A discussion of the factors affecting the implementation of one-to-one computing learning environment in a primary school

Siew Khiaw LIM,
Beacon Primary School, Singapore

Lee Yong TAY
Beacon Primary School, Singapore

Cher Ping LIM
Hong Kong Institute of Education, Hong Kong, China

Abstract

This ethnographic case study describes and analyses the conditions that support the seamless integration of information communication technology (ICT) into the classroom with school initiated student one-to-one computer ownership program in a primary school. The findings suggest the importance of two factors: technological infrastructures and teachers' beliefs and practices. In addition, curriculum, school leadership and professional development also play less visible but supporting functions in the process of integrating ICT into the teaching and learning process.

Keywords: one-to-one, integration of ICT into teaching and learning, future school

Introduction

This paper describes and discusses the conditions that support the seamless integration of information communication technology (ICT) into the classroom vis-à-vis the school-initiated one-to-one computer ownership program for all its Primary 4 (i.e., aged 10) students. The school in this case study research has

implemented a one-to-one student computer ratio for all its students when they started school at Primary 1, with computers provided by the school. Starting from Primary 4, students procure and use their own computers for learning.

The school in this research study is one of the eight future schools under the FutureSchools@Singapore program. The FutureSchools@Singapore program is a collaborative project between the local educational ministry and information communication development authority. The main aim of the program is to have a small group of schools lead the way in providing possible models for the seamless and pervasive integration of information and communication technologies (ICT) into the curriculum for engaged learning in schools.

One-to-one learning environment

Research studies have indicated that one of the main reasons for lower ICT usage in educational setting is due to the lack of the necessary technological resources (Crisan, Lerman, & Winbourne, 2007). "Studies have suggested that there is little use of ICT in primary schools as access is still the major challenge – limited access leads to limited use, resulting in limited impact" (Tay, Nair, Lim, p. 40). The main intent of the school's one-to-one initiative is to overcome this barrier of insufficient technological hardware.

The school in this study took a progressive approach by providing the necessary computing device (i.e., notebook computers) from Primary 1 to 3. In Primary 3, the school started to discuss the student one-to-one computer ownership initiative with the parents. All the cohort of 225 students and parents supported the program – 160 students purchasing the school recommended notebook computer model, 50 using their existing computers and the remaining 15 student who tapped on to the financial computer assistance scheme provided by the local infocomm authority (i.e., Infocomm Development Authority, Singapore).

Conditions for ICT integration

A review of the relevant research studies (Benes, et. al., 2008; Bouterse, Corn, & Halstead, 2009; Chere-Masopha & Bennett, 2007; Divaharan & Lim, 2010; Dourneen & Matthewman, 2009; Garthwait & Weller, 2005; Hayes, 2007; Masopha & Bennett, 2007; Passey, 2006; Penuel, 2006; Sipilä, 2010; Tondeur, Cooper, & Newhouse, 2010; Towndrow & Vaish, 2009) conducted in the area of ICT integration and pervasive use of technology in the classrooms suggest the importance of the following factors: (1) Technological infrastructures and support; (2) Teachers' beliefs and practices; (3) Curriculum; (4) School leadership and (5) Professional development

Technological infrastructure (i.e., the physical hardware such as the computing devices and the wireless network) and technical support are critical elements for successful and seamless ICT integration into the classrooms.

Many researchers have ranked teachers' beliefs and practice as one of the key factors for successful ICT integration (Chere-Masopha & Bennett, 2007; Garthwait & Weller, 2005; Hayes, 2007; Oliver, 2010; Penuel, 2006; Sipilä, 2010; Tondeur, Cooper, & Newhouse, 2010; Towndrow & Vaish, 2009).

In general, curriculum refers to subject content that is developed in line with the guidelines set by the governing education body.

The school leadership provides the direction and support in terms of school policy that outlines goals and also the necessary resources for the teachers. "Successful change and ICT implementation in schools depends on effective leadership" (Stuart, Mills, & Remus, 2009, p. 734). "Strong and coherent leadership was an important factor in initiating and maintain the impetus of integration ICT" (Hayes, 2007, p. 392). Ng (2009) also reports that strong leadership is needed to promote quality ICT integration.

Professional development is an essential part of every teacher's development to improve his/her skills and knowledge. Research has suggested the importance in professional development for the integration of ICT into the curriculum (Penuel, 2006; Sipilä, 2010, Ward & Parr, 2010). "A variety of types of professional development… are needed to meet not only the varying needs of individual teachers, but also the varying ways in which ICT can be used" (Ward & Parr, 2010, p. 113).

Research design and methods

An ethnographic case study design is adopted in this exploratory study (Stake, 1995). The main intent is to discuss the key factors supporting the one-to-one program. The paper describes the school's effort and process in the implementation of the student computer ownership program, as well as its one-to-one computing learning environment initiative to date. Although ethnographic case studies seem to be a poor basis for the purpose of generalisation to inform about future practices, the intent is not to understand other cases. The most important criterion is to maximise what we can learn from the case rather than for generalisation purposes. The implementation considerations of this school could be used to inform the education fraternity regardless of where they are situated.

The research methods include: (1) questionnaire survey and informal interviews with teachers, parents; (2) the review of documents students (i.e., schemes of work and lesson plans) and (3) observations by the authors. Data collection from teachers, parents and students aim to provide a more comprehensive account of the case. The data from the various research methods (i.e., questionnaire surveys, informal interviews, review of documents and observations) mentioned above were triangulated to enhance validity of the study.

Key findings

Teacher, students and parents self-reported questionnaire survey

After 9 months of implementation, parents, students and teachers gave positive feedback on the school's implementation of the student computer ownership and one-to-one computing learning environment programs. Parents, students, and teachers involved were asked to rate the implementation of the programs on a questionnaire survey based on a Likert-scale of 1 to 7, with 1 being strongly disagree and 7 being strongly agree with the questionnaire statements. Of the 169 parents who responded to the survey, an average score of 5.32 was recorded when they were asked whether the students' computers were well-used. The 22 teachers who were directly involved gave an average score of 5.5 when they were asked to rate the success of the one-to-one program for the cohort of Primary 4 students. All students reflected that the notebook computer or their personal learning device was a useful tool for their learning.

Twenty-two teachers who were involved in the one-to-one program for the Primary 4 cohort of students took a simple survey rating the importance of each of the five factors mentioned above on a Likert-scale of 1 to 7 (1 being not important and 7 being very important). Technological infrastructure was ranked first with an average score of 6.35, followed by teachers' belief and practice at 6.17, curriculum at 6.00, school leadership at 5.48 and professional development at 5.30. All teachers involved tend to agree that the above factors were at least somewhat important in contributing to the success of the program.

Observations on the conditions for one-to-one learning and ICT integration

Technological infrastructures and support
The ICT department worked with the teachers and also liaised with various industry representatives to set up the necessary infrastructure (e.g., wireless network). The school's ICT team of teachers and technicians also worked with these representatives to recommend a model of computer (i.e., 13 inch, full-featured notebook computer weighing approximately 1.8 kg) with the necessary software (e.g., word-processing, presentation, spread sheets, and anti-virus), warranty and repairs, and insurance scheme for the students. The school also had a 4-man technical team to set up and assist technical requirements and troubleshooting.

Teachers' beliefs and practice
As teachers who view technologies positively tend to incorporate the use of ICT into their lessons, special care was taken in the selection of teachers who would be teaching these Primary 4 classes. All the teachers were ICT savvy and have been using ICT for their administrative work, leisure, as well as teaching in the classrooms. Most of the teachers selected have a good track record of ICT use in their classroom teachings to ensure the success of this first implementation of the program.

The pedagogical concept of learning from and with technology (Ringstaff & Kelly, 2002) guided the teachers in their planning of lessons. Broadly speaking, learning from and learning with technology could provide a very useful conceptual technological pedagogical knowledge framework when integrating ICT into teaching and learning. Learning from the computer leans itself more towards the behaviouristic theories of learning whereas learning with technology has its roots from the constructivist and social constructivism paradigms. More passive behaviours such as reading and listening are associated with learning from technology, while more active behaviours such as creating, writing, and updating are associated with learning with technology (Harris & Rea, 2009).

Curriculum
The use of ICT was explicitly spelled out in the curriculum plans and schemes of work on how ICT would be used in the classroom. Detailed lesson plans were also planned and shared by all teachers. For instance, the use of the digital storytelling approach in the teaching of languages was planned, shared and adopted by all teachers of the school. The digital storytelling is a simple and effective approach in allowing students to create their digital 'compositions' with digital images and also personal digital voices. Images and student's digital narration were added to enhance the stories. Students also created pictorial graphs with the spreadsheet software application to analyse trends and patterns in their Mathematics lessons. Teachers also sourced for relevant videos and learning materials to be shared with their students in their Science lessons.

School leadership
Since its inception, the school leaders have been actively promoting the use of ICT to all its stakeholders – parents, students, teachers, non-teaching staff, and officials from the local education ministry. Co-ordinators of the various departments (e.g., the English, Mathematics, Science, and ICT) have also been actively promoting the use and integration of ICT into the curriculum. The procurement and maintenance of the infrastructure hardware and computer networks have been on-going. Principal also strongly supported the allocation of necessary technological and manpower resources for the ICT department of the school. In addition, the principal also led several local and overseas study trips to learn more from the other schools, especially with regards to the integration and use of ICT in teaching and learning.

Professional development
Teachers were encouraged to attend in-services courses, seminars, and conferences (local and overseas). Teachers also shared actively in their weekly meetings on pedagogical insights and administrative/logistical requirements to enhance each other's professional developments, especially in the area of ICT integration into the curriculum. In addition, the school also encouraged the teachers to be practitioner-researchers to look deeper and evaluate on their own practices. Teachers would share their projects and research studies in their in-house research seminar and also at local and international conferences. A few of the teachers were also actively publishing in international refereed journals and books.

Discussions and Conclusion

This ethnographic case study once again highlighted the importance of taking a holistic approach towards the integration of ICT into the classrooms and curriculum (Lim, 2007). Although the questionnaire survey and informal interviews with the teachers involved in the one-to-one initiative seem to suggest that the technological infrastructures and teacher beliefs and practice are the most critical factors, the other factors (i.e., curriculum, leadership and professional development) may be less visible to the teachers but they play important and supporting roles in this endeavour. Even with an elaborate technological infrastructure, teaching and learning would not be possible without committed and skilful teachers who are on the ground implementing the day-to-day lessons in their respective classrooms. In addition, directions for the school leadership and channelling of the necessary resources are all critical factors to be considered. A good curriculum plan also provides the necessary structure and procedures of how to carry integrate ICT in a more seamless and pervasive manner.

References

Benes, P., Mudrak, D., Prochazka, J., Rambousek, V. & Stipek, J. (2008). Research of ICT education in the Czech Republic. *Problems of Education inthe 21st Century*, *5*, 24-34.

Bouterse, B., Corn, J.O., & Halstead, E.O. (2009). Choosing the Perfect Tools for One-to-One. *Learning & Leading with Technology*,*37*(1), 14-17.

Chere-Masopha, J.C. & Bennett, S. (2007). Using Teacher Professional Identity to Understand Classroom ICT Practices. *The International Journal of Learning*, *14*(7),75-82.

Crisan, C., Lerman, S., & Winbourne, P. (2007). Mathematics and ICT: a framework for conceptualising secondary school Mathematics teachers' classroom. *Technology, Pedagogy and Education, 16*(1), 21-39.

Divaharan, S. & Lim, C.P. (2010). Secondary school socio-cultural context influencing ICT integration: A case study approach. *Australasian Journal of Educational Technology*, *26*(6), 741-763.

Dourneen, J. & Matthewman, S. (May 2009). Seeing through ICT: Re-viewing student teachers' transformation of practice from university session to school placement. *Studying Teacher Education*, *5*(1), 61-74

Garthwait, A. & Weller, H.G. (2005). A Year in the Life: Two Seventh Grade Teachers Implement One-to-One Computing. *Journal of Research on Technology in Education, 37(4), 361-375.*

Harris, A. L. & Rea, A. (2009). Web 2.0 and virtual world technologies: a growing impact on IS education. *Journal of Information Systems Education, 20*(2), 137-144.

Hayes, D. (2007). ICT and learning: lessons from Australian classrooms. *Computers & Education, 49*(2), 385-395.

Lim, C. P. (2007). Effective integration of ICT in Singapore schools: pedagogical and policy implications. *Educational Technology Research and Development, 55*(1), 83-116,

Ng, P. T. (2009). Relating quality and innovation: an exploration. *International Journal of Quality and Innovation, 1*(1), 3-15.

Passey, D. (June 2006). Technology enhancing learning: analyzing uses of information and communication technologies by primary and secondary school pupils with learning frameworks. *The Curriculum Journal*, *17*(2), 139-166

Penuel, W. R. (2006). Implementation and Effects of One-to-One Computing Initiatives: a research synthesis. *Journal of Research on Technology in Education, 38*(3), 329-348.

Ringstaff, C., & Kelly, L. (2002). *The learning return on our educational technology investment: A review of findings from research*. San Francisco: WestEd.

Sipilä, K. (March 2010). The impact of laptop provision on teacher attitudes towards ICT. *Technology, Pedagogy and Education, 9*(1), 3-16.

Stake. R. (1995). *The art of case study research*. Thousand Oaks, California: SAGE Publications, Inc.

Stuart, L. H, Mills, A. M., & Remus, U. (2009). School leaders, ICT competence and championing innovations. *Computers and Educations, 53*(3), 733-741.

Tay, L. Y., Nair, S. & Lim, C. P. (2010). Supporting one-to-one computer-mediated learning environments in a Singapore primary school. In L.Y. Tay, C. P. Lim, & S. K. Myint (Eds.),*A school's journey into the future: research by practitioners for practitioners* (pp.39-67). Singapore: Pearson.

Tondeur, J., Cooper, M. & Newhouse, C.P. (2010). From ICT coordination to ICT integration: a longitudinal case. *Journal of Computer Assisted Learning*,*26*(4), 296-306.

Towndrow, P. A., & Vaish, V. (2009). Wireless laptops in English classrooms: A SWOT analysis from Singapore. *Educational Media International*, *46*(3), 207-221.

Ward, L, & Parr, J. M. (2010). Revisiting and reframing use: implications for the integration of ICT. *Computers and Education, 54*(1), 113-122.

Author contact details:
Siew Khiaw Lim lim.siewkhiaw@bcps.sg; lim_siew_khiaw@moe.gov.sg