shows that the Blog is one of the electronic services which could be used to implement Mobile Learning in schools. Blog could provide a space for discussions between teachers and students, also among students. It also provides spaces for teachers to provide information. The use of Blog could even encourage a continuity of learning without thinking of the time and place factors. Students could access the Blog, give opinions, read the provided information at any time and at any place whenever they are free.

The findings also showed that the expert panel agreed towards the six electronic services that could be used to implement Mobile Learning in schools. The supporting services were computer labs, server, router, wireless network, access point, wireless LAN and WAN network.

Supporting equipment in schools is important to implement Mobile Learning in schools. In general, almost all Malaysian schools own a computer lab each with hardware equipped such as server, router, access point, wireless network and LAN network and also firewall. The Internet line is provided as well through SchoolNet project. Until January 2007 about 370 schools were equipped with SchoolNet. The Ministry of Education has provided RM120 million as preparation for the Internet access centres in schools. About 1 584 access centres were set up and 2 790 more to be set up (Utusan Malaysia, 2007, January 18).

In Malaysia almost all schools either primary or secondary, are provided with wireless technology laptops from the Ministry of Education through English for the teaching of Mathematics and Science (EteMS) policy. As for that, there should be no problem technically to implement mobile learning. The only addition needed is the gadget applications such as PDA's, mobile phones or computer tablet. The facilities provided in schools like computer labs, server, broadband Internet, router, wireless access point, laptops enable Mobile Learning to proceed. Other hardware items which are still unavailable like the PDA's and mobile phones are additional ones that need to be provided by the Ministry of Education.

Conclusion

Education based on mobile learning undeniably is suitable to be implemented in Malaysia. The Hardware, electronic services and supporting hardware in schools are essential elements needed for the implementation of mobile learning in schools. They are important elements to be considered in future curriculum design construction. The elements which have been identified by experts would eventually support the future curriculum plan of Malaysia.

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