IMPLEMENTATION OF ICT IN PRIMARY SCHOOLS IN HONG KONG : CONSISTENCY AND DISCREPANCY OF ATTITUDES BETWEEN SCHOOL HEADS AND TEACHERS

Kit-pui Wong
Lingnan University, Hong Kong SAR, China
kp24wong@ln.edu.hk

ABSTRACT

This paper will begin by discussing some of the important theories relating to the use of Information and Communications Technology (ICT) in learning. It then explores problems affecting the implementation of educational technology in Hong Kong's primary schools, including issues of cost effectiveness. A survey was administered to school heads and teachers, resulting in 574 questionnaires being completed and analysed. The survey found that teachers have a remarkably less optimistic view than heads on several aspects in ICT use. Such a perception gap between them, if any, can lead to serious problems. Policymakers should be aware of this, and carefully re-examine if there have been any problems with the implementation. Although the study was conducted in Hong Kong, its rationale and method are likely to be applicable to other parts of the world.

Keywords: Educational Technology, Heads, Hong Kong, ICT, Primary Education, Teachers

INTRODUCTION

The use of Information and Communications Technology (ICT) in education, has been a controversial research topic ever since the technology saw wide adoption in the 1990s. Since computers are "probably the most versatile form" of educational technology (Starker, 1989, p.2), the terms "computers", "educational technology" and "ICT", will be used interchangeably throughout this paper.

The contributions of computers in education have long been the subject of dispute. Some scholars are strong advocates for the educational use of ICT, including Luckin (2001) and Ager (2000). They claim that ICT may create, or at least enhance, a collaborative learning environment and bridge the gap between a child's actual and potential developmental levels, but this view is by no means universally held by researchers.

To examine user perspectives of how well educational technology has been implemented in Hong Kong, primary data was collected from school heads and teachers. The head of a school is also known as principal, headteacher or headmaster/headmistress in different educational systems. For simplicity, this role will be called "head" or "principal" throughout this paper.

THEORETICAL BACKGROUND

In discussing the relationship between educational technology and learning, the Zone of Proximal Development (ZPD) and other theories by Vygotsky (1978; 1986) have been sometimes treated as holy writ. Luckin (2001), for example, considered ZPD "the foundation of an [educational] software design framework" and "a useful theoretical construct for educational design" (Luckin, 2001, p.57). There have been many discussions on Vygotsky's ZPD theory and its application to educational technology – for example, Ager (2000, p.11-13); Chang (2001); and Downes, Arthur & Beecher (2001).

In Vygotsky's theory, each individual child has an actual developmental level which the child can achieve without any help from external parties. A child has also a potential developmental level. To achieve that level, a child must get help from external parties, such as parents, teachers or even capable peers. The Zone of Proximal Development is defined as the "distance", or "gap", between the actual developmental level and the potential developmental level of a particular child. (Vygotsky, 1978, p.86; David, 1999, p.4; Nutbrown, 2001, p.136).

Traditionally, parents, teachers, and peers have been regarded as the key persons to help bridging the gap between the actual and potential development levels of children. Many recent studies have examined the development of children's potential levels with ICT seen as an alternative or supplement to the work of parents or teachers. For instance, Luckin (2001, p.66) explored "the nature of effective collaborative assistance" through a few variations of Ecolab software in the learning of ecology.

Along with being an individual experience, learning is also seen by many as a social activity (Ager, 2000). Ager further suggested that children collaboratively working in front of a computer could create an environment in which everyone in the group could progress, as a result of the scaffolding effect. When educational technology begins to supplement the role of teachers, the traditional teacher-pupil relationship changes. Instances of "peer-to-peer tutoring" become prominent and, in particular cases, "pupils instructing teacher" is also observed. (Lawson and Comber, 2000, p.426-427). Ideally, this kind of scaffolding effect enhances the pupil-to-pupil and pupil-to-teacher interactivity inside the classroom. Interactivity is

recognized as one out of "five characteristics of the most successful teaching" (Hargreaves, Moyles, Merry, Paterson, Pell & Esarte-Sarries, 2003, p.218). It is also noted that interactive teaching happens when "pupils' contributions are encouraged, expected and extended" (p.218). ICT is frequently perceived as providing such a favourable environment.

Although all of the theories discussed have their value, implementing them in the classroom is not always a straightforward task. For instance, in Bornas and Llabrés' (2001) study of sixty low-achieving third-grade children, computer software was classified into three scaffolding levels, namely the (a) minimal level, (b) cognitive level, and (c) meta-cognitive level. Bornas and Llabrés concluded that computer software must reach the meta-cognitive level in order to successfully fulfil the role of teacher in the ZPD model. Unfortunately, they realized that this type of software had not yet been developed and it was difficult to predict when it would become available.

In addition, Ferneding (2003), and Armstrong & Casement (2000), among many others, have expressed considerable dubiety regarding the benefits of ICT in education. They have argued that many researchers might have overlooked undesirable side effects of ICT. Moreover, Oppenheimer (2003) characterised the campaign to put computers in schools as "a crisis in the Chinese sense of the word, defined by two characters – one standing for danger, the other for opportunity" (p.412).

PRACTICAL USE AND INPUT RESOURCE

Educational technology has been taught as a subject, often called Computer Studies or Computer Applications to students in Hong Kong's secondary schools since the 1980s. This instruction mainly focused on "why" and "how" computers and other elements in technology worked. At that time, students were involved mainly in the learning of the technology as a subject, as shown in the right oval in Figure 1.

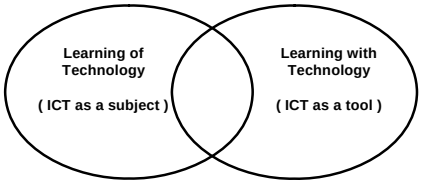

Figure 1: Two main domains of ICT activities in schools

Subsequent to the political change in 1997, the new Hong Kong SAR government initiated a number of major reforms to the existing education system (Tung, 1997). One of these involved expanding the educational use of ICT. Since then, ICT began to spread into Hong Kong primary schools. Technology itself became an instrument for learning, in addition to a subject. With this objective, primary teachers and children were encouraged to make use of ICT in learning a variety of subjects, i.e. learning with technology.

The government painted a beautiful picture of the potential benefits deliverable to education through the use of ICT (EMB, 1998). Huge financial resources were promised to propel a number of ICT initiatives, involving HK $2,880M for capital costs (US$1 = HK$7.8) and HK $260M for annual recurring costs (EMB, 1998). These expenditures include the acquisition of 65,000 computers for primary and secondary schools and the establishment of over 45,000 training facilities for teachers. Another HK $334M of capital costs and annual recurring costs of $294.5M were projected (EMB, 1998) for further initiatives, such as introducing ICT coordinators and enhancing technical support (EMB, 1998) to more public-financed primary and secondary schools – and, eventually, to all of them.

In earlier years, computers were commonly regarded as a cost-effective, or even a "cheap" tool in education (Straker, 1989, p.3). Nevertheless, when one considers the amount of money invested in ICT in Hong Kong, for example, they will probably reject the notion that ICT is "cheap". It is likely that only hardware costs were considered in Straker's assumptions. A few other factors appear to be more predominant recently. First, the life cycle of a piece of hardware may be as short as three to five years, and money must always be budgeted for replacements. Second, the drop of individual hardware costs may be offset by more and more demanding hardware requirements for new educational software. Third, the costs of maintenance and technical support are also major components in the entire cost model of ICT expenses, but there has been no observable trend of costs dropping. In other words, the overall capital and operating costs of ICT may not be significantly reduced even if the price of hardware itself is dropping. All in all, the claim of cost-saving due to technology advancement may be dubious.

Many benefits of computers are often assumed, instead of being supported by concrete evidence. It has been commonly "taken for granted that the use of technology in education is a 'good thing'" (Selwyn 2002, p.3, quotes in original). Oppenheimer (2003) strongly criticises the attraction of educational technology as being based on "seductive," but false, claims (p.401-402). Alessi & Trollip (2001) also argued that computers generate only a "small" educational effect (p.5).

Obviously, a gap exists between the high expectation and the "small" effect. Systematic research is therefore needed to draw the real picture and help policymakers and educators utilize educational funding in a more effective way.

RESEARCH METHOD

As already noted, the Hong Kong SAR government has spent, or has promised to spend, a huge amount of money for ICT in education. It is therefore important to study whether, or if, the expenditures in ICT have improved the quality of teaching and learning. The current study is aimed at starting a long-standing investigation, initially from the perspectives of teachers and principals, who are supposed to play the most critical roles in schools.

As in many social or educational research studies, the current research will make use of a quantitative survey. The selected instrument in this survey is a kind of cross-sectional "self-completion" or "self-administered" questionnaire (Cohen & Manion, 1994, p.92-94; or Gorard, 2001, p.83). Including the demographic section, there were totally 39 close-ended questions and one open-ended question in the questionnaire. Nonetheless, only the 19 directly relevant to this paper are shown below in Table 1 and thereafter covered in the analysis in this paper. In each of the questions, respondents are requested to give rating from (1) "absolutely disagree" to (6) "absolutely agree".

Table 1: Questions Q1-Q19 in the questionnaire

No.	*Description*
Q1	Your school provides convenient access to computers and the Internet for pupils
Q2	Your school provides convenient access to computers and the Internet for teachers
Q3	Teachers have easy access to good teaching software
Q4	Good training in ICT is easily available for teachers
Q5	Technical support, such as a hotline and reference material, etc., is easily available for teachers
Q6	There is sufficient space in your school for setting up computer facilities
Q7	You are knowledgeable and skilful enough to implement ICT in school
Q8	The implementation of ICT in school is a heavy burden for you
Q9	You enjoy the process of ICT implementation in school
Q10	You are very eager to implement ICT for teaching
Q11	It is a simple and easy task for you to help implement ICT in your school
Q12	Implementing ICT in school retards your daily teaching and administrative duties
Q13	Your colleagues are very eager to implement ICT in school
Q14	The head in your school is very eager to implement ICT
Q15	ICT plays an essential role in modern teaching and learning
Q16	For the time being, there is still strong resistance against the implementation of ICT in your school
Q17	In the past 3 years, your school has obtained plenty of financial and other resources from the government for the implementation of ICT
Q18	In the past 3 years, input of resources from the government has significantly contributed to the use of ICT in your school
Q19	Generally speaking, the input of resources in ICT has not improved the quality of teaching and learning

SAMPLING AND LIMITATIONS

As pointed out by Kemper, Stringfield & Teddlie (2003, p.277), "purely quantitative studies typically use larger samples selected through probability techniques." Probability sampling can produce results characterised by their generalisability or external validity (Kemper et al, 2003). However, on many occasions, perfect probability sampling is unavailable or infeasible. So-called "second best" techniques may have to be adopted as alternatives.

In "official" surveys, like the census, selected households are legally obliged to participate (Clark-Carter, 2004, p.77). In contrast, individual researchers, such as the author, are not usually supported by any legal obligation on the part of their subjects. Their studies are particularly "dependent on the goodwill and availability of subjects [i.e. participants]" (Bell, 1999, p.126). Such researchers will probably encounter difficulties when they try to achieve "a true random [i.e. probability] sample" (p.126). In such cases, Bell (1999) agrees that opportunity samples "are generally acceptable as long as the make-up of the sample is clearly stated and the limitations of such data are realized" (p.126).

It is the author's view that sampling should not be treated in a dichotomous way, that is, simply as either probability or opportunity. There is, in fact, a continuum between complete probability and complete opportunity sampling. The author has chosen a more ideal probability sampling in the principal subgroup because a complete list of all schools in the region and their principals is available online to the public. However, since a complete list of all teachers is not available to the author, a "less ideal" probability sampling is employed for this subgroup. Table 2 below shows the sampling strategies for these two subgroups of participants.

Table 2: Sampling strategies for principals and teachers

	Principals	*Teachers*
Population	Principals serving primary schools in Hong Kong	Teachers serving primary schools in Hong Kong
Sampling Frame	List of primary schools available online	Online available advertisements, memos and notices of public seminars, forums and conferences open for teachers
Samples	Systematic	Cluster, followed by Random
Assumption	The list of school is a complete one	The distribution of participants of these seminars closely approximated that of all in-service teachers

Finally, a total of 574 sets of questionnaire were collected. The overall response rate was 62%, which is generally considered to be a "good" level (Babbie, 2001, p.256).

DATA ANALYSIS

The collected data was then entered into a statistical software package. The mean ratings of the 19 questions were plotted and are shown in Figure 2.

As can be seen in the graph, principals showed a tendency toward higher ratings than teachers in most items, with the exceptions of "reversed wording" questions (to be discussed later). For instance, in Q1, teachers' mean response was approximately 4.0, while principals' mean response was approximately 4.4. In this and many other questions, it was shown that principals generally held more optimistic attitudes toward the use of ICT, while teachers generally gave less optimistic opinions. These apparent differences will be explored in Table 3 and Table 4.

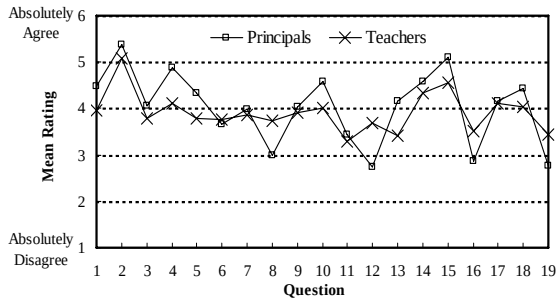

Figure 2: Questions 1 to 19 rated by principals and teachers

This general attitude was further confirmed in the results of Q8, Q12, Q16 and Q19, which were intentionally written in reversed wording in order to minimize any potential occurrence of a "response set" (Hui & Triandis, 1985). As a result, teachers agreed to those questions more strongly than principals did. This outcome also proved that a "response set" did not likely occur in this survey.

By definitions, teachers and principals in this study belonged to non-overlapping, or mutually exclusive, subgroups in the survey. Student T-test for independent samples was employed to compare the mean differences between these two subgroups. In the null hypothesis, $H_{0,}$ principals and teachers were assumed to generate the same mean rating for a particular question. A summary is shown in Table 3.

Table 3: Differences in mean rating by principals and teachers

Case	*Question*	*Mean difference*	*Implication*
1	Q6, Q7, Q9, Q11, Q14, Q17,	H_0 holds, i.e. there is no significant difference in mean rating at .05 level	Principals and Teachers had similar opinion in these questions
2.	Q1, Q2, Q3,Q4, Q5, Q10, Q13, Q15 and Q18	The mean differences are positive and significant at the .01 or .05 level	Principals had more positive opinion in these questions
3	Q8, Q12,Q16 and Q19	The mean differences are negative and significant at the .01 or .05 level	Principals had more negative opinion in these questions

To further identify the question(s) in which principals and teachers displayed the greatest discrepancy, the top 5 questions with the greatest mean differences were examined and extracted. They are Q12, Q4, Q13, Q8, and Q19 as listed in Table 4 in

descending order. In theory, a higher magnitude in the mean difference indicates a greater discrepancy between the subgroups.

Table 4: Top 5 mean differences in ratings

Item	*Description*	*Mean Diff*	*Sig*
Q12	Implementing ICT in school retards your daily teaching and administrative duties	- .930	0.00
Q4	Good training in ICT is easily available for teachers	+ .760	0.00
Q13	Your colleagues are very eager to implement ICT in school	+ .746	0.00
Q8	The implementation of ICT in school is a heavy burden for you	- .736	0.00
Q19	Generally speaking, the input of resources in ICT has not improved the quality of teaching and learning	- .686	0.00

For example, the topmost issue, Q12, indicates that principals perceive less hindrance in ICT implementation than teachers do. The other four issues are closely related to the difficulties in the implementation of ICT in schools. The significant differences between the attitudes expressed by principals and teachers suggest that the principals do not perceive these problems being as serious as the teachers do. If the teachers have not overstated the problems in the implementation of ICT, it may imply that principals have underestimated the difficulties. Principals are supposed to bridge the communication gap between teachers and policymakers in the bureaucratic hierarchy. In reality, however, if the principals perceive certain matters differently from teachers, the voice of teachers may not be efficiently communicated to the top of the hierarchy.

It is especially interesting to study Q17, Q18 and Q19, since these questions directly address how the respondents perceive the resource inputs and outcomes of ICT in teaching and learning. Table 5 shows and compares the mean responses and differences of the two subgroups, principals and teachers, obtained from Q17, Q18, and Q19.

Table 5 shows that principals and teachers have very close ratings in Q17, but teachers are significantly less positive in Q18 and more positive in Q19 (which is in reverse wording).

Table 5: Mean ratings with T-test mean comparisons

	Q17	*Q18*	*Q19*
Mean (Principals)	4.17	4.44	2.76
Mean (Teachers)	4.11	4.04	3.45
Mean Difference	0.052	0.403	-0.686
Sig. (2-tailed)	0.742	0.009 *	0.000 *

* Mean differences are significant in Q18 and Q19

This implies that principals perceive more positively the contribution of educational funds spent on ICT (implied from Q18) and the contribution of ICT in teaching and learning (implied from Q19). In contrast, teachers are less positive regarding these two issues. These responses also strongly suggest that principals are more optimistic regarding the effects of ICT in teaching and learning.

CONCLUSION AND DISCUSSION

There are many theories and arguments in support of educational technology in various areas of learning. Different people, including many researchers and governmental officials, seemed to have great expectations for ICT in relation to the enhancement of teaching and learning. In Hong Kong, for instance, ICT initiatives have been intensively enforced and munificently funded. However, there are also certain arguments being voiced against the “blind” implementation of technology. There seems to be a missing link between theory and the practical implementation.

The current study was proposed within this context, to investigate how ICT had been implemented in Hong Kong primary schools, initially from the perspectives of principals and teachers. In the preliminary findings, principals and teachers showed remarkable differences in a number of issues. In short, principals generally showed a more positive view on the implementation and benefits of ICT in education. A perception gap between principals and teachers, if any, can lead to serious problems. Principals may think that everything is working fine, when in fact it is not. In turn, the principals will

report to the upper level in the bureaucratic structure what they believe to be true. Thus, teachers may encounter difficulties with ICT, but have no way to communicate to the policymakers. Nobody actually listens to the difficulties faced by teachers. Consequently, their views are not considered, and no improvements will be ever made.

Ideally, effective communication channels should be established between school heads and teachers, and between policymakers and teachers. Unless the problems encountered by teachers can be communicated to the policymakers, educational improvement will be difficult to achieve. In fact, the existence of a gap between the policy and implementation levels may also apply to other educational policies, aside from ICT applications. If the policymakers tend to listen to only one side of the story, a pleasing but distorted picture may be obtained.

Least but not last, it should be noted that an effective implementation of ICT is not as straightforward as just spending money to deploy computers in schools. As Loveless (1995) also emphasizes, children do not automatically gain benefits in learning just by placing a computer in front of them. In order to maximize the potential benefits and minimise the potential dangers of ICT, "high quality and creative instructional design coupled with careful evaluation and revision" are necessary (Alessi & Trollip, 2001, p.6). This study is intended to initiate, rather than conclude, rigorous research or evaluation in this area.

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