Enhancing Teachers' Incorporation of ICT in Classroom Teaching

Kin Ping LEUNG

Faculty of Education

University of Hong Kong

Hong Kong

Kpleung1@hkucc.hku.hk

James J. WATTERS

School of Mathematics, Science and Technology Education,

Faculty of Education

Queensland University of Technology

Australia

j.watters@qut.edu.au

Ian S. GINNS

School of Mathematics, Science and Technology Education,

Faculty of Education

Queensland University of Technology

Australia

i.ginns@qut.edu.au

Abstract: It is recognised worldwide that there is a slow uptake by teachers of Information Communication Technologies in school classrooms. This study focused on determining the effectiveness of a school-based, on-site, and ongoing professional development program conducted in a primary school in Hong Kong. There were training sessions conducted by fellow teachers, and participatory action research groups to share resources and experience in incorporating ICT in teaching. Teachers' incorporation of computers in teaching was significantly increased in the first year of intervention but showed fluctuation in the second year. A number of explanations were offered by teachers in their interviews for these changes. The paper concludes with an examination of the implications of the study for teaching in primary schools.

Introduction

Many academics of developed countries believe that Information and Communication Technology (ICT) education is necessary for preparing our citizens for the work force of the future (Ertmer, Addison, Lane, Ross & Woods, 1999) and facilitating students to learn and teachers to teach effectively (Cuban, 2001), hence many countries like Australia, Canada, Japan, UK, and USA have implemented different initiatives for promoting ICT in education. Hong Kong is no exception. The Chief Executive of Hong Kong, Mr. Tung Chee Wah (1997) launched the Five-Year Strategy of Information Technology for Learning in a New Era (EMB, 1998). HK$3,770 million was provided to schools as capital and recurrent grants to set up computers, network and other infrastructure, and teacher's professional development. Large scale teacher training programs were implemented and supported. The principal of the primary school in the study described in this paper was a visionary person who wanted to lead her teachers and students into a new era of teaching and learning. The teachers of the school were also eager to find out various ways to master the techniques and skills in using ICT in teaching in order to enhance their teaching. The researcher (KPL) has been working to promote computer and ICT education for over two decades. He was very eager to help teachers of the school develop an effective professional development program so that teachers could learn to use ICT effectively in their teaching so as to facilitate their students' effective learning. The research question was: What were the effects of a professional development initiative on teachers' integration of ICT in teaching? To investigate the effects of the professional development initiative, the following indicators were used: i) What were the changes in teachers' perceptions of their ICT skills as a result of the intervention? ii) What were the changes in their self-efficacy as a result of the intervention? iii) What were the changes in teachers' incorporation of ICT in teaching?

Literature Review

A purpose of the intervention was to motivate teachers to enhance their knowledge and skills, and hence to change their beliefs which would, in turn, change their practice. By comparing the reinforcement theory, expectancy-value model and social learning theory, it was found that self-efficacy embodied in Bandura's (1977) social learning theory is effective and widely used as an indicator of motivation in studies of various areas such as health functioning, anxiety and phobic disorders and teaching and learning which included chemistry, computers, mathematics, peer assisted learning, science, and writing. Performance accomplishment, vicarious experience, verbal persuasion and emotional arousal are the four sources upon which efficacy expectations are based (Bandura, 1977). Since using computers and ICT in teaching is an innovation, Rogers' (1995) diffusion theory was also applicable. Both theories underpin the framework of the study.

Sparks and Loucks-Horsley (1990) found that training is a cost-effective means for teachers of the whole school to acquire knowledge and skills, so there was a training component in the program. It is found that school-based training is the most preferable one because participants take part in determining objectives and have opportunities to get involved in planning the content from the beginning (Levine, 1985) so that the content is planned in response to assessed needs, and activities are built upon the current understandings of teachers, and moving from the known to the unknown (Fullan, 1982). When the training is on-site, i.e., in the school computer room, multimedia language centre and classrooms, on-site resources can be fully utilised (McDougall & Bretts, 1997) and "the site is physically and psychologically comfortable for participants" (Dunlop, 1990, p. 11). An on-the-job training program (Fullan, 1982; McDougall & Bretts, 1997) aims at providing ICT knowledge relevant to a teacher's location (Dunlop, 1990). Participants are able to locate a particular activity in a larger

context that is directly related to their experiences (Hinson, Caldwell & Landrum, 1989). Thus, whatever is learned by teachers can be applied immediately in their own classrooms. Teachers can increase their repertoire of teaching techniques and self-efficacy after trying successfully new practices learned from the training sessions (Bandura, 1977; Sparks & Loucks-Horsley, 1990). As one-shot seminar type professional development activities are not effective and should be avoided (Hinson et al., 1989), the literature suggested ongoing staff development with concrete, teacher-specific and extended training (Bennett, 1995; Joyce & Showers, 1982; McDougall & Bretts, 1997), with spaces weeks apart for opportunities for classroom practice would be more effective. An emphasis was placed on hands-on activities so that teachers could have maximum opportunity for involvement, performance accomplishment, vicarious experience, and self help (Bandura, 1977; Bennett, 1995; McDougall & Bretts, 1997; Levine, 1985). The goals of the professional development activities were consistent with those in the daily work setting (Fullan, 1982).

Peer coaching has been found to be more effective (Sparks, 1983) and was an important component of this intervention. Teachers prefer their peers as trainers and feel more comfortable exchanging ideas, they play a more active role in workshops, and psychological safety is a key to effective staff development (Bennett, 1995), so fellow teachers (peers) serve as coaches to one another (Joyce & Showers, 1982) and activities are conducted in a climate of trust, peer support and open communication, because peer tutors are change agents who are compatible with client needs (Rogers, 1995) and able to put themselves into the roles of the participants (empathy) (Rogers, 1995). Since the tutors work in the same environment and similarly (homophily), are closest to the context; often understand it best, can put themselves into the situations of the participants (empathy), have better ICT knowledge and skills (heterophily) (Rogers, 1995) and a strong interest in the problems and issues addressed, and personally committed to finding workable solutions, the strategies they developed are more likely to succeed (Guskey, 2000). Participants not only increase their specific knowledge and skills, they also enhance their ability to work collaboratively and share in decision making (Guskey, 2000). The tutors (peers), by participation in the process of development of teacher training sessions and improvement of teachers teaching (Guskey, 2000; Sparks & Loucks-Horsley, 1990), will become more appreciative of individual differences, more aware of the perspectives of others, acquire skills in group dynamics, and their 'internal expertise' (Hobbs, 1989) is capitalised upon. An observer gains professional expertise by watching a colleague, preparing the feedback, and discussing the common experience (Bandura, 1977), while the teacher being observed benefits from another's point of view, gains new insight, and receives helpful feedback (Guskey, 2000). Participatory Action Research (PAR) is the application of fact-finding (Burns, 1998), using rigorous, systematic inquiry through scientific procedures, to practical problem-solving (Burns, 1998) and investigation of human actions in a social situation at the classroom or school level (Burns, 1998; Guskey, 2001). Somekh and Davis (1997) found "action research is a practical and effective methodology for promoting effective, long-term use of ICT in education" (p. 125).

Hong Kong is a Confucian-Heritage Culture where modesty is always stressed and observed (Biggs & Watkins, 2001; Huang, 2002; Jan, 1980). With the implantation of British institutions over 150 years under British rule, both cultures have had a strong emphasis on examination results. Both cultures have had a deep influence on the Hong Kong education system shaping it into one that is examination-oriented, norm-referenced, subject-based, highly segregated, schedule-tight and teacher-centred (Biggs & Watkins, 2001; Lo, 2000). There have been many top-down education reforms implemented. Seventy percent of teachers are under enormous pressure due to these rapidly changing education policies (HKPTU, 2001; 2003). They work very long hours and therefore have no time for learning and using ICT in teaching and learning. Schools and teachers are having

infrastructural barriers where there are very limited spaces for accommodating computers and related peripherals in computer rooms, classrooms and staff room (Chung & Ngan, 2002). Ngan and Lee (2002) found in a survey that 36.5% teachers never used a computer in their teaching, 30% used 1 to 5 strategies incorporating ICT in teaching, 7.2% used 6-10 strategies and 8.2% used more than 11 strategies. The survey by the City University (Singtao Education News, 2003) found that the average time teachers incorporating ICT in teaching was less than 5%.

Informed by the literature, a school-based, on-site and ongoing professional development program with fellow teachers as tutors in training sessions and leaders in weekly participatory action research activities was chosen for implementation. This professional development model has all the benefits and effectiveness of enhancing teachers' ability in using ICT in teaching, nurturing a collaborative and collegiate atmosphere where assistance in different forms, from experience sharing, resources sharing, to collaborative and cooperative teaching could be available. Could the most effective professional development model in western classrooms described previously be effectively implemented in Hong Kong?

Methodology

Setting of the Study

In 1999 and early 2000, although schools and teachers felt the need to use ICT in teaching, it was not easy to get the full support of the school authorities, the principal and the teachers to embark on a research study. The principal and teachers of Philanthropy Primary School (pseudonym) were willing to participate. This school constituted the case of the study. It is typical whole-day school with 40 teachers and 28 classes and is located in the residential area of medium-low economical status in the Kowloon peninsula of Hong Kong.

Number of Participants

All teachers in the school over the two-year period actively participated in the study. But since there were teachers who left the school after the first year, and new teachers who joined the school in the second year, some of the responses in the surveys and timetable reports were not useful. In order to yield reliable results, only the data of those 31 teachers who participated throughout the entire project were taken into account.

The Three Components of the Study

This study adopted a case-study research design (Yin, 1994) with three components in data collection and analysis, namely, situational analysis, qualitative case-studies and quantitative surveys. In this paper, only the quantitative results will be presented. The full discussions of situational analysis and case-studies will be presented in other papers, only the results will be used in this paper.

Quantitative surveys

There were two instruments used in this study. The first instrument was a questionnaire called the Chinese Information Technology Integration in Teaching Efficacy Beliefs Instrument (CITITEBI), developed by adopting the Microcomputer Utilisation in Teaching Efficacy Beliefs Instrument (MUTEBI) (Enochs, Riggs & Ellis, 1993). The CITITEBI was validated using a survey of 37 primary schools with 975 returns out of 1249 teachers surveyed in the Shatin District of Hong Kong (Leung & Chui, 2001).

The second instrument was a modified timetable for each teacher in which she/he documented the frequencies of incorporation of various strategies selected from a repertoire of ICT strategies in teaching provided on the side of the timetable. There were also spaces for teachers to record the problems encountered when using ICT in classroom teaching and solutions they used to enhance the situations.

Analysis of data

Descriptive statistics, repeated-measure ANOVA of general linear model, t-test pairwise comparison and effect size calculation were used in the analysis of the survey and timetable data.

The Intervention

The intervention included a school-based, on-site and ongoing ICT training with peer-tutoring, participatory action research activities and classroom observations. The study was conducted in four stages as shown in Figure 1. The duration of each stage varied as required.

Results

The situational analysis revealed that the Hong Kong education system has shaped a didactic, expository, teacher-centred and teacher-directed, approach to schooling. Teachers have to cover the scheduled content in a specified duration of time so that they can prepare students for examinations. The poor infrastructure, lack of space and equipment and resources became major barriers preventing teachers from using ICT in teaching effectively. The size and classroom setting, students' lack of experience with project and independent learning, difficult Chinese text entry, and parents' inability to provide their children with a home computer and the required software, made doing projects very difficult, if not impossible. The many education reforms with the momentum of an avalanche and tsunami right at their heels have created enormous pressure on teachers, forcing them to overwork unrelentingly and leaving them little time for whole-hearted concentration on their study of ICT. However, the stipulations of the Education and Manpower Bureau provided a substantial external incentive for teachers to adopt and engage in the use of ICT in teaching. This factor was particularly significant in an employment situation when there were excess teachers and declining student numbers. This pressure to adopt an innovation is consistent with Rogers' (1995) classification scheme for the adoption of innovation, by authority. Teachers at Philanthropy Primary School, although they faced more barriers than those in schools with better buildings and facilities, were influenced by the government, school and media and became aware of the advantages of incorporating ICT in teaching. With the support from the school authorities, teachers were willing to squeeze their time to learn to incorporate ICT in their teaching.

Stage I	Stage II	Stage III	Stage IV
9/2000	10/2000	10/2000 – 6/2001	9/2001 – 6/2002
Rapport	Prerequisite knowledge	Training & PAR	Autonomous
PAR intro	PPT ICT in teaching	School-based training	Training
		PAR meetings	PAR meetings
		Timetable report	Timetable report
Survey		Survey	Survey
		Interviews	Interviews
		Observation	Observation

Figure 1. Four stages of the research design.

Indicator One on teachers' perceptions of their own ICT knowledge and skills showed that there was a significant increase in the first year, $t(30) = -6.751$, $p < .01$ and effect size = 0.85, and a significant drop in the second year, $t(30) = 3.448$, $p < .01$ with effect size = -0.57. The overall increase in teachers' perceptions of their own ICT skills and knowledge over two years was $t(30) = -2.573$, $p < .05$ with effect size = 0.40. Indicator Two on teachers' self-efficacy in using ICT in teaching showed that teachers displayed a pattern similar to teachers' perceptions of their ICT skills. Their self-efficacy increased significantly after the first year, $t(30) = -6.867$, $p < .01$ with effect size = 1.21, and scored significantly decrease at the end of the second year, $t(30) = 3.443$, $p < .01$. The overall increase was still significant, $t(30) = -3.32$, $p < .01$ with effect size = 0.67. By analysing the data on teachers' perceptions and self-efficacy with age groups, it is found that older teachers with relatively low initial knowledge and skill levels in ICT could maintain or even enhance their perceptions and self-efficacy in the second year, but younger teachers with higher initial knowledge and skill levels showed bigger reductions. Two explanations for the lower perception and self-efficacy scores were offered by younger teachers during the interviews. One was attributed to the Chinese philosophy, deeply influenced by Confucius and Lao-Tzu, that people should be modest and humble (Jan, 1980). The other explanation referred to the different levels of applications of ICT in teaching. Before they used ICT more in their teaching, the younger teachers believed they were quite expert in ICT, especially compared with the older teachers. As the basics of ICT were relatively easy, there were more levels for the older teachers to record an advance in their ICT skills when their initial scores were at a low level. So they reported a higher increase in their perceptions and self-efficacy, as well as frequency of using computers. For the younger teachers, who were at higher initial levels and have learned the basics, it would be more difficult for them to score the same increase as the low initial level learners. After they tried to do more advanced development of teaching materials, they inevitably came across more problems. They no longer claimed expert status but chose one level lower. That explains why the younger teachers did not report increases in their perceptions and self-efficacy as much as the older teachers.

Indicator three on the changes teachers' incorporation of ICT in teaching revealed that there was a significant increase in the number of periods, $t(30) = -5.205$, $p<.01$, and the number of weeks, $t(30) = -6.269$, $p<.01$, in which teachers incorporated ICT in their teaching per teacher per week from the first to the second year, although the increase in the number of strategies incorporating ICT in teaching per teacher per week was not significant. Teachers became more selective in using ICT strategies in their teaching in the second year. The increase of teachers' incorporation of ICT in teaching can also be seen from the significant increase in teachers' frequency of computer use, $t(30) = -2.619$, $p < .05$ and effect size = 0.53 in the first year. Although the increase

in the second year was not statistically significant, $t(30) = -0.421$, $p=.677$ and effect size = 0.07, the overall increase is significant, $t(30) = -3.978$, $p < .01$ and effect size = 0.61. The improvement can also be compared with the results of a contemporary study as shown in Table One. The average percentage of time incorporating IT in teaching by teachers in the current study was found to be 5.28% in 2001-02, while a survey of 152 primary schools conducted by the City University Professional Consultancy Limited (Singtao Education News, 2003) in May 2003 showed that the average time incorporating IT in teaching by teachers of these schools during school year 2002-03 was less than 5%, as mentioned in the Literature Review Section. These results answered the researcher question on the effects of a professional development initiative on teachers' integration of ICT in teaching was that the professional development initiative enhanced teachers' beliefs and practice and enabled them to change their practice by incorporating IT in their teaching quickly and more effectively than other training.

Table 1.

Comparison of IT strategies used in teaching between 1457 teachers from 66 schools (Ngan & Lee, 2002) and those at Philanthropy Primary School.

No. of strategies	Ngan & Lee (2002)	Philanthropy 2000-01	Philanthropy 2001-02
Mean # strategies per year	4.73	38.84	59.58
Never used	36.5%	0	0
Did not answer	18%	0	0
1 – 5 strategies	30%	3.23%	0
6 – 10 strategies	7.2%	12.9%	6.45%
More than 11 strategies	8.3%	83.7%	93.55%
Mean # periods per year		9.58	29.65
1 – 5 periods		29.03%	6.45%
6 – 10 periods		38.71%	3.23%
More than 11 periods		32.26%	60.32%

Implication

The implication of the study is that the school-based, on-site and ongoing professional development program with peer-tutoring and participatory action research activities which is effective in enhancing teachers' incorporation of ICT in their teaching in Hong Kong can also be applied in other Confucian-Heritage Culture such as Japan, Korea, Mainland China, Taiwan, Singapore, or other countries. Indicators showed that teachers' beliefs and practice in incorporating ICT in teaching can be significantly increased after the professional development program. It is worthwhile to try in other culture too.

References

Bandura, A. (1977). *Social learning theory*. NY: Prentice-Hall Inc.

Bennett, C. K. (1995). A staff development partnership for technology integration. *Journal of Staff Development, 16*(3), 19-22.

Biggs, J. B., & Watkins, D. A. (2001). Insights into teaching the Chinese learner. In D.A. Watkins & J.B. Biggs. (Eds.), *Teaching the Chinese learner: Psychological and pedagogical perspectives*. (pp. 277-300). Hong Kong: Comparative Education Research Centre. The University of Hong Kong.

Burns, B. B. (1998). *Introduction to research methods*. 3rd Edition. Melbourne: Addison Wesley Longman Australia Pty Ltd.

Chung, C., & Ngan, M. Y. (2002). From "Rooftop" to "Millennium": The development of primary schools in Hong Kong since 1945. *New Horizons* in *Education, Journal of Education, No. 46*. pp. 24-32. Hong Kong: Hong Kong Teachers' Association.

Cuban, L. (2001). *Oversold and underused: Computers in the classroom*. Cambridge, MA: Harvard University Press.

Dunlop, R. (1990). *Professional development: A review of contemporary literature.* Brisbane: Research Services, Division of Curriculum Services, Department of Education, Queensland.

EMB (Education and Manpower Bureau). (1998). *Information technology for learning in a new era - Five-year strategy: 1998/99 to 2002/03*. November, 1998. Hong Kong: Government Printer.

Enochs, L. G., Riggs, I. M., & Ellis, J. D. (1993). The development and partial validation of microcomputer utilization in teaching efficacy beliefs instrument in a science setting. *School Science and Mathematics, 93*(5), 257-263.

Ertmer, R. A., Addison, P., Lane, M., Ross, E., & Woods, D. (1999). Examining teachers' beliefs about the role of technology in the elementary classroom. *Journal of Research on Computing in Education*; *32*(1). p. 54-68. Washington; Fall 1999.

Fullan, M. G. (1982). *The meaning of educational change*. Toronto: OISE Press and NY: Teachers College Press.

Guskey, T. R. (2000). *Evaluating professional development*. Thousand Oaks, CA: Corwin Press, Inc.

Hinson, S., Caldwell, M. S., & Landrum, M. (1989). Characteristics of effective staff development programs. *Journal of Staff Development, 10*(2), 48-52.

HKPTU. (2001). Survey on teachers' pressure. *News Release*, Hong Kong Professional Teachers' Union, September, 2001.

HKPTU. (2003). 2003 Survey on teachers work pressure. *News Release*, Hong Kong Professional Teachers' Union, 2/11/2003.

Hobbs, E. (1989). *Managing the effects of change in secondary education*. Brisbane: Research Services, Division of Curriculum Services, Department of Education, Queensland.

Huang, L. M. (2002). Taoist Philosophy and "Feminie Style": On the Nature of Feminity. Paper presented at *23 Conference of International Association for Media and Communication Research*, Barcelona, July 2002. [Online] Retrieved 5/5/2004 from http://www.portalcomunicacion.com/bcn2002/n_eng/programme/prog_ind/papers/0_arribats_peremail/abans_07_2002/pdf/linmei_huang.pdf

Jan, Y. H. (1980). A Buddhist Critique to the Classical Chinese Tradition. *Journal of Chinese Philosophy*. V. 7 (1980) pp. 301-318. [Online 5/5/2004 from http://ccbs.ntu.edu.tw/FULLTEXT/JR-JOCP/jc26695.htm

Joyce, B., & Showers, B. (1982). The coaching of teaching. *Educational Leadership, 40*(1), 4-10.

Leung, K. P., & Chui, S. W. H. (2001). Report of research on Hong Kong primary school teachers' self-efficacy on using computers in teaching. *Proceedings of IT in Education Conference CD-ROM*, Hong Kong: The Department of Information and Applied Technology, the Hong Kong Institute of Education.

Levine, S. L. (1985). Translating adult development research into staff development practice, *Journal of Staff Development, 6*(1), 6-17.

Lo, L. N. K. (2000). Educational Reform and teacher development in Hong Kong and on the Chinese Mainland. *Prospects, Vol. XXX, 2*, pp. 237-253. International Bureau of Education Publications Lortie, D. (1975). *School teacher: A sociological study*. Chicago: University of Chicago Press.

McDougall, A., & Bretts, J. (1997). Teacher professional development in a technology immersed school. In D. Passey & B. Samays (Eds.), *Information Technology: Support change through teacher education*. (pp. 222-227). London: Chapman & Hall on behalf of the International Federation for Information Processing (IFIP).

Ngan, M.Y., & Lee, J.C.K. (2002). Teacher Receptivity to Information Technology Education and School Culture. *Journal of Quality School Education, Vol* 2, pp.27-42. Hong Kong: Primary Education Research Association & CRIC, HKIEd. Available from: http://www.ied.edu.hk/cric/jqse/chi/content/vol2/paper2.pdf

Rogers, E. M. (1995). *Diffusion of Innovations*. 4th Edition. New York: The Free Press.

Singtao Education News. (2003). Sufficient resources but only 5% IT in teaching. *Singtao Education News*, *Sing Tao Daily*, 10/6/2003, p. F3.(作者(2003)：資源足唯 IT 教學僅半成，《教育新聞》香港：星島日報，2003 年 6 月 10 日，頁 F3。)

Somekh, B., & Davis, N. (1997). Using Information Technology effectively in teaching and learning. London: Routledge.

Sparks, D., & Loucks-Horsley, S. (1990). *Five models of staff development for teachers*. Oxford, Ohio: National Staff Development Council.

Sparks, G. (1983). Synthesis of research on staff development for effective teaching. *Educational Leadership,* 47(3), 65-72.

Tung, C. H. (1997). *HKSAR: 1997 Policy Address*. [Online]. Retrieved 2nd June 1999, from http://www.info.gov.hk/pa97/english/patext.htm.

Yin, R. K. (1994). *Case study research: Design and methods.* Thousand Oaks, CA: SAGE Publications, Inc.