Online software applications for learning – observations from an elementary school

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Online software applications for learning – observations from an elementary school

This exploratory case study research describes the integration of ICT into the teaching and learning of English, mathematics and science in an elementary school in Singapore. The school in this case study research is one of the first primary level future schools that was set up under the FutureSchools@Singapore program in 2008. The school has implemented a successful one-to-one program (i.e., one-to-one computer to student ratio) for all its students. The use of blogs, communication applications (e.g., online chats and email), online educational games, online learning management systems, online searches for information and educational related videos were commonly used to integrate ICT into the teaching and learning of the various subjects mentioned above. A total of 221 (Primary 3 and 4) and 466 (Primary 3, 4 and 5) students participated in an ICT usage survey conducted in 2011 and 2012, respectively. Three interesting phenomena were observed through the descriptive statistics. First, it was observed that the ICT usage rates for the various subjects (i.e., English, mathematics and science) peaked at the primary 4 level when the computer ownership program was introduced and declined in primary 5. Second, descriptive statistics analyses suggested the use of blogs, communication applications, online educational games, and Internet searches, were more frequently used, as compared to the learning management systems and the use of videos, in the students' learning of English, mathematics and science. Thirdly, ICT usage rates were also different for the different classes of Primary 5. Follow-up interviews with teachers and student open-ended survey responses were also analysed. The triangulated findings seemed to suggest that blogs were frequently used and acted as gateways to other online software applications. The findings also once again pointed to the importance of the sociocultural context – school leadership, curriculum planning and assessment, technological infrastructure, and teachers' practices – in ICT usage and integration in schools.

Keywords: future school, ICT integration, online software applications, elementary school

Introduction

This exploratory case study research describes the integration of ICT in the learning of English, mathematics and science in an elementary level future school in Singapore. As technology or computer use and the Internet are very closely linked and at times seem to be synonymous, this case study research explores students' usage of online software applications that are commonly available online. Some of these online software applications are easily available with relatively low or no financial cost (e.g., open-source online software applications). These online software applications are: blogs, communication platforms (e.g., emails and chats), online educational games, learning management systems, Internet searches, and online videos.

The school in this case study research is one of the first primary level future schools that was set up under the FutureSchools@Singapore program in 2008. The school's core mission is to seek innovative teaching approaches that leverage on technologies to better engage the new generation of young learners. The school has implemented a successful one-to-one program (i.e., one-to-one computer to student ratio) for all its students. The program ensures a two-to-one student-to-computer ratio for its Primary 1 students and one-to-one student-to-computer ratio for Primary 2 and 3. Computer ownership program, where students procure and own their own notebook computers, has been introduced to all Primary 4 students. In other words, students are to procure their own personal notebook computer for use in school every day and at home for the purpose of learning. The program promotes the vision for every child to own a personal learning device to support, extend and enrich their learning. A student-owned model is adopted to ensure sustainability of the one-to-one program and the continuity of independent learning beyond the school.

Background

The school is situated in typical working class neighbourhood in the western part of Singapore. Of the various learning subjects offered in the primary schools in Singapore, English Language, mathematics and science are the core academic subjects that take up the bulk of the curriculum. The use of blogs, communication applications (e.g., online chats and emails), online educational games, online learning management systems (both open-source and commercially available platforms), online searches for information and educational related videos and were commonly used to integrate ICT into the teaching and learning of the various subjects mentioned above. Some, or most, of these applications are easy to use at relatively low or no cost. In addition, computer and Internet use these days, at least for the past decade, are synonymous in many ways. Other than the common word processing, presentation and spreadsheet software applications, the school in this case research study also uses the above mentioned online software applications for teaching and learning.

Purpose of study

The purpose of this research study is to describe how ICT has been integrated into the teaching and learning processes among English, mathematics, and science. More specifically, this case study research looks into the following areas: (1) students' usage pattern of the various types of commonly used online software applications (i.e., blogs, communication applications, online educational games, learning management systems, online searches and online videos) for their learning and (2) how these online software applications were used. This study also discusses the (3) factors that affect the use and integration of ICT in the classrooms.

Literature review

With the proliferation of the Internet and broadband networks over the past decade, the use of online software applications is becoming more popular and prevalent in schools (Tay, Lim, Lye, Ng & Lim, 2011) and many of such software applications are easily available at relatively low or no software cost. Even in schools where technical expertise is not available, the commercially available learning management systems often have functions and features of online software applications as mentioned above (Anderson, 2006). Since the mid of last decade, several authors have already called for the inclusion and integration of the commonly used online social software applications into the commercially available learning management systems (Craig, 2007; Dalsgaard, 2006; Mott, 2010; Sigala 2007; Kemp and Livingstone, 2006). The school in the case study uses such online software applications quite extensively for all its students and it would be insightful to look into its usage rates and pattern of use by the students for the various subjects taught (i.e., English, mathematics, and science).

In addition, several studies also highlight factors such as school leadership, physical and technological infrastructure, curriculum and assessment, and teachers' practices (Hew & Brush, 2007; Lim & Oakley, 2013; Tay, 2011) affect the integration of ICT into the classrooms. This study also seeks to understand the roles of these factors in the use and integration of ICT in schools. Hew and Brush (2007) highlighted four factors that should be taken into considerations to facilitate the integration of ICT into the classrooms: teachers' knowledge and skills, subject culture, assessment and institution support (Hew & Brush, 2007). Lim and Oakley (2013) highlighted four necessary and sufficient conditions to support ICT for teaching and learning in primary schools – policy and school leadership; physical and technological infrastructure; curriculum and assessment; and teachers' professional development and practices. In

line with the above authors' argument, the objective of this case study research is to contribute to knowledge in the educational technology field with regard to students' ICT usage pattern for the various online software applications with the various subjects. This study also attempts to highlight factors that could have an impact on students' usage rates and patterns.

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 (Hew & Brush, 2007; Tay, Nair & Lim, 2010). The school in this case study is one of the few primary-level future schools in Singapore with one-to-one computing and a fully wireless networked learning environment. The physical and technological setup of the school has overcome this issue of limited access and now, it would be interesting to see whether ubiquitous access would increase usage and ICT usage pattern among the students.

Research design and methods

A case study approach (Merriam, 1998; Stake, 1994, 1995; Yin, 1994, 1997) is adopted for this exploratory research study. The main objective is to explore students' usage of online software applications for their learning of the various academic subjects (i.e., English, Mathematics and Science).

Students in the school are exposed to the use of various types of online software applications to facilitate their learning of the various subjects mentioned above. These online software applications include the following: (1) blogs for discussion of ideas among students and teachers, the blogs also allow for the dissemination of subject related information and content online; (2) emails and chats for online communication; (3) online games for the reinforcement of skills and concepts learned; (4) learning management system for the assessment of students' understanding via quizzes and the

dissemination of subject content via the online course modules; (5) online Internet searches for relevant information for their learning; and (6) online videos for the learning of knowledge, concepts and skills.

Three research methods were utilised for this case study research – (1) students' self-reported ICT usage rate survey on a Likert scale of 1 to 7; (2) students' self-reported survey on how they use ICT for their learning of English, Mathematics and Science; and (3) interviews with selected teachers (a total of eight teachers – three English, three mathematics, and two science teachers) on how ICT was used in the teaching of the various subjects mentioned.

Primary 3, 4 and 5 students were given a survey questionnaire requiring them to put down their overall ICT usage frequency and also their frequencies of using (3) blogs, (1) emails and chats, (2) online games, (4) learning management systems, (6) online searches, and (5) online videos. Students rated their ICT usage rates on a Likert scale of 1 to 7 (1 = once a month, 2 = once every 3 weeks, 3 = once every 2 weeks, 4 = once every 10 days, 5 = once every week, 6 = once every 2 to 3 days and 7 = once every day). Students were also given open-ended short questions on how they have used ICT in their learning and how they felt about their learning with ICT. In addition, a total of eight teachers were interviewed to have a more in-depth understanding of how ICT was integrated into their lessons and factors that could affect the ICT usage rates and patterns.

Findings

Students' self-reported survey of usage rates on online software applications

In 2011, 221 Primary 3 and 4 students (i.e., 85 Primary 3 and 136 from Primary 4) participated in an online survey in October 2011. In 2012, 466 Primary 3, 4 and 5

students (i.e., 155 from Primary 3, 155 from Primary 4 and 156 from Primary 5) participated in a survey in October 2012 to indicate their frequency of use for the above mentioned online applications. Two interesting phenomena were observed through the descriptive statistics. First, it was observed that the ICT usage rates for the various subjects (i.e., English, mathematics and science) peaked at the Primary 4 level when the computer ownership program was introduced and declined in Primary 5 (see Figure 1, 2 and 3 – students' online software applications usage rates for the various subjects for details). Further analysis revealed that there were higher frequencies of usage of blogs, communication application, online games and Internet searches as compared to the use of learning management systems and online videos for the three subjects (i.e., English, mathematics, and science). Figures 4, 5, and 6 provide the detailed mean usage rates for the various online software applications. Figures 7 and 8 provide a detailed breakdown of the ICT usage rates for all the classes in Primary 4 and 5 in year 2012. The usage rates between the Primary 5 classes differ much more as compared to the Primary 4 classes. Primary 4 classes are not streamed according to academic ability while Primary 5 classes are, 5.1 being the academically higher ability students and 5.6 the lower ability ones. Figures 7 and 8 revealed greater variations of usage rates among the Primary 5 as compared to Primary 4 classes, suggesting that ICT usage rates were linked to the ability of the students. However, Table 1 – ICT usage rates by class and teacher further suggested that the usage rates were linked more to the teachers than the ability of students. For instance, comparing Teacher A (Classes 5.1 & 5.6) and Teacher B (Classes 5.2 & 5.5), the ICT usage rates for English classes taught by Teacher B were consistently higher than that of Teacher A.

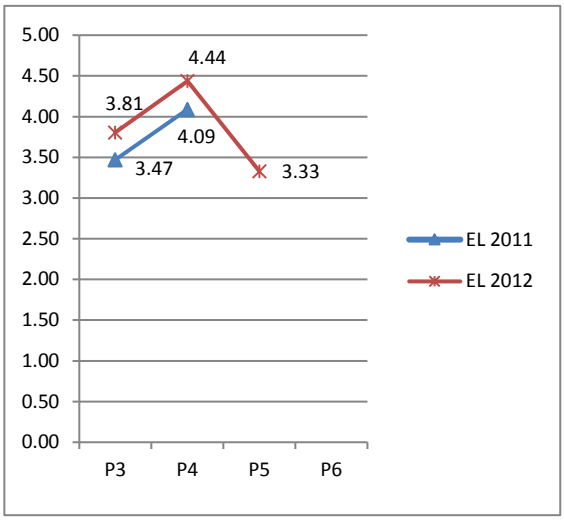

Figure 1: Students' ICT usage rates for English mathematics

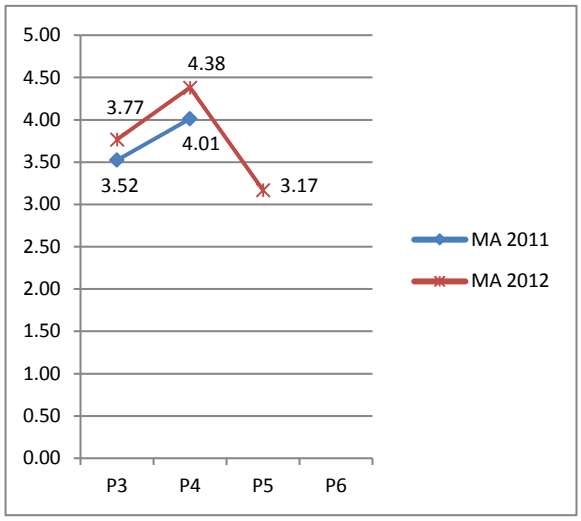

Figure 2: Students' ICT usage rates for

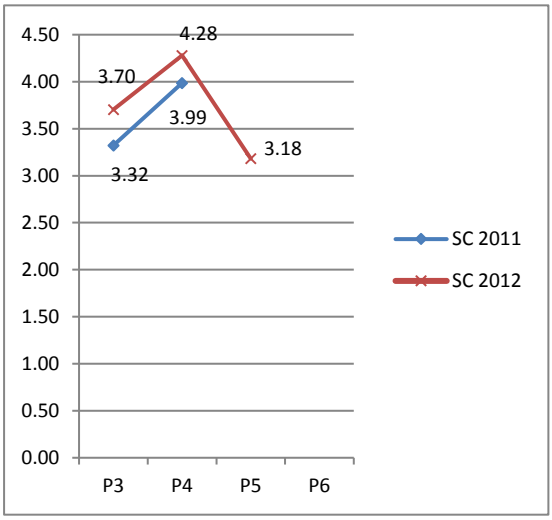

Figure 3: Students' ICT usage rates for science

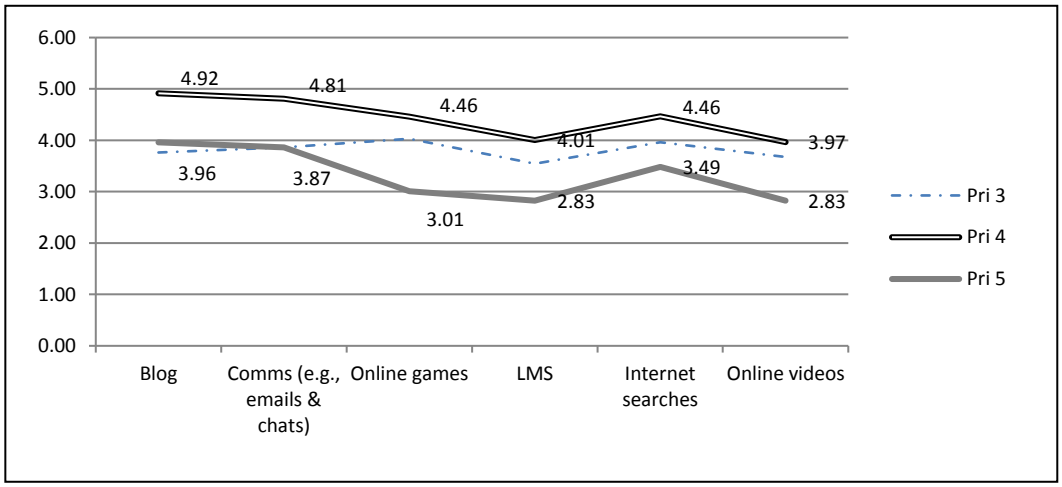

Figure 4: Students' online software applications usage rates for year 2012 for English

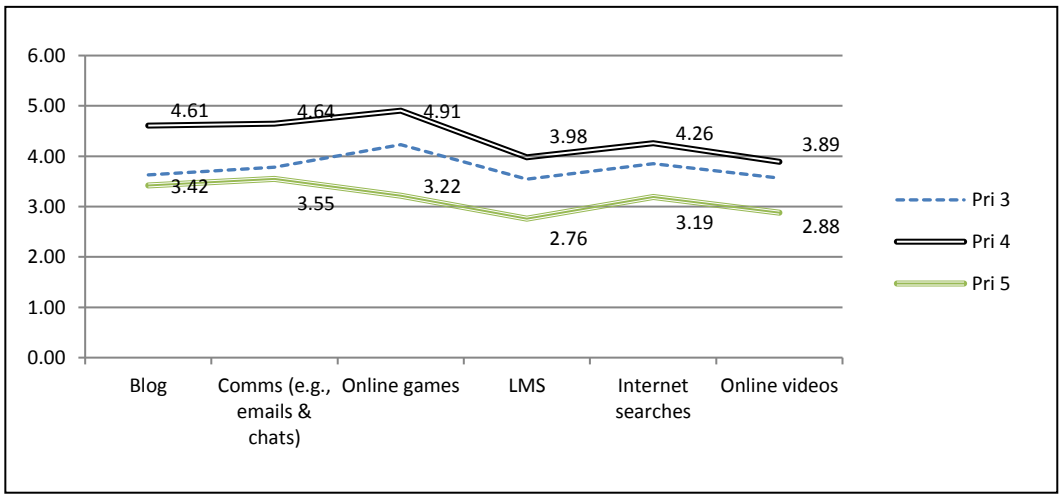

Figure 5: Students' online software applications usage rates for year 2012 for mathematics

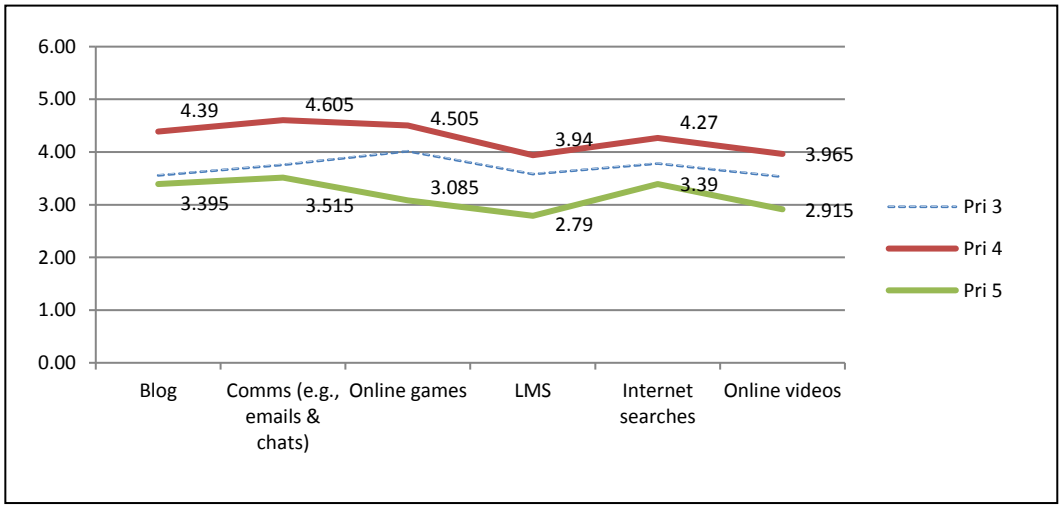

Figure 6: Students' online software applications usage rates for year 2012 for science

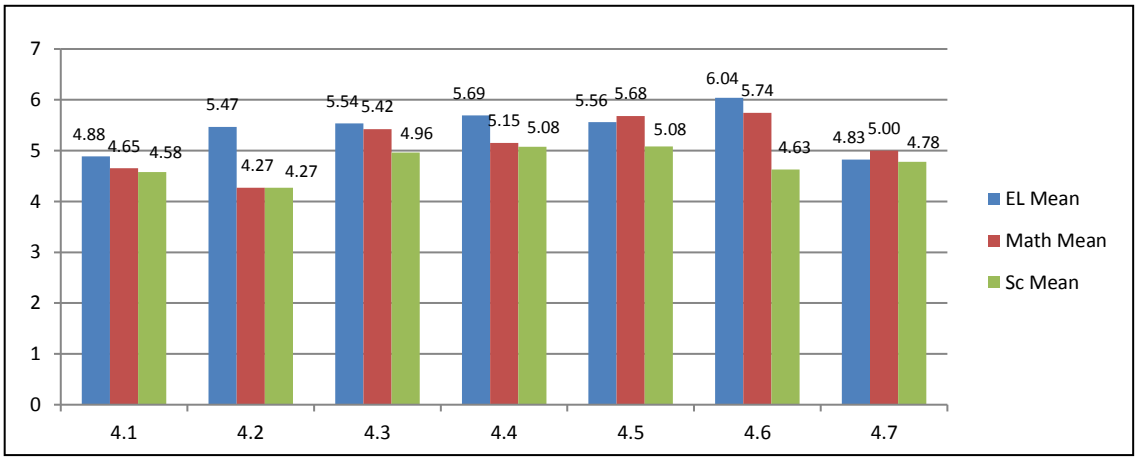

Figure 7: Students' ICT usage rates by class – Primary 4 (2012)

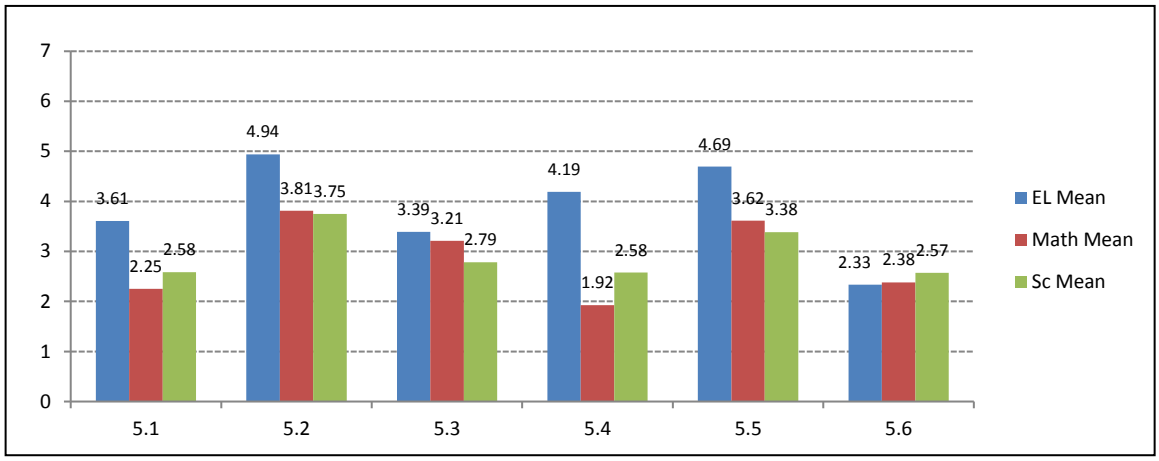

Figure 8: Students' ICT usage rates by class – Primary 5 (2012)

Table 1: ICT usage rates by class and teacher

Teacher teaching the various subjects	**Classes & mean ICT usage rates**
Teacher A (English)	5.1 (3.61) & 5.6 (2.33)
Teacher B (English)	5.2 (4.94) & 5.5 (4.69)
Teacher C (English, mathematics & science)	5.3 (3.39, 3.21 & 2.79)
Teacher D (mathematics)	5.1 (2.58) & 5.2 (3.75)
Teacher E (mathematics)	5.4 (1.92) & 5.6 (3.62)
Teacher F (science)	5.1 (2.58) & 5.4 (2.58)
Teacher G (science)	5.2 (3.75) & 5.5 (3.38)

* Mean ICT usage rates in parentheses

Students' self-report open-ended survey questions

204 Primary 4 and 202 Primary 5 students were asked to answer two open-ended questions in a survey given in 2012. They were asked how they felt about using ICT in school and also what they did with their computers during their lessons.

From the text analysis, both the Primary 4 and 5 students reflected significantly more positive feeling words than negative ones towards their use of ICT for their learning. There were 74 counts of positive feeling words as compared to 12 negative ones for the Primary 4 students surveyed and 58 counts of positive words as compared to 24 negative ones for the Primary 5 students. In addition, students also mentioned, with high frequency counts, the use of blogs, teacher guided ICT learning, ICT as a

school initiative, the computer as an information tool and using the computers for their homework for the Primary 4 students. The Primary 5 students also talked about the use of blog, using ICT as an information tool, teacher guided ICT learning, playing of educational games and collaborative work with the computers. Table 2 is a summary of the students' open-ended responses on the two questions (i.e., how they feel about using computers in school and what do they do with their computers during their lessons in school).

Table 2: Students' responses to the 2 open-ended survey questions

No.	**Questions**	**Response**	
		Primary 4	**Primary 5**
1.	How do you feel about using computers in school?	▪ 74 counts of positive feeling words ▪ 12 counts of negative feeling words	▪ 58 counts of positive feeling words ▪ 24 counts of negative feeling words
2.	What do you do with your computers during lessons?	▪ High frequency words: (1) Blogs, (2) Teacher guided ICT learning, (3) ICT as a school initiative, (4) ICT as an information tool, & (5) Use computer for homework.	▪ High frequency words: (1) Blogs, (2) ICT as an information tool, (3) Teacher guided ICT learning, (4) Playing of educational games, & (5) Collaborative work.

Interview with teachers

Teachers were shown quantitative data of the students' usage of the online software applications and asked for their opinions on the patterns. The interview with the teachers reflected the high usage rates of blogs for the dissemination of teaching and learning related information to the students and also as an online communication platform for student-student and teacher-student interactions. Teachers were not surprised with the survey findings. The use of blogs was widely promoted by the school and the teachers since 2008, when the first cohort of students was in Primary 1. There were subject blogs for mathematics and science containing the topic sequence,

useful links to various topics for further learning and also links to related online games. Every class maintained a class blog for the dissemination of information to students and parents, at the same time, the blogs were also used by the various subject teachers to push content and at times, acted as an online platform for asynchronous discussion among the students. Some classes even posted their journals online for their classmates and school mates to comment. More interestingly, the blogs were often used as gateways to other online software applications. The usage of other forms of online software applications were also described in the sections below. The teachers also shared that the ICT usage rates and patterns were influenced by high-stake examinations, curriculum planning, technical issues, and teachers' practices. The students' ICT use for consumption and production was also discussed briefly.

High usage of blogs by teachers

All the teachers interviewed shared that they used blogs in their lessons. Most, if not all, the teachers interviewed shared that blogs were not only used for information dissemination and online collaboration, they were online platform that linked to other online software applications (e.g., links to online videos, games and etc.); in other words, the blog site became the gateway to other applications.

Usage of blogs in English lessons. One of the English teachers interviewed shared that blogs were mainly and commonly used by teachers to disseminate information, and among the Primary 4, to instruct students on homework and what they had to do for the next few days. She reflected that she had her own blog in order to provide more content for her students, such as language play and online readings. Blogs could also be an avenue for journal entries written by students and specific discussion topics for students to participate and discuss. For instance, videos on certain topics could be posted onto the blog for students to view and post comments to facilitate discussions. Otherwise,

links could be given on the blog for students to self-investigate and later share on the blog with other classmates. Another English teacher further clarified that blog was her avenue for communications and exchange between the teachers and students. Online games were not really used in her lessons and videos were normally uploaded onto the blog as stimuli for classroom debate and discussions. The third English teacher shared that blogging took a chunk of it, as students were required to blog often and read online resources such as the current affairs blog. "For language, blogging is still the key for learning."

Usage of blogs in mathematics lessons. A mathematics teacher quoted an instance when he was absent from school, he was able to post up his lesson objectives for the lesson for the day up onto the class mathematics blog for his students to do their learning independently with much intervention from the relief teacher. To the teacher, his mathematics blog is like a gateway to other learning portals, "it is an online management site where we can communicate with the students and parents with regards to lessons and homework, with useful functions like calendars and reminders. For myself, I will regularly update the blog with the materials I have covered in class, such as workings to different questions in PDF format or PowerPoint slides, allowing students to access them at home or in school." When asked about the use of communication applications, the teacher reflected that he did not really use them to communicate with his students. He added that he used the blogs more often. As for the use of online videos, he answered that it would depend on the topics taught. He quoted the use of videos for the topic on tessellations, which could show a more realistic visualisation of the workings. He added that the links to the various topics would be posted on the class blog. Another mathematics teacher who was interviewed shared that she had explored many different stuff, like blogs, communication online applications

(e.g., emails), online games, and learning management systems. She also used Internet searches and graphic organisers for her mathematics lessons. For her, online videos were used more for demonstration to highlight specific concepts to students. The teacher described how blogs were used by her students. She did investigative mathematics with her students, take photographs to share with students and other teachers. Her students, when they were in Primary 4, were encouraged to post onto the blogs to reflect what they have learned from the investigation. For her Primary 5 students, they would learn how to formulate problems and posting them on the blogs. Her Primary 6 students also used spreadsheet to create charts and formulate questions for discussion via the blogs. In this process, the teachers would need to model to her students what it meant to post a good and constructive comment to facilitate and add-on to the depth of the online discussion.

Usage of blogs in science lessons. Of the science teachers interviewed, the blogs also served as gateways to the various online software applications and resources. Although videos were also used, the links were uploaded to the blogs for easy access by students. Students were guided by their science teachers to discuss science related concepts where their misconceptions would be discussed and corrected by the teachers.

Other online software applications for teaching and learning

Online games

When asked about the use of online games, the teachers' general response was that they were not as frequently used as compared to the blogs. The online games, usually coupled with quizzes within the games, were a good means for reinforcement of learning by the students. One of the English teachers cautioned that she needed to be selective with the selection of such online games as not all would be suitable for her

students as she looked out for free and open-source online learning games. The mathematics and science teachers also shared that online games were mainly used for reinforcement of concepts and skills learned during lessons.

Online learning management systems

The school used both open-source (e.g., Moodle and edmodo) and commercially (online learning management systems that required a subscription) available learning management systems. Of the English, mathematics, science teachers interviewed, it seemed that the mathematics and science teachers utilised the quiz function of the learning management systems more often to reinforce content taught in class.

According to one of the mathematics teachers, his students could access various learning resources, such as animated learning videos and quizzes, via the commercially available learning management system. He was able to track his students' performance as mathematics would require lots of practice and as long as they did not score full marks, the students would have to re-attempt till they got it right. According to the teacher, this was a subtle way for his students to keep practicing and revising. He also informed that there was this level-wide quizzes found within the Moodle learning management system for all students from the same level, just like the level-wide mathematics blogs used for common level lessons maintained by the mathematics department. One of the science teachers used the quiz function to reinforce important science spelling words.

Another English teacher described the online reading comprehension site that they school had subscribed. According to her, the online reading platform encouraged students to read and listen to more texts; it also allowed students to answers questions based on the stories. It was a good way to motivate students to learn their English. This site had point system that encourage students to read more online and recognising their

efforts and level of reading proficiency. Teachers were able to set the difficulty level for each student and also able to track the students' performance.

Internet searches

The teachers all shared that their students were taught and encouraged to do Internet searches for relevant information for self-directed type of learning. The students frequently utilised Internet searches to source for more information. One of the English teacher interviewed shared, "When the students are in Primary 4 and 5, there is no need to prompt the students to do their own self-research as they understood that research would mean to go online to search for information." Another English teacher also echoed this view, "Even at this point, the students from her better class were still consistently uploading information onto their class blog, while her weaker students lagged behind."

Another mathematics teacher shared how he used Internet searches to teach her students. For instance, he asked his students to type in '6 times 5' on the Google search bar and that would not only provide a direct answer, but also able to lead to more examples and workings. According to the teacher, this function was considerably more useful and robust as compared to the normal calculators. In addition, he also mentioned that one of the very good website was the BBC mathematics which had many useful materials for the students. Science teachers and their students used Internet searches frequently for their lessons. The students used the Internet search function frequently for science lessons. Teacher encouraged their students to do online searches on topics and science concepts that the students were unsure of.

Online videos

Online videos were often embedded in the blogs. The teachers teaching the various subjects shared that online videos were used for the introduction of new concepts and also for reinforcement of content learned during lessons. For English lessons, online videos were commonly used as stimulus or talking points for students' discussions. For mathematics and science lessons, the online videos were used more for the learning of concepts and reinforcement of content learned.

ICT usage rates

Shift in emphasis from Primary 4 to 5 to prepare for high-stake examinations

A science teacher shared that the shift of emphasis from ICT to paper and pencil from Primary 4 to 5, was likely due to the national high-stake examinations at the end of Primary 6. She did not think that the dip in usage was due to other reasons. The more likely reason was that the school and students were gearing towards the national examinations at the end of Primary 6. To her, the contrast was made more distinct between Primary 4 and 5 was because ICT because the Primary 4 teachers were given the freedom to try out new ideas for their students, sharing ideas on integration, and ICT was used for all subjects including alternative assessments. One of the English teachers also shared that that due to the shift in emphasis for written assignments and assessments in the upper levels, especially Primary 5 and beyond, the students had to be reined in terms of ICT, though their proficiency in the usage will not be affected. A mathematics teacher also reflected that there was an increase in written work of the Primary 5 students. In short, when asked why there was a dip in the ICT usage rate from Primary 4 to 5, all teachers stated that the Primary 5 began to realise that they were preparing themselves for the high-stake examinations at the end of Primary 6.

Teachers also preferred to focus on their students' foundation and ultimately, it was still down to the paper and pencil during the examinations.

Curriculum

According to one of the science teachers interviewed, he shared that the increased in the ICT usage for the Primary 4 students was a result of conscious effort made by the school and the teachers. It was also due to the novelty of owning a notebook computer for lessons. At Primary 5 level, the demand of the curriculum and the increased focus on written work might affect the usage – teachers used it more sparingly, more for reinforcement of concepts and extension of the lessons. In addition, for students who were not efficient in completing written assignments, it would inevitability mean lesser time for online. He shared that alternative assessment could be one of the ways to infuse ICT into the curriculum. When students were required to come up with their experiments and present the processes, the presentation software could be used and hence ICT usage would be facilitated. He added that there seemed to be a conscious effort to infuse ICT into the English curriculum but there was not such a clear protocol for mathematics and science. So curriculum planning would be important. One of the mathematics teachers added that a lack of compulsory level-wide online quizzes also might have affected the ICT usage rates.

Technical issues

One of the mathematics teachers quoted the dip in ICT usage might be due to technical reasons such as lack of Internet access at home, slower processing speed after one year of usage, and serviceability of the notebook computers. He felt that for problems such as wear and tear of laptops and lack of use, it was an eminent problem that could really hinder the class progression. Another teacher added that some of the students did not

take good care of their computing devices and that might have added to the reduction of ICT usage.

However, some teachers did not feel the same way. A mathematics teacher, when asked whether her students had any issues with the serviceability of their notebook computers, shared that she did not experience such a problem with her students. Students always diligently brought their computers to school for learning purposes. Another science teacher also echoed her view that the dip in the usage rates was not due to the serviceability rate of the students' notebook computers. The difference in ICT usage, according to one of the English teachers shared, "in my opinion, had nothing to do with the technology, rather the students' attitude in learning." For the more academically inclined students, they generally have the support from home and their learning habits were rather well established, taking responsibility for their own learning by knowing what was needed to bring to school – all these can translate to their academic results. On the other hand, the academically weaker students had issues with all these study habits, which would directly affect their results. They might be keen in using ICT but due to their work habits, it would result in higher 'disappearance' rate for laptops and such. The weaker students had this issue of not bringing their laptops. According to her, the dip in the usage rate was intentional as there was a need to train students in certain requirements and skills.

Teachers' practices

Teachers who were interviewed generally stressed the importance of the role played by the teacher in the integration of ICT into the curriculum. One of the mathematics teachers said that, "…for ICT to be a consistent practice, teachers must constantly engage the students in ICT usage, so students could be always ready to take in new ICT knowledge and be familiar with it." He added that most likely the students would be

influenced by the teacher's style. He further elaborated that it would really depend on each teacher's own style of teaching – whether he or she placed larger focus on workbooks and worksheets, or constantly structuring his or her teaching to make more use of online and ICT resources. Another teacher also added that the notebook computer serviceability rate might be lower for his academically weaker students. He opined that computer usage and serviceability rates were very much teacher-influenced. If there were a need for them to use the notebook computers in class everyday, they would have a more urgent need to get them fixed. If not, there would be no sense of urgency.

Some teachers reflected that the dip in the ICT usage at Primary 5 was intentional. One of the English teachers quoted the instance where her students still lacked proper writing techniques and there was a need to have a heavier focus on written skills and techniques. Another English teacher also echoed similar sentiments. According to this teacher, for the academically weaker students, there was an intended reduction on the use of ICT. As the purpose for blogging was to share good works what were worth sharing among classmates but the teacher noticed that for her weaker class, there was a need for them to strengthen their basic writing skills through various approaches. Her weaker class was required to work on compositions in class in order to connect these students to the paper and pencil format. The teacher did not require her weaker students to bring their notebook computer so frequently. Although there might be some issues with the notebook computers for this group of students, the real hindrance was the fact that these students had a greater need for physical and written learning. "It really depends on whether I need them in the classroom. If I really need them, I will be able to ensure that happens. Curriculum wise, laptops are mainly used for sharing and collaboration. After considering what my students need, I will

determine the amount of ICT required for each class or level. And the earlier we can determine this it will help in reducing unwanted distractions and frustrations in class. ICT or not, they are just different modes of teaching, and what is important is that the students benefit and learn."

In closing, one of the teacher reflected that teachers must be strong in their pedagogy, as some teachers could be using ICT to babysit the students and to 'kill' time. ICT should be used only when there was value-addedness, specific to lessons. Teachers needed to be competent in what they wanted to do and what they could use to teach and deliver to their students.

Discussions

Usage of online software applications – blog as the gateway for other online software applications

The triangulated findings seem to suggest high usage rate of blogs for teaching and learning purposes. In summary, both quantitative (i.e., surveys of students) and qualitative data (i.e., interview of teachers) reflected that teachers used blogs to disseminate information and instructions. The blogs also were used as a platform for students to do online asynchronous discussions. The interview with the teachers has provided a detailed descriptive account of how blogs and the various types of online software applications were used by the teachers. One interesting and more significant findings is that in this case study, blogs seem to be the gateways to other online software applications. Online games were used to reinforce skills and concept learned. The learning management systems were mainly used for the learning of subject related content via digital animated applets and online quizzes. As for the online Internet searches, students and teachers used the search engines to look for supplementary and

more information for teaching and learning. Online digital videos were mainly used to elaborate and reinforce concepts and contents taught and learned.

Factors affecting ICT usage rates and patterns

As mentioned in the literature review section above, school leadership, physical and technological infrastructure, curriculum and assessment, and teacher professional development are factors that facilitate the integration of ICT into the classrooms.

Implicit in the above discussion is the role played by the school leadership. The one-to-one computing learning environment and the student computer ownership program for all its Primary4 students to procure and have their own computers are efforts that would not be possible without a supportive leadership for the use of ICT in the classrooms. The school leadership has set up the necessary physical and technological infrastructures such as the wireless broadband Internet access, one-to-one computing, and LCD projectors in all its classrooms. One of the teachers shared the importance of curriculum and planning to better facilitate the usage of ICT in teaching and learning. All teachers suggested that the dip in the ICT usage from Primary 4 to 5 across the various subjects was due to the high-stake national examinations at the end of Primary 6. In Primary 5, teachers and students started their preparation for the national examinations. In preparing pupils for national exam, pupils are more geared towards familiarisation and speed of answering exam type of questions starting from P5. Teachers also shared that teachers need to constantly update and upgrade their teaching knowledge and skills with ICT as the teacher is pivotal in the use of ICT in the classroom. As some teachers who taught the academically weaker students reflected that they purposefully reduced the use of ICT to better expose and train their students in the paper and pencil mode of assessment and the required exam format. The quantitative survey data also showed that there were significant differences among the

classes taught by different teachers; this further suggested that teacher made a difference to the usage rates of ICT. For instance, some teachers used ICT more frequently in their classes as compared to others. Some teachers suggested that the dip in the ICT usage rate could be due to the serviceability of the student-owned notebook computers but there were also counter opinion. Nevertheless, it pointed to a need to a need to regularly look into the serviceability of the school's ICT infrastructure and equipment, as well as students' ICT equipment, as a form preventive maintenance to reduce the rate of technical failure.

Conclusion

The quantitative survey analysis of the students followed by the qualitative interviews with the teachers revealed interesting ICT usage patterns. Among the various online software applications used, blogs became the gateways to the other software applications due to its very versatile nature – blogs could be an online tool for information disseminate as well as a platform for student-student and student-teacher discussions. Implicit within the case study was the support given (e.g., direction and funding) by the school leadership; the prevalent and ubiquitous use of ICT would not be possible without strong direction and support from the school leadership. The technological infrastructure and serviceability of the computing equipment were important considerations as well. For instance, the necessary infrastructure may be available but the absence of serviceable computers, whether school-owned or student-owned, could become an issue with ICT integration and usage. Hence, regular maintenance should be built in as a standard procedure. Curriculum planning and assessment were also factors that affected usage rates. Subjects with better integration into the scheme of work have a higher usage rate compared to those subjects with less integration planned into the curriculum. The national high-stake examinations, to some

extent, have curtailed the usage rates at Primary 5 level. Lastly, the teacher's beliefs, skills, knowledge and practice would affect ICT usage – teachers are pivotal in the integration of ICT into the curriculum.

Once again, this case study research also highlights the importance of the sociocultural context in the efforts towards the use and integration of ICT into the classrooms (Lim, 2002, 2007). Integration of ICT goes beyond what happens within the classrooms; the school and the society have also impacts of what goes within practices in the classrooms.

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