

## Promoting Teachers' Technology Professional Development through Laptops

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### ABSTRACT

This paper reports on a survey study that was carried out to determine the impact levels of laptops use on teachers' technology professional development. Teachers' technology professional development is approached as a constructivism process that demands teachers to learn how to use technology and apply them in their daily routines. Teachers in this study were granted laptops from the Teaching-Learning of Science and Mathematics in English (PPSMI) programme. Hence, they were regarded as the early adopters of technology innovation in schools, and became the agents of change. It is believed that playing the teachers' role as the agents of change has contributed on a significant change in their practice. Based on the notion, this study was conducted to reveal the impacts of laptop use by teachers on their professional development. A survey was carried out among 386 laptop teachers using a set of questionnaire that measures the impact from four dimensions; namely teaching-learning, the use of resources, communication and sharing of information, and teachers' laptop competency. The findings explicate that teachers' use of laptop has a moderate impact on their technology professional development.

**Keywords:** Impact, laptop, laptop use, PPSMI, professional development, teacher

### INTRODUCTION

Malaysia has great aspirations to become an information and communications technology (ICT) competent country. Malaysia's former Prime Minister, Tun Dr. Mahathir Mohamed, in his speech, "Malaysia: The Way Forward" at the Malaysian Business Council in 1991, expressed his hope to build Malaysia as a fully developed country:

By the year 2020, Malaysia can be a united nation, with a confident Malaysian society, infused by strong moral and ethical values, living in a society that is democratic, liberal and tolerant, caring, economically just and

equitable, progressive and prosperous, and in full possession of an economy that is competitive, dynamic, robust and resilient.

(Wawasan 2020, 1991, p. 21-22)

Tun Dr. Mahathir Mohamed had also introduced nine central strategic challenges that Malaysians need to overcome in order to become a fully developed nation. These include the challenge to form a progressive, scientific and technology savvy community.

The sixth is the challenge of establishing a scientific and progressive society, a society that is innovative and forward-looking, one that is not only a consumer

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of technology but also a contributor to the scientific and technological civilization of the future.

(Wawasan 2020, 1991, p. 22)

Since the early 1970s, the Malaysian Government has introduced a myriad of initiatives to facilitate a wider adoption of ICT and to boost capabilities in every field including education (Ministry of Education, 2005). Thus, new initiatives and innovations have been introduced to elevate the Malaysian educational system to fulfil the national aspirations as well as to meet the international challenges. Consistent with the Seventh National Plan (1996-2000) that pointed out education as a process of producing knowledgeable, highly-skilled experts by the year 2020, schools have been identified as the best place to expose students, who have yet to become future workers, to the ICT (Bismillah Khatoun Abdul Kader, 2007).

The emergence of ICT in Malaysia's education system started from the Smart School Concept which was rolled out in 1999 (Ministry of Education, 1997). In this initiative, schools were provided with computers and other related applications. The implementation of the Smart School project is Malaysia's brand of creating "Schools of the Future". With their concept of bringing technology not only to educators and administrators but to the young as well, this project aimed for these groups to get access and to have a good grasp of ICT (Ministry of Education, 2005).

Another programme embarked by the Malaysian government was the MoE-Intel School Adoption Project for 1:1 e-learning (Ministry of Education & Intel Malaysia, 2008). This particular programme, which was launched in 2007, is consistent with the objective of the National Education Blueprint that aims to establish smart partnerships with all the parties outside the Ministry of Education. As part of the project, Intel is responsible of sponsoring 2000 classmate personal computer (CMPC) and supplying the licenses for the Microsoft Windows XP operating system and the Microsoft Office, providing workshops for participating

schools, and trainings for facilitators under the Intel® Teach programme.

Mobile computing started to sprout in 2003. It was then laptop began to dominate the field of education, initially as a part of the teaching and learning of Science and Mathematics in English (better known by its Malay acronym, PPSMI) programme (Choong, 2004; Pillay & Thomas, 2004; Microsoft's Partnership in Learning, 2007). This programme was launched to prepare the new generation with the advancements and development of knowledge, as the acceleration of science and technology demands new skills and capabilities to meet global challenges and needs (Noraini Idris *et al.*, 2006).

#### *Laptop, Classroom and Teachers' Professional Development*

The use of laptop in schools is visualised as beneficial to teachers and students. It is believed that diffusing the laptop technology in education can transform classroom for the better. Laptops offer portability, immediacy, accessibility and convenience, and hence, a great degree of flexibility of usage (Laptop Computer Pilot Interim Report 2002-2003, 2003). When laptop makes its way into the schools, teachers are the key to its full utilisation. Teachers are expected to produce a learning experience beyond the four walls in a technology augmented classroom (International Society for Technology in Education, 2010).

Scholars highlighted that laptop brings added value to its users and the learning environment (Dunleavy *et al.*, 2007). As such, online research and productivity tools provide effective use and wide range in the instructional approach used. Teachers also frequently use laptops for drill and practice exercises for instruction, remediation, reinforcement and assessment of concepts. By practising these, teachers have increased their ability to give rapid feedback on class' and students' progress.

Teachers use laptop as a tool to support their virtual communications in online environments, a venue where they share information and ideas synchronously or asynchronously (Dunleavy

*et al.*, 2007). These have also promoted collaborations among teachers. They share information about the technology, find solutions to technical problems, and share ideas about classroom management strategies (Rockman, 2004; Cunningham *et al.*, 2003). There is also evidence that laptops can allow increased communication between students, parents and teachers (Cunningham *et al.*, 2003).

Moreover, some previous studies have also demonstrated that having laptops affords greater access to resources for lesson preparation, and provides for streamlining of management or administrative tasks (Cunningham *et al.*, 2003; Windschilt & Sahl, 2002). These researchers have reported increases in teachers' technology confidence and competence. A more recent study by Cowie and Jones (2005) revealed that teachers developed confidence and expertise from the use of laptop, and regarded them as an addition to their professional lives.

Meanwhile, other scholars have found that teachers' capability to integrate laptop in classroom instruction depends on their skills (Moses *et al.*, 2010). They further emphasized that it is imperative for teachers to master their technology skills as they are the sole individuals who integrate technology into the classroom. Nevertheless, the adoption of technology into the teachers' practices has brought a new paradigm, where teachers began to shift their role as the instructional leaders and masters of all knowledge (Rockman, 2004), and became more professional in their career (Cowie & Jones, 2005).

Since the main entry point for the new technology is the classroom, the professional development of teachers is therefore the key to its widespread use (Pugach & Warger, 2001). Professional development has become increasingly important as a way to ensure that teachers thrive in matching the teaching goals with their students' needs (Diaz-Maggioli, 2003). The ultimate purpose of professional development is to promote effective teaching that will result in learning benefits for all students.

In this study, teachers' technology professional development was approached as a constructivism process where teachers are regarded as individual learners who are responsible of their own experiential learning (Kanuka & Anderson, 1999), and construct their own understanding (Smaldino *et al.*, 2008). Scholars suggest that teachers' professional development is therefore based on constructivism (Villegas-Reimers, 2003; McLaughlin & Zarrow, 2001; Lieberman, 1994). Nonetheless, it was against this theory that this study was based on, where it was perceived that teachers as learners who constructed their own understanding in learning how to use the laptops, and thus, contributed to their professional development.

The PPSMI programme and laptop endowment have long been implemented in schools, but information on teachers' technology professional development from the initiative is still scarce. Therefore, this study aimed to investigate how teachers use laptop in schools, and to determine the level of the impact from the use on their technology professional development. It is hoped that the findings of this study can serve as a springboard for the people of authority to better understand teachers' use of laptops, and chart their plans for more technology professional development programmes for the teachers.

## MATERIALS AND METHODS

This study was based on the work by Cunningham *et al.* (2003), who framed teachers' professional development based on their technology competency and daily routines, namely teaching-learning, use of resources, as well as communication and sharing of information. A set of questionnaire was designed and developed by the researchers based on the previous research and literature, especially the work by Cunningham *et al.* (2003) and Silvernail and Lane (2004). These two studies were chosen because the nature of both studies is very similar to this study and addressed almost similar objectives. Permissions to use the instruments

were obtained prior to its construction to be used in the current study.

The instrument was translated using the back-to-back translation technique by a panel of translators who are language experts. A bilingual questionnaire was used so as to enhance teachers' comprehension when answering the questions. The questionnaire was tested for its validity and reliability, prior to its distribution. A committee of technology experts were also formed to review for the relevancy and appropriateness of the items. In addition, the internal consistency tabulated from the SPSS Statistical Package revealed that the items obtained an alpha value of .925, which is considered as a high and reliable scale (DeVellis, 1991; Hinton, 2004; Pallant, 2005).

The survey was administered in the secondary Government schools in Johor. The schools in this state consist of urban and rural schools, and there were a total of 2710 teachers from the three selected districts chosen as the population. These schools possess similar characteristics as they are daily secondary schools in the same state and have similar education system and curriculum. A total of 386 teachers from 28 selected schools had participated in the survey. They were chosen based on a proportional stratified random sampling method from the total population of the PPSMI teachers in Johor.

## RESULTS AND DISCUSSION

### *Demographic Information*

There were 79 males and 307 females participated in this survey. Teachers reported to spending an average of 4.55 hours (S.D. = 2.46) per day using the laptops, and have a range of less than a year to 32 years of teaching experience (M = 10.41; SD = 8.48).

### *Teachers' Professional Development*

In the following sections, the results from the survey are organized and discussed according to the professional development dimensions; namely teaching-learning, use of resources,

communication and sharing of information, and laptop competency. The participants stated their preferences from five choices with the respective scoring — 1 point (Strongly Disagree), 2 points (Disagree), 3 points (Neutral), 4 points (Agree) and 5 points (Strongly Agree).

### **Teaching-Learning**

From the analysis of the impact of laptops use on teachers' teaching-learning, it was found that almost half of the teachers agreed (49.7%) and strongly agreed (41.2%) that the use of laptops benefited their classroom instructions (M=4.28, S.D.=0.75). In terms of time, 40.9% of the teachers agreed that the use of laptops saved their time, while 25.4% of them strongly agreed on this (M=3.71, S.D.=1.08). On the contrary, a majority of the teachers disagreed (49.5%) and strongly disagreed (25.4%) that the presence of laptops in classroom was disruptive to their teaching (M=3.92, S.D.=0.88). Approximately one third of them (35.8%) were neutral when indicating whether they were able to teach better without the help of a laptop (M=3.05, S.D.=1.02).

However, the total percentages of the respondents who agreed and strongly agreed (35.0%) were higher compared to those who disagreed and strongly disagreed (29.7%) on the statement. This was expected as not all teachers would willingly embrace change (Cuban, 1986). There was a possibility that the teachers were so used to teaching the subjects without the aid of technology and caused them to refuse change. Yet, at the same time, most of the teachers agreed (46.9%) and strongly agreed (33.2%) that they could explain more effectively with the use of laptops to their students (M=4.06, S.D.=0.87). These laptops were used in conjunction with other ICT peripherals, such as the LCD projector.

### **Use of Resources**

The analysis on the impact of laptops use on teachers' use of resources is presented in this section. A majority of the teachers agreed (51.8%) and strongly agreed (33.4%) that the

laptops have helped them to obtain access to more up-to-date information ( $M=4.13$ ,  $S.D.=0.80$ ). More than half of them agreed (40.9%) and strongly agreed (25.6%) that they had access to the Internet using the laptops from anywhere they like ( $M=3.76$ ,  $S.D.=1.04$ ). This result is in congruence with other scholars' findings that laptops have given teachers greater freedom to access the Internet from different locations (Cunningham *et al.*, 2005; Laptop Computer Pilot Interim Report 2002-2003, 2003).

Now that teachers have laptops, a number of them agreed (46.4%) and strongly agreed (25.6%) that they could download documents from the Internet ( $M=3.85$ ,  $S.D.=0.96$ ). However, on using the laptop with the Internet to enhance teaching, the total percentage of the teachers who strongly disagreed, disagreed and neutral with the statement (47.1%) is almost equivalent to the percentages of those who agreed (40.2%) and strongly agreed (12.7%) ( $M=3.46$ ,  $S.D.=0.95$ ). Nevertheless, a majority of the teachers agreed (58.3%) and strongly agreed (21.0%) that the laptops have given them the access to a greater range of teaching resources than ever before ( $M=3.94$ ,  $S.D.=0.79$ ). This is supported by a number of them who also agreed (46.1%) and strongly agreed (14.0%) that they now intend to purchase educational electronic resources, such as CD, VCD and DVD, since they already have a laptop ( $M=3.55$ ,  $S.D.=0.99$ ).

### Communication and Sharing of Information

An analysis on the impact of laptop use on teachers' communication and sharing of information revealed that the majority of teachers agreed (50.8%) and strongly agreed (17.1%) that the laptops have enabled them to share information with other teachers ( $M=3.84$ ,  $S.D.=2.68$ ). Meanwhile, a number of teachers agreed (33.9%) and strongly agreed (8.0%) that they use the laptops to exchange e-mails with colleague teachers via the Internet ( $M=3.24$ ,  $S.D.=0.98$ ). However, there were approximately one third of the teachers (35.8%) who were neutral to the statement. Although one third

of the teacher agreed (34.5%) that the laptops promote efficient use of time as things can be sent to other teachers through e-mail, there were also an almost equal percentage of teachers who were neutral (34.2%) about it ( $M=3.35$ ,  $S.D.=0.99$ ).

In terms of uploading and sharing materials such as worksheets, score sheets and files in the school network, the percentages of the teachers who were neutral (33.2%) and agreed (32.6%) that they often do this were more or less the same ( $M=3.22$ ,  $S.D.=1.02$ ). However, there were a small number of them who strongly agreed (9.3%) on the statement. In terms of school network engagement, slightly more than one third of the teachers were neutral (41.2%) on their interest in the activity, but there were also a number of them who agreed (30.3%) and strongly agreed (9.3%) that they were not interested in getting actively involved in the school network using their laptops ( $M=3.35$ ,  $S.D.=0.95$ ). Nonetheless, there is also evidence that revealed that laptops have facilitated networking among the teachers in terms of communicating and exchanging information with each other via electronic mails, as they perceived that this activity could promote efficient use of time. This is supported by various studies by carried out by several researchers such as Rutledge *et al.* (2007), Warschauer and Grimes (2005), and Cunningham *et al.* (2004). This leads to the development of communities of learners where teachers work together, and consequently improves their professional development.

### Teachers' Laptop Competency

The teachers in this study were allowed to bring the laptops home; doing so had enabled them to experiment and get familiar with the laptops and help them to gain confidence with the use of technology (Cunningham *et al.*, 2004). In fact, the analysis on the impact of laptops use on the teachers' competency explicates a big margin of the teachers who agreed (60.4%) and strongly agreed (24.9%) that they are more ready to use technology resources since they already have a laptop ( $M=4.04$ ,  $S.D.=0.77$ ).

In congruence with the previous section that found laptops promote efficient use of time via electronic mail communications for teachers, this section also found that most of them disagreed (45.6%) and strongly disagreed (9.1%) that they were unfamiliar with some software and thus resulted in several of their tasks taking more time to be completed using the laptops (M=2.65, S.D.=1.04). Additionally, a majority of the teachers agreed (58.5%) and strongly agreed (20.2%) that they had become competent users of specific software packages, such as the presentation software, now that they already own a laptop (M=3.92, S.D.=0.79). Indeed, the percentages of the teachers who agreed (47.7%) and strongly agreed (13.7%) that they are now able to use graphic software more effectively with their laptop were high (M=3.92, S.D.=0.79). Moreover, more than half of them agreed (51.8%) and strongly agreed (17.9%) that they could produce high quality multimedia integrated worksheets using the laptops to make their lessons more exciting (M=3.75, S.D.=0.90).

Although approximately one third of the teachers agreed (35.2%) and strongly agreed (11.4%) that their lack of skills in typing had resulted in more time taken to complete tasks, there were also a number of teachers who disagreed (29.8%) and strongly disagreed (6.2%) with the statement (M=3.16, S.D.=1.16).

Conversely, a number of them agreed (50.5%) and strongly agreed (13.0%) that they could complete more tasks with the same time frame as before since they received the laptops (M=3.59, S.D.=0.95). On the contrary, there were a number of teachers who agreed (43.3%) and strongly agreed (13.5%) that they would prefer other methods than using the laptops to do things (M=3.55, S.D.=0.93). Even though the findings yield positive results, the teachers also pointed out that the methods, other than using the laptops, were also preferable in completing some tasks.

### Impact of Laptop Use on Teachers' Professional Development

In order to determine the impacts of laptop use, levels were used. The levels were determined by transforming the data using quartiles in the SPSS Statistical Package. Professional development was categorized into three levels; namely, low, moderate and high, according to the 25<sup>th</sup>, 50<sup>th</sup> and 75<sup>th</sup> percentiles. The cumulative scores that fall below the 25<sup>th</sup> percentile is categorized as having a low impact, whereas between 25<sup>th</sup> and 75<sup>th</sup> percentile is a moderate impact, but the impact is high if the value is above 75<sup>th</sup> percentile.

Table 1 shows that the percentages of teachers who perceived that laptop has a

TABLE 1  
Levels of Laptop Impact on Teachers' Professional Development

| Dimension                                | Low % (f)     | Moderate % (f) | High % (f)    | Mean | SD   |
|--|---------------|----------------|---------------|------|------|
| Teaching-Learning                        | 30.1<br>(116) | 35.2<br>(136)  | 34.7<br>(134) | 3.80 | 0.67 |
| Use of Resources                         | 27.5<br>(106) | 46.9<br>(181)  | 25.6<br>(99)  | 3.75 | 0.69 |
| Communication and Sharing of Information | 29.8<br>(115) | 45.1<br>(174)  | 25.1<br>(97)  | 3.49 | 0.81 |
| Laptop Competency                        | 32.4<br>(125) | 42.2<br>(163)  | 25.4<br>(98)  | 3.45 | 0.48 |
| Overall Professional Development         | 26.4<br>(102) | 48.7<br>(188)  | 24.9<br>(96)  | 3.62 | 0.47 |

moderate (35.2%) and high (34.7%) impact on their teaching-learning process were almost equivalent ( $M=3.80$ ,  $S.D.=0.67$ ). In terms of the use of resources, the analysis revealed that the impact was rather moderate (46.9%,  $M=3.93$ ,  $S.D.=0.61$ ). The laptop was found to have a moderate impact on almost half the teachers (45.1%) in terms of communication and information sharing ( $M=3.49$ ,  $S.D.=0.81$ ). A moderate impact was also found on teachers' laptop competency (42.2%,  $M=3.45$ ,  $S.D.=0.48$ ). On the whole, the impact level laptop use on teachers' professional development was found to be moderate (48.7%,  $M=3.62$ ,  $S.D.=0.47$ ).

The survey results showed that personal laptop ownership had a moderate impact on the four dimensions of teacher professional development; namely, teaching-learning, use of resource, communication and sharing of information, and teachers' laptop competency. In many cases, laptop has promoted the efficient use of time because of its mobility (Laptop Computer Pilot Interim Report 2002-2003, 2003), ability to be used in conjunction with ICT peripherals, and accessibility to the Internet and school intranet (Cunningham *et al.*, 2003). It has also enhanced classroom instruction, facilitated teachers in understanding their students' needs and carrying out the assessment process, improved teachers' work quality, offered the opportunity to a wide range of resources through the Internet, encouraged electronic communication and networking among teachers, as well as boosted teachers' technology skills (Cowie & Jones, 2005; Silvernail & Lane, 2004; Cunningham *et al.*, 2003). On the whole, the results suggested that the use of laptops has a positive moderate impact on teachers' professional development.

Based on the findings and the constructivism process, teachers are now learning from their experience of laptops use (Kanuka & Anderson, 1999). Although the impact was found to be moderate, it is imperative to recognise the importance of laptops use in shaping the professional development of teachers. The results were as such because teachers might need more time to familiarize themselves with the laptops in order to construct their own

understanding to fully utilize them (Smaldino *et al.*, 2008). Nevertheless, it is believed that the continuance of laptops usage in schools can further enhance teachers' professional development.

## CONCLUSION

This study has provided some insights into teachers' professional development, and their enhanced growth through the use of laptops. The teachers of the current study were found to have experienced a positive, moderate impact of laptop on their professional growth. For instance, the use of laptops during classroom instruction has helped teachers improvise the teaching-learning process. In addition, the laptop has been considered as the fountain of information. It has exposed teachers to the Internet, and enabled them to access a greater range of up-to-date teaching resources. Meanwhile, the availability of numerous downloadable instructional materials on the Internet has benefited teachers in aiding and enhancing their classroom instructions. With the ubiquitous Internet, teachers also enjoy exchanging e-mails with each other as they have perceived it as a tool to promote an efficient use of time. It has indeed improved their communication and networking with their colleagues, where they have started to actively communicating with each other via the school network (Rutledge, Duran & Carrol-Miranda, 2007; Warschauer & Grimes, 2005). Teachers share information by uploading and downloading files so that it can be used by other teachers. Besides, the flexibility of the laptop has offered the teachers with more choices about where and when to do their work (Cowie & Jones, 2005; Silvernail & Lane, 2004; Fairfax County Public School Office of Program Evaluation, 2003; Cunningham *et al.*, 2003). Moreover, it was also seen that laptop use among teachers has promoted effective time utilization.

Teachers' engagement in technology rich environment has enlightened their technology literacy. Thus, it is important to note that the ubiquitous of laptop and its integration in school activities have contributed towards the

growth of teachers' professional development. Even though the findings reported a moderate level of laptop impact, it could be regarded as an indicator that teachers are now beginning to accept and assimilate their daily practices with the use of laptops.

It should be noted that teacher change is a timely and difficult process. As the front-runner of educational reform, teachers need to learn and apply new approaches in teaching. The rapid changes of the instructional approach in the education system require teachers to become proficient in dealing with something new. In the age of ICT, where life is at a fast lane, teachers are most likely required to put in extra efforts to keep themselves at par with the latest instructional technology. However, many have overlooked that change may be a threat to teachers as they take the risk of failure. Furthermore, some teachers are struggling to combat their fears, and at the same time, dealing with their anxiety of applying the new practices or procedures. Thus, it is imperative to recognize that change is a difficult process that requires a great amount of time.

As technology changes rapidly, further studies are needed to keep in tap with the new information that keeps on emerging every day. In order to inculcate measure and improvise technology professional development among teachers and to obtain more exciting results on this particular topic, a study which is qualitative and exploratory in nature can be conducted as a means to obtain in depth information and mass fascinating opinions on how laptops have benefited teachers in their professional development.

## REFERENCES

- Bismillah Khatoon Abdul Kader (2007). Malaysia's experience in training teachers to use ICT. *ICT in Education: Case studies from the Asia Pacific Region*, 10-22.
- Choong, K. F. (2004). *English for the teaching of Mathematics and Science (ETeMS): From concept to implementation*. English Language Teacher Centre Malaysia, pp. 1-11. Retrieved September 13, 2007 from [www.eltcm.org](http://www.eltcm.org).
- Cowie, B., & Jones, A. (2005). *Digital horizons: Laptops for teacher's evaluation study update on secondary teacher's experience*. University of Waikato. Retrieved October 30, 2007 from [http://www.minedu.govt.nz/web/downloadable/dl8568\\_v1/laptop-leaders-report-12-9-with-edits-ds.doc](http://www.minedu.govt.nz/web/downloadable/dl8568_v1/laptop-leaders-report-12-9-with-edits-ds.doc)
- Cuban, L. (1986). *Teachers and machines: The classroom use of technology since 1920*. New York & London: Teachers College Press.
- Cunningham, M., Kerr, K., McEune, R., Smith, P., & Harris, S. (2003). *Laptops for teachers: An evaluation of the first year of the initiative*. ICT in School Research and Evaluation Series No. 19. Becta/National Foundation for Educational Research (NFER).
- DeVellis, R. F. (2003). *Scale development: Theory and application*. Thousand Oaks, California: Sage Publications, Inc.
- Diaz-Maggioli, G. H. (2003). *Professional development for language teachers*. ERIC Clearinghouse on Language and Linguistics. Washington D.C. Retrieved October 4, 2007, from [www.cal.org/ericll](http://www.cal.org/ericll)
- Dunleavy, M., Dextert, S. & Heinecket, W. F. (2007). What Added Value Does A 1:1 Student to Laptop Ratio Bring to Technology-supported Teaching and Learning? *Journal of Computer Assisted Learning*, 23, 440-452.
- Gordon, S. P. (2004). *Professional development for school improvement: empowering learning communities*. USA: Pearson Education, Inc.
- Hinton, P. R. (2004). *Statistics explained* (2<sup>nd</sup> ed.). New York: Routledge.
- International Society for Technology in Education, (2010). Standards for global learning in the digital age. Retrieved October 2, 2010, from [www.iste.org/standards.aspx](http://www.iste.org/standards.aspx)
- Laptop Computer Pilot Interim Report 2002-2003. (2003). Fairfax Public Schools Office of Evaluation. Department of Education Accountability, USA.



- Maurer, M. & Davidson, G. S. (1998). *Leadership in Instructional Technology*. Upper Saddle River, NJ: Prentice-Hall, Inc.
- Microsoft's Partnership in Learning. (2007). *Learning to Lead Change: Building System Capacity*. Asia Elite Short Course, March 2007.
- Ministry of Education & Intel Malaysia (2008). *Project report: MOE-Intel school adoption project phase I*. Educational Technology Division.
- MoE (Ministry of Education) of Malaysia. (1997a). *The Malaysian smart school: An MSC flagship application, a conceptual blueprint*. Putrajaya. Retrieved October 5, 2007 from <http://vlib.unitarklj1.edu.my/pdf/Smartscbp.pdf>
- MoE (Ministry of Education) of Malaysia. (2005b). *Smart School roadmap 2005-2020: An educational odyssey*. Cyberjaya. Retrieved October 5, 2007, from <http://www.msc.com.my/smartschool/downloads/roadmap.pdf>
- Moses, P., Wong, S. L., Kamariah Abu Bakar & Rosnaini Mahmud (2010). A preliminary study: Level of laptop competence among secondary school teachers. In *Proceedings of Global Learn Asia Pacific Conference 2010* (pp. 195 – 204). AACE.
- Noraini Idris, Loh, S. C., Norjoharuddeen Mohd. Nor, Ahmad Zabidi Abdul Razak, & Rahimi Md. Saad. (2006). The Professional Preparation of Malaysia Teachers in the Implementation of Teaching and Learning of Mathematics and Science in English. *Eurasia Journal of Mathematics, Science & Technology Education*, 3(2), pp. 101-110
- O'Sullivan, F., Jones, K., & Reid, K. (1990). The development of staff. In L. Kydd, M. Crawford & C. Riches (Eds.). *Professional development for educational management*. Buckingham, Philadelphia: Open University Press.
- Pallant, J. (2005). *SPSS Survivor Manual: A step by step guide to data analysis using SPSS, Version 12*. New York: Open University Press.
- Pillay, H., & Thomas, M. (2004). *A nation on the move: From chalkface to laptops*. Paper presented at MICELT. Retrieved October 16, 2008 from [www.elctm.org](http://www.elctm.org)
- Pugach, M. C., & Warger, C.L. (2001). How does technology support a special education agenda? Using what we have learned to inform the future. In L. Cuban & J. Woodward (Eds.), *Technology, curriculum and professional development: Adapting schools to meet then needs of students with disabilities*. California: Corwin Press, Inc.
- Rockman, S. (2004). *Getting results with laptops*. techLEARNING. Retrieved April 22, 2008, from <http://www.techlearning.com/shared/printableArticle.jhtml?articleID=49901145>
- Rutledge, D., Duran, J., & Carroll-Miranda, J. (2007). Three years of the New Mexico laptop learning initiative (NMLLI): Stumbling toward innovation. *AACE Journal*, 15(4), 339-366.
- Silvernail, D. L., & Lane, D. M. M. (2004). *The impact of Maine one-to-one laptop programme on middle school teachers and students*. Maine Education Policy Research Institute University of Southern Maine Office, USA.
- Warschauer, M., & Grimes, D. (2005). *First year evaluation report Fullerton school district laptop program*. Irvine: University of California.
- Wawasan 2020 (1991). *The way forward: Vision 2020*. Available from <http://www.wawasan2020.com/vision/>.
- Windschilt, M., & Sahl, K. (2002). Tracing teacher's use of technology in a laptop computer school: The interplay of teacher beliefs, social dynamics and institutional culture. *American Educational Research Journal*, 38, 165-205.
- Zuber-Skerritt, O. (1992). *Professional development in higher education: A theoretical framework for action research*. London: Biddles Ltd, Guilford.