English Language Learning in a One-to-One Computing Environment – Impacts and Considerations

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Abstract: This case study research describes and evaluates the impacts of the learning of English language in an ICT-enriched learning environment in a primary school under the FutureSchools@Singapore programme. Students from the school are provided with two-to-one computing devices in Primary 1 and subsequently one-to-one computing learning environment from Primary 2 (i.e., Grade 2) onwards. Students procure their own computing devices from Primary 4. This case study describes how ICT has been used for the teaching and learning of English. The frequency of ICT use in the English classrooms is also presented. More importantly, the impacts in terms of the students' ICT skills, English test score and feedback from students involved are also presented and discussed. The students performed well in the ICT skill test. The students also performed relatively well in the English test as compared to the control school. In general, the students commented that they were satisfied with the use of their notebook computers. They found it interesting, useful and easy to use. However, students complained about the computer viruses, small computer screen, battery lifespan, weight of their notebook computers, slow internet connect speed and internet connect errors. In the self-reported higher-order thinking questionnaire, no significant difference was found for students' problem-solving skills. However, students from the control school reported a statistically higher score as compared to the experimental school for reflective thinking.

Keywords: One-to-one computing, impacts, evaluation

1. Introduction

1.1 Objectives

The main intent of this research study is to obtain a more in-depth understanding of the impact of the use of Information Communication Technology (ICT) in the teaching of English in a primary school under the FutureSchools@Singapore program. This paper also describes how ICT has been used for the teaching and learning of English.

1.2 Background

The school in this case study research is the first primary future school 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.

2. Literature review

The literature review focuses on both the positive and negative impacts of the use of ICT in educational settings.

2.1 Positive Impacts of ICT

Research studies indicate positive impacts of ICT use in educational settings. Positive level of learning engagement and motivation [1][10][11][21][22] (Binnur, 2009; Kim & Jung, 2010; Krish, 2008; Softa, 2011; Suhr, Hernandez, Grimes, Warschauer 2010), higher test scores[3][22] (Brescia, Kissinger & Lee, 2009, Suhr, Hernandez, Grimes, Warschauer 2010) and the learning of higher-order related type of thinking skills[13][24] (e.g., problem-solving and critical thinking skills) (Lim and Tay, 2003; Takahira, Ando & Sakamoto, 2002) have been reported.

2.1.1 Higher English Test Scores

Brescia, Kissinger and Lee[3] (2009) find that students who used a computer for one hour per day showed more positive school behaviours and higher reading test scores than those who did not. The research by Suhr, Hernandez, Grimes, Warschauer[22] (2010) shows that 4th grade students in one-to-one computer classrooms outperformed students in the traditional classrooms in English Language Arts tests. Dumanig, David and Jubilado[6] (2011) also found that computer-mediated reading, when used adequately, creates a significant impact on students' reading comprehension skills.

2.1.2 Facilitation of Higher-Order Type of Learning

According to Mouri, Sakamoto, Hatano, and Sakamoto[15] (2002)'s research, schools which actively work on Internet Education produce students who can read critically. Lim and Tay[13] (2003) propose that ICT could be used to facilitate the learning of higher-order thinking via a constructivist's paradigm. Kim and Jung[10] (2010) report that digital textbooks have a positive effect on students' metacognition, self-regulated learning, self-efficacy, problem-solving, motivation, and self-reflection.

2.2 Issues and Considerations with the use of ICT in Educational Settings

Some of the authors who have reported the positive impacts have also raised concerns[11][12][15][22] (Krish, 2008; Lai & Pratt, 2004; Mouri, Sakamoto, Hatano & Sakamoto, 2002; Suhr, Hernandez, Grimes & Warschauer, 2010) such as insignificant impacts on student's English test scores[27][26] (Tilfarlioğlu, 2011; Tse, Yuen, Loh, Lam, Ng, 2010) and ICT as a distractor besides adding to the complexity to students' learning[2][11][22] (Blumenfeld, Kempler & Krajcik, 2006; Krish, 2008; Lai and Pratt, 2004; Suhr, Hernandez, Grimes and Warschauer, 2010).

2.2.1 Insignificant Impacts on Students' Performance

Tilfarlioğlu[27] (2011) concludes that while Web2.0, a language teaching tool, provide an opportunity for English Language learning, few students see its educational purposes. Tse, Yuen, Loh, Lam, Ng[26] (2010) also find that blogs do not have much influence on students' academic performances in English reading-comprehension in Hong Kong. There was also little evidence to prove that regularly consulting the Internet was associated with high grades on English reading tests. Blumenfeld, Kempler and Krajcik[2] (2006) caution that the use of ICT, even based on learning theories, may not bring out the intended effects as cognitive engagement requires more than the use of ICT alone.

2.2.2   ICT Complicates the Teaching and Learning Process

2.2.2.1   Additional Efforts and Support Required

Krish[11] (2008) discusses that the complexity of the classrooms and teachers' roles have also been increased. Instructors are required to be well-versed not only in the language, but also in technological tools. More effort and time is needed to prepare for lessons. Zare-ee and Shekarey [29](2010) collate a list of problems such as lack of infrastructures[14][17][18] (Mehlinger & Powers, 2002; Pelgrum, 2001; Rossberg & Bitter, 1988), lack of adequate training for teachers and staff[8][20][23][28] (Jacobson & Weller, 1988; Schrum, 1999; Strudler & Wetzel, 1999; Willis, Thompson & Sadera, 1999), weak technical support[19] (Schrum, 1995), lack of time, software, knowledge of available information technology resources, and unavailability of computer resources. Design elements used in ICT can also be a distraction from actual learning targets.

2.2.2.2   Computer and the Internet as a Distractor

Suhr, Hernandez, Grimes and Warschauer[22], (2010) find that students use their laptops at home in a variety of homework- related and entertainment activities. Writing papers was the most common, followed by browsing the Internet, managing photos, and playing games. There were only two homework-related items with entertainment activities dominating student's time. Another issue is that in the first year of implementation, much time was spent teaching students basic computer skills and less on content learning. Lai and Pratt[12] (2004) also present comments from the teachers that there is misplaced focus on the quantity of students' research instead of the quality. With the wealth of information available on the web, many students also have poor researching skills and critical reading ability. Plagiarism is also a serious problem. The positive effects of ICT were mostly superficial and changed neither the philosophy nor the teaching pedagogy of teachers to a large extent. Takahira, Ando and Sakamoto[24] (2007) have shown that increased usage of the Internet has resulted in a decline in their capability to produce information.

2.3 The Positive Impacts and Concerns Raised – ICT in Education

The above literature review seems to suggest that ICT in educational settings could bring about higher level engagement and motivation among learners, improve English test scores and also facilitate the learning of higher-order type of thinking skills or be a device that distracts the students from their academic or learning tasks.

3. Research Design and Methods

A case study approach is used in this research study to look into the impacts and considerations of the ubiquitous use of ICT in the teaching and learning of English in a primary school context, focusing on the pioneer batch of Primary 4 students who has been with the school since its inception from January 2008.

The following data were being collected for analysis and triangulation – (1) interview with the five English teachers; (2) the students' frequency of in class ICT use survey; (3) feedback from the 167 Primary 4 students; (4) document review of scheme of work, (5) the students' English test scores; and (6) the students' self-reported questionnaire survey.

4. Key Findings

4.1 Interview with teachers

A total of 5 teachers taught the seven Primary 4 English classes. All the teachers were interviewed individually so that the responses from the teachers could be independent. These sessions took the form of informal interviews; based on how they had integrated ICT into their lessons. All the interview sessions were tape-recorded and transcribed for analysis.

4.1.2 ICT and the teaching of English

The English quiz module in the learning management system is the most frequently used tool. The self-marking task and item analysis available in the quiz module was time-saving and simple. Students were given comments immediately and were more driven to reflect and get the right answer. Teachers also set up blog sites for the sharing of online teaching materials and for students to upload their compositions so their classmates and teachers could exchange pointers to further improve the flow and idea of their writings.

On top of that, the English department also subscribed to an online reading comprehension portal where students could learn by accessing the online digital stories available at their own speed. The English teachers piqued their students' interest through the writing of digital stories, a main instructional methodology for the picking up of languages and media literacy techniques. The students first employed a suitable software programme to formulate a digital story. Teachers provided feedback and the finished stories were circulated on the school network and internet through blog sites, so everyone could look at it and offer their opinions or encouragement. The students were engrossed and enjoyed the process of turning their ideas into words that were accompanied by vibrant pictures and music. ICT expedited the presentation of their stories.

4.1.2 Teachers' Reflections and Thoughts about Students' Learning

Teachers who were interviewed unanimously reflected that the use of ICT in their English classes were engaging and motivating in learning and academic tasks. They also felt that it could facilitate the learning of the higher-order type of thinking skills. However, they also raised concerns, just like the literature reviewed, that ICT seemed to engage and motivate their students but the teachers were not certain that this would lead to better performance in students' English test scores. Teachers also shared that the use of ICT required more effort to prepare lessons, technical support and resources (i.e., technological infrastructures).

4.3 Feedback from students

In general, the students found the notebook computers interesting, useful and easy to use. However, the students also complained about the computer viruses, battery lifespan, and computer weight, slow internet connect speed and internet connect errors.

The Primary 4 students were asked to respond on how they felt about their use of their personal notebook computers. 167 out of the 225 students responded in a positive and encouraging manner. The positive comments were 3.8 times more than the negative, with mainly technical related complains.

4.5 Students' English Test Scores

All the Primary 4 students (aged 10) took a 38-item (48 marks) English test with a comparative control school. The test scores were converted to 100%. The paper was in the form of multiple-choice questions, fill-in-the-blanks and open-ended responses. The students were tested on their vocabulary, grammar, cloze, editing and comprehension. A total of 440 Primary 4 students took the English test with 216 from the school and 224 from the control. The mean scores were 73.87 and 67.38 between the school and comparative control school, respectively. The mean difference between the schools was significant at $t(434) = 4.414$, $p < 0.001$. The effect size between the two means according to Cohen's d was 0.4057 (small-medium effect size). A non-linear regression analysis on the frequency of ICT usage during English lessons and the students' English results during their first semester assessment shows that the frequency of ICT usage during English lessons had an impact on the students' English test scores.

4.6 Students' self-reported questionnaire survey on critical problem-solving and reflective thinking (higher-order type of thinking skills)

A total of 890 students (Primary 4 students) participated in a self-reported questionnaire survey (i.e. 434 from the school and 456 students from the control school) on their critical problem solving and reflective thinking. The self-reported questionnaire survey items were presented using a 7-point Likert response scale with 1 = strongly disagree and 7 = strongly agree. On average, the questionnaire did not take more than 5 – 10 minutes to complete. The questions were derived through literature search, discussion among the authors and validation with experienced teachers.

4.6.1 Principal components analysis

An exploratory factor analysis was conducted using the principal components analysis. In particular, the varimax rotation was employed onto the 15 items. In accordance to recommendations from Kaiser[9] (1960), components with eigenvalues greater than 1.0 were adopted. Two components with eigenvalues more than 1.0 were yielded and it composed of 50.65% of the total variable explained. Most of the factor loadings were above 0.5 which bears practical significance and was therefore retained for further analysis[7] (Hair, black, Babin and Anderson, 2010). Furthermore, similar test with oblique rotation (Promax: Kappa = 4) showed consistent results of two constructs. To validate the items within each of the two constructs, a reliability analysis, in the form of Cronbach's[5] alpha was used. In accordance to recommendations by Cronbach[5], scores of the two constructs were 0.771 and 0.898 and these were considered acceptable and good. With the above analysis, we therefore derived two constructs, namely, problem-solving and reflective thinking. Based on initial literature review, these are in turn related to higher-order thinking skills.

4.6.2 Confirmatory factor analysis

Confirmatory analysis was used to examine the factorial structure of the 15 item scale and AMOS 17.0 was used for this analysis. A proposed model was built and model fit was assessed by a number of indices. The Mardia's coefficient (1970), which is a standard measure of multivariate normality, was first consulted. The coefficient, 109.087, was lower than the recommended threshold of 225 (15X17) and based on the recommended value of $p^*(p+2)$, the requirement is satisfied hence the data for this study was deemed to be adequate for confirmatory factor analysis.

Next, we turn our attention to the model fit indices. As chi-square has been found to be too sensitive to sample size, the ratio of chi-square to its degree of freedom was used (CMIN/DF) and scores of 3.0 or below (CMIN/DF = 1.925) are deemed to be an acceptable fit between the hypothesized model and sample data [4](Carmines and McIver, 1981).

4.6.3   Model Comparison

In accordance to suggestions by Noar[16] (2003) and Timothy et al. [25] (2010), fit indices of alternative models allow for comparison of proposed instruments. Based on the R^2 values of the items, the item with the lowest R^2 (item 1, $R^2 = 0.210$) was removed from the proposed model and a 14-variable model was re-run. The Tuker-Lewis Index and the Comparative Fit Index both fell below 0.95 (TLI = 0.916 < 0.95, CFI = 0.928 < 0.95), indicating a less than acceptable fit. On this basis, we concluded that model 1 with 15-items and two constructs was retained as the model of better fit

4.6.4   Means Testing (T-Test) on each of the two constructs

We further want to investigate if there were any difference between the 2 schools in terms of the creative problem solving and critical reflective thinking constructs. We derived mean scores for each of the constructs and compared the scores between the schools with results as follows, using the *t*-test procedure

4.6.5   Problem-solving and reflective thinking

Based on the Levene's test of equality of variances, we proceed to look at the results to the variance assumed *t*-test, with results $t = 1.089$, $p = 0.277 > 0.05$. We therefore conclude that there we no statistical difference between the 2 schools in terms of the mean problem-solving scores. For reflective thinking, based on the Levene's test of equality of variances, we proceed to look at the results to the variance not assumed *t*-test, with results $t = -3.923$, $p = 0.000 < 0.05$. We therefore conclude that there we is a statistical difference between the 2 schools in terms of the mean reflective thinking scores with mean scores of the control school higher at 6.41 against the school in this study at 5.9474.

5. Discussion and conclusion

The above findings seem to suggest that students' level of engagement and motivation was high when ICT was used in their English lessons. In addition, the students' English test scores were, on average, significantly higher than the control school. The students also performed well in the ICT skills tests as compared to the national cohort. On an average, students' frequency of ICT usage during English lessons was recorded as 5.16. Computer use was frequent during English lesson and in general, students enjoy using ICT for learning.

The interview with the teachers and review of documents reflect sentiments similar to the literature reviewed, that more effort and extensive technological infrastructures were required. At times, ICT was a device of distraction. No difference was observed on students' creativity in problem-solving between the experimental and control schools. However, students' from the control school reported a significantly higher mean score for critical reflective thinking as compared to the experimental school. Although the students' English test score were higher than those of the control, the regression analysis indicated that the r^2, which is the variance explained, only accounted for 3.1 percent. In other words, the use of ICT only accounted for 3.1 percent of students' English performance.

All in all, it seems that ICT does have an impact on the learning of English in the primary or elementary level, especially in areas of engagement, motivation and test scores. Students generally favour the use of ICT for their learning of English. However, it is important to consider the extra effort, manpower and technological infrastructure overheads when embarking on such an endeavour. It is also worth the effort to further explore how to reduce students' off task activities with their computers. The relationship between ICT use and the facilitation of the acquisition of higher-order type of thinking skills also deserve more in-depth study and exploration; in terms of how could this aspect be more accurately measured.

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