

## Researching a Decade of ICT in Post-Secondary Education

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### Abstract

This paper reviews published research on information and communication technology (ICT) in post-secondary education since 1998 and identifies the extent to which this research addresses government policy, indicating areas in which further research would be beneficial to meet the challenges contained in government reports. The paper is written to inform government agencies and researchers of the gaps in the research to date. The published papers were wide-ranging, informative and enriching in scope and evidenced the important role of ICT in post-secondary education. The majority of publications were based on empirical inquiry of successful small-scale case studies to guide present and future practice, though less research was evidenced to support other government directives, for example, the role of ICT in cross-institutional collaboration and the role of ICT to support sharing of teaching and resources. There was limited research on theoretical inquiry, providing original perspectives, ideas and ideals to shape future thinking and few cross-sector and inter-institutional studies identifying the role of ICT to improve teaching and learning. It was concluded that future research would benefit from a greater balance between empirical research and theoretical enquiry and to identify more strategically significant cross-institutional research to support the government's vision of making Hong Kong a regional education hub.

### Introduction

In recent years, many initiatives have been taken to promote the use of information and communication technologies (ICT) in the post-secondary sector in Hong Kong (higher education, adult continuing education and vocational education and training). For instance, *Higher Education in Hong Kong* (University Grants Committee, 2002) recognised the potential of electronically-based teaching and learning to 'transform bricks and mortar institutions' by providing new environments to 'facilitate the tuition, support and management of learners on- and off-campus' and 'the development of collaborative, inter-institutional teaching' (p. 25). The University Grants Committee (UGC), the government advisory body on funding and strategic development of higher education encourages this collaboration and use of ICTs through such initiatives as the Teaching Development Grants and through the Restructuring and Collaboration Fund to support cost effective collaboration and to encourage the sharing of teaching and resources between institutions (<http://www.ugc.edu.hk>).

There has been a great deal of research and evaluation about the adoption, implementation and impact of ICT on teaching and learning in Hong Kong's post-secondary institutions. There are seven fully funded government and two self-financing universities, one government funded college, three self-financing colleges and one funded vocational training institution. Research and publications from all

these institutions should be included in this paper. However, the research is not always accessible or comprehensive. Conference papers presented overseas, for example, are not readily available. Other research and publications either deal with a wide range of issues or do not always identify possible directions for future research about the efficacy of ICT in teaching and learning in post-secondary contexts.

The review of 1998 to 2007 published research of ICT in post-secondary education in Hong Kong reported in this paper addresses these concerns about accessibility, comprehensiveness and direction. After a period of substantial policy development and the implementation of many ICT innovations and projects, it is appropriate to identify and document the research completed to date. UGC (2002) recommended conducting another review in 2007 to assess progress on the expansion of the post-secondary sector, the interface with the school sector, articulation between the community, colleges and universities and the implementation of the 2002 report recommendations. This paper identifies research that addresses government directives and indicates gaps and possible directions for future ICT research in education with reference to government policy. The paper aims to inform government agencies and researchers of the outcomes of this research.

### **Method**

The development of a comprehensive and authoritative bibliography relating to ICT in Hong Kong was a necessary prerequisite to a review of the research completed to date. Only research undertaken and completed in Hong Kong or addressing a Hong Kong context and based either entirely or to a significant extent (e.g., for cross-cultural comparisons) on local participants was included. Research undertaken by local researchers but based on *non-local* subjects, situations or circumstances was excluded, whereas studies undertaken by researchers based in other countries were included if they focused on Hong Kong students, teachers, policies, or educational contexts.

The bibliography included research from a pedagogical, practical, cultural, economic, interpersonal, philosophical, sociological, technical, or government policy perspective, in any post-secondary education context, both on-campus and distance education. Due to the large number of publications identified, only research published in the period from January 1998 to January 2007 was included in the bibliography.

The following types of published materials were included - journal articles (print or electronic); book chapters; conference proceedings (print or electronic - CD-ROM or Web-based - formats); government documents and related research reports; theses (undergraduate; masters; doctorate) and newsletters and resources online, reporting on research (commercial; professional society; academic; non-government organisation).

The bibliography was compiled using the citation management software EndNote®. Publications were located using bibliographic databases, online aggregators (journals and conference proceedings), Hong Kong government websites, online *curriculum vitae* of Hong Kong researchers, online education project sites, Google Scholar and online public access catalogues (theses, dissertations and undergraduate projects) as well as physical searches within Hong Kong universities' libraries. Bi-lingual publications in Chinese and English from Hong Kong, China, Taiwan and elsewhere were also included in the search. Advice from Chinese academics was provided to ensure the inclusion of relevant references from Chinese language publications. The

project also employed a Chinese speaking research assistant to collate and translate Chinese only texts into English. For each publication, the following information (where available) was recorded: full citation; abstract; annotation; index terms ('keywords'), Uniform Resource Locators (URL); author affiliation; and reference type identifiers (journal article, book chapter, etc.) and links to the full text.

## Results

A search of the bibliographic database using the keyword 'post-secondary' located 461 publications. These publications were grouped into categories, 12 derived from the *British Journal of Educational Technology* Author Guidelines for refereed articles and colloquia (Latchem, 2006) and two additional categories: professional development and collaboration; knowledge building and working online, which reflected a significant focus of recent research in Hong Kong. The category and number of publications is shown in Table 1 and the type of publication is identified in Table 2.

*Table 1: Categorisation of post-secondary publications*

Category	No. Publications
1. Design and production of learning materials	62
2. Evaluation and monitoring	54
3. Delivery systems for open and distance learning	46
4. Curriculum development and course design	45
5. Professional development and teacher education	45
6. Support for self study and for learners at a distance	43
7. Problems and potential of new technologies in education and training	37
8. Collaboration, knowledge building and collaborative work online	35
9. Priorities in resources, planning, organisation and policy	32
10. Educational research and dissemination	19
11. Assessment, notably assessment on demand and of learning from experience	17
12. Psychology of communication	12
13. Storage, retrieval and dissemination of resources and information	10
14. Effectiveness and cost-effectiveness of print, electronic and optical media	4
<b>Total</b>	<b>461</b>

*Table 2: Type of publication*

Category	Journal articles	Book chapters	Conference papers	Reports	Newsletter/resources	Masters/PhD dissertations	TOTAL
1	10	9	37	3	0	3	<b>62</b>
2	16	5	23	4	2	4	<b>54</b>
3	24	4	15	0	0	3	<b>46</b>
4	17	4	17	1	0	6	<b>45</b>
5	12	10	19	2	0	2	<b>45</b>
6	15	5	21	0	0	2	<b>43</b>
7	9	3	16	0	0	9	<b>37</b>
8	10	6	17	0	1	1	<b>35</b>

9	6	6	14	3	1	2	<b>32</b>
10	6	4	7	0	0	2	<b>19</b>
11	11	3	3	0	0	0	<b>17</b>
12	6	1	4	1	0	0	<b>12</b>
13	4	0	2	0	0	4	<b>10</b>
14	1	0	2	0	0	1	<b>4</b>
<b>Total</b>	<b>147</b>	<b>60</b>	<b>197</b>	<b>14</b>	<b>4</b>	<b>39</b>	<b>461</b>

Placing publications within specific classifications (Table 1) was not always easy as many items crossed categories. For example, an item placed in the category design and production often included extensive evaluation. Classification was therefore based on judgement of the extent to which the item fitted the primary category. The final quantitative categorisation of publications must therefore be treated with some caution. However, broad trends were identifiable and offer a general impression of where papers have been published within the individual categories. Table 2 provides a breakdown of the type of publication within categories and offers insights into the spread of publications across all categories. Few newsletters and resources online that addressed research in ICT in education were identified. This type of publication was therefore not considered very significant to this study, though the numbers found in the various categories are included in table 2. The research publications categorized in each of the 14 categories are described in the following section.

### Category findings

#### 1. *The design and production of learning materials (n=62)*

The largest number of published items came within this category. The majority of items were web-focused case studies identifying increased flexibility in study for learners through the use of ICT, reflecting government initiatives to rapidly increase the availability of online learning materials (Education Commission, 2001). The majority of these publications (37) were conference papers, with only 19 journal papers and chapters in refereed publications. The category's conference paper numbers represent 19% of all conference publications in this study. This is not surprising given the nature of the category which dealt primarily with individual focused projects and uses of technology to support teaching and/or learning in particular classes, laboratories, modules or courses. The category also included items where the learning materials were designed and used for more than one course or module and some were shared across discipline, notably in English language teaching and learning and especially to provide support, where the principal language of instruction used is different from most students' mother tongue (Chinese).

#### 2. *Evaluation and monitoring (n=54)*

In the second largest publication category, most papers concerned specific implementations, providing insights on issues and problems encountered in particular situations. A large group of publications (16) focused on research into the use of technology for English language teaching. There was also a high number (16) of theoretical inquiry publications on original perspectives and concepts to shape future thinking, software implementation projects (12), evaluating professional development programmes (7) and comparing learning management systems (3). This category appears more balanced in publication type with 21 journal papers and chapters compared to 23 conference papers.

#### 3. *Delivery systems for open and distance learning (n=46)*

Much of the research described or evaluated specific applications of delivery systems, either individually designed 'web-based learning systems' or commonly used learning management systems (LMS) such as WebCT, Blackboard and Moodle. These case studies typically outlined the features of the software, the advantages as reported by participants, the difficulties experienced and how they may be handled.

Other research focused on specific features of LMS such as: (a) synchronous chat, for 'real-time' teaching (online replication of face-to-face instruction) and discussions among students enrolled in various countries; and (b) purpose-built features for learning activities (such as virtual laboratories in biology and engineering, and trading platforms in commerce), student support (vocabulary, lexicon, concordance and multimedia assistance for language learning), administration (assignment submission and management) and library services.

Other publications reported on (a) the initiatives taken by institutions in the delivery of distance / online programmes in Hong Kong; (b) comparisons of Hong Kong institutions with those in other countries; (c) assessments of the potential of web-delivery of programmes in Mainland China; and (d) the importance of instructional designers and support services in developing and maintaining distance education programmes.

In the main, the research methodologies were case studies and descriptive accounts based largely on interview and survey data. One study (Kumta, Hung & Cheng 2001) used a pre- and post-test design to investigate the impact of multimedia web-based 'critical thinking' tutorials with randomly selected groups of final year medical students. Overall, the number of journal publications to other types was high (63%), indicating this is a more mature research category in Hong Kong with a longer history of research into open, distance and flexible learning.

#### *4. Curriculum development and course design (n=45)*

All items took the form of case studies of specific implementations, providing insights about the issues, problems and practices in specific situations. Invariably, these implementations were regarded as 'successful' (although 'modifications for future implementations' were often recommended). Publications indicate a progression in thinking about curriculum development and course design over time, which in the future will become extremely important leading up to the introduction of the four year undergraduate degree programs across all higher education institutions in Hong Kong, replacing all three year degrees. However, no publication within this time period discussed issues directly relating to the four year curriculum to be introduced in 2012. Papers published in this category were evenly spread across refereed journals (17) and chapters (4) and conference presentations (17) and (6) masters dissertations.

#### *5. Professional development and teacher education (n=45)*

There were 34 in-service professional development but only nine initial teacher education publications with a further two papers that covered both areas. The majority of papers were concerned with teacher practices and issues arising with the introduction of technology into teaching and learning contexts. The predominant focus was on ways of successfully integrating ICT into existing teaching and learning practices and curricula. Four publications were more theoretically based using frameworks to make sense of practices identified. Seven papers concerned English language teaching, the gender gap and the use of ICT over a two year period and on the improvement of student skills, confidence and uptake of technology in a university

over a four year period. Places of publication were evenly spread with 22 journal papers and chapters and 19 conference papers and presentations.

6. *Support for self study and for learners at a distance (n=43)*

A high percentage (44%) of publications described tutorial support initiatives for second language learners of English, rising to 52% if 'online support' by major distance education providers (such as the Open University of Hong Kong (OUHK) and the University of Hong Kong School of Professional and Continuing Education (HKU SPACE)) is assumed to include language support resources (e.g., academic vocabulary, oral presentation and writing). On the other hand, it was surprising that only one publication (Chao, 1998) dealt with cultural issues and learning, exploring the suitability of adult learning approaches for local adult learners and the perceived lack of independent learning skills among Hong Kong students.

Other topics reported (each in one or two publications only) included evaluations of face-to-face tutorials in a distance education programme, the provision for 'self-learning' during SARS, and surveys of student perceptions of online support in distance education programmes. Peer instruction, and the use of problem-solving using remote collaboration to support learners (in software engineering, informatics and management) were also reported.

Many of the student support services described used familiar Web-based methods (text, email, chat). However, reports of the use of an intelligent tutoring system for distance learning (Cheung, Hui, Zhang, & Yiu, 2003) and student use of weblogs - a 'significant predictor of learning outcomes' (Du & Wagner (2007) - described other approaches to support learners in face-to-face and distance education programmes. Roughly 50% of publication in this category were journal papers and chapters in texts.

7. *Problems and potential of new technologies in education and training (n=37)*

Most publications were descriptive accounts highlighting the practices and challenges of using technology to support teaching and learning in post-secondary education and training (19). Topics included second language learning, autonomous learning, collaborative learning and teacher education. Student and teacher attitudes towards using technology, as well as student experiences and perceived advantages and disadvantages in using ICT to support teaching and learning were also discussed and analysed (18). Four theoretical inquiry papers in this category developed conceptual models to make sense of ICT use and the challenges that arise for future thinking about technology integration. A significantly higher proportion of publications in this category were presented at conferences (16), however, this category was also the most popular for dissertations (9).

8. *Collaboration, knowledge building and collaborative work online (n=35)*

Research reported on various forms of 'collaboration' including 'knowledge building', 'peer learning', 'active learning', 'group discussion', 'interaction among learners', 'e-collaboration' and, more recently, 'blogging'. In the main, the research focused on online, tutor-moderated, asynchronous, text-based, discussion forums in undergraduate programmes using familiar software products (such as WebCT and Knowledge Forum) within a single institution. These analyses took the form of case studies of particular modules/programmes, and focused on the perceptions of participants using questionnaires, interviews, and action research as well as the actual messages (content analysis) and the way messages were exchanged among participants (interaction patterns).

In the main, the research focused on identifying 'successful' aspects of working online in specific cases, and suggesting ways in which 'unsuccessful' outcomes could be improved. Many of the case studies identified pedagogical strategies which facilitated dialogue and enhanced 'collaboration' among participants. A couple of studies referred to synchronous discussions, collaboration in graduate study programmes, or to online interaction where student participation was a voluntary rather than a mandatory (sometimes assessed) component of the programme. A few case studies included examples of 'collaboration' involving students in other countries, or explicitly examined theoretical posits or particular aspects of 'collaboration' in multiple situations (modules /programmes). There were few inter-institutional collaborative projects though there were some publications where partnership between higher education institutions and schools had occurred. Fifty per cent of publication in this category were journal papers and chapters in texts.

*9. Priorities in resources, planning, organisation and policy (n=32)*

Publications mainly concerned specific implementation strategies and guides for immediate and future practices (23). Other publications in this category concerned policy position papers and frameworks for policy development and implementation (8), professional development programmes and the organisation of courses (4) and government reports (2). A higher proportion of papers were published as conference proceedings.

*10. Educational research and dissemination (n=19)*

Articles in this category dealt with a diverse range of topics including historical background of distance education in Hong Kong and comparisons of the use of ICT in tertiary and distance education in Hong Kong, other Southeast Asian countries and other parts of the world (North America, Europe, China and Japan). One article proposed a taxonomy of Web learning environments, and another explored the use of narrative in educational research during SARS. More publications in this category were in refereed journals or as book chapters.

*11. Assessment, notably assessment on demand and of learning from experience (n=17)*

Publications in this category report on peer/collaborative assessment in technology-enhanced learning environments, instructional support for "self-accessed" learning, a meta-cognitive approach for self-assessment of teacher education students, and student assessment in a virtual laboratory in Engineering. The assessments described were all based on existing assessment and criteria, transferred from a text to digital format. Most publications were in journals (11) and book chapters (3), with only three conference papers.

*12. The psychology of communication (n=12)*

This research focused on the use of computer-mediated communication with non-native English speakers. It included research on the explanatory power of the 'Community of Inquiry' (CoI) model (Garrison, Anderson & Archer, 2000; 2003) on students' performance and satisfaction with online conferencing, and the 'interactional dynamics' of face-to-face and on-line peer-tutoring in writing by university students. Other research concerned the effect of learning tasks on incidental vocabulary learning, and the use of a CD-ROM dictionary in computer-assisted language learning. Two publications reported research on Chinese language learning - investigations of (a) university students' awareness of elements of effective

communication in Chinese practical writing, and (b) the influence of ‘Confucian Heritage Culture’ on Chinese learners (e.g., perceived passivity about expressing opinions and uncertainty about learning without a teacher's assurance) in a web-based learning environment. Most publications were in journals (6) with one chapter and four conference papers.

*13. The storage, retrieval and dissemination of resources and information (n=10)*

A low number of items in this category but the very high percentage (89%) of journal articles (4), conference papers (2) and dissertations (3 masters and 1 PhD) indicate that this is a new topic of interest in Hong Kong, which is being researched in some depth. Topics include online search behaviours and information literacy skills of staff and students, technology and knowledge management, and library user preferences for e- or printed-texts.

*14. The effectiveness and cost effectiveness of print, electronic and optical media (n=4)*

All four accounts were case studies, comparing effectiveness, time efficiencies or comparison costs of print to digital technology resources or courses. One publication in vocational training argued that technology-based courses had reduced costs and the length of time needed to run and complete skills-based training programs.

## **Discussion**

The majority of the English, Chinese and bilingual publications in the review were empirical studies based on specific contexts, offering analysis and recommendations towards improving existing practices and addressing “the extent to which... [educational technologies] can appropriately underpin teaching and learning” (Editorial Committee, 2005, p. 10). These investigations were mainly exploratory in nature, trialling the adoption and adaptation of technology to introduce efficiencies and production gains to existing practices through the use of ICT. In this sense, much of the literature reviewed represented the early stages of technology adoption focusing on awareness raising, learning new processes, understanding and applying, confidence building, and the adaptation of outcomes to other contexts (e.g. Chim & Chen, 2004). The authors of publications of this type were mostly the teacher-researchers involved in the design and use of the technology applications. Many were enthusiastic beginners or struggling aspirers to using ICTs to benefit their students’ learning and much of this writing was positive, examining the benefits but less the drawbacks of technology adoption. In this sense they should be praised and recognised as teacher-researchers who worked hard to find improvements to the education process and resources they offered their students. Their research focused mainly on the first level effects of technology (Lankshear & Snyder with Green, 2000): the expected benefits from implementing new technologies and the efficiency gains to existing practices. This appears consistent with the major government policy drives to introduce ICT into educational settings in Hong Kong during this period (e.g. Education Commission or EC, 2000; UGC, 2002; Education and Manpower Bureau or EMB, 2005).

The literature however, had few examples of research that investigated the more complex second level effects that relate to changes in the environment of practices and in the practices themselves created by the use of new technologies. Second level effects include: “changes in environments ... (classrooms...) and in practices themselves (...teaching, learning...) which result from participants ... using the technologies. When new technologies are introduced into sites of practice, they change the social circumstances within which they are used” (Lankshear, Snyder with



Green, 2000, p. 36). One focus for future research could therefore be studies concerned with second level effects and the interrelationships between technology, technology affordances, the environment, the curriculum and the teaching and learning. In particular, how technology adoption facilitates certain practices and ways of working but excludes others. As institutions prepare for the major changes in all undergraduate degrees from three to four years in 2012 (EMB, 2004), and the continued increase in student numbers, not supported by equivalent increases in funding (UGC, 2002), research into these new practices facilitated by the adoption of new technologies would help in planning for new curricula activities, use of staff and student time and use of on-and off-campus spaces.

A high proportion of items (16%) of the total 461 publications concerned second language acquisition in autonomous, self-accessed or distance education programmes and on the analysis of computer conferencing and guided self-study. This exploration of more student-centred learning ‘along with educational technologies and cultures that support this’ (Editorial Committee, 2005, p. 6) is in line with government documents, calling for increasing flexibility in study, assisting students to learn at their own pace through self-directed study (e.g. EC, 2001) and supports the changes in the UGC mission to establish Hong Kong as “an education hub of the region” (UGC, 2004).

In line with international publications elsewhere on educational technology, the favoured methods included “case studies, examples of best practices or implementations of new pedagogical tools” in specific contexts within a limited period of time - often one semester or less (Mishra & Koehler, 2006, p. 1018). This research relied heavily on survey and interview data with some use of content (message) analysis and a few studies utilising experimental designs. In most cases, the sample sizes were small and were based on research in one institution: 77% of papers were published by authors from a single institution; 12% of authors across institutions in Hong Kong; and 12% collaboration with overseas institutions. Although a significant number of publications directly concerned collaborative knowledge building online, this was predominantly carried out within a single institution. However, there was some evidence of partnership between higher education institutions and schools. Future research could benefit from larger scale studies conducted across institutions and across several years to guide future practices and planning for the use of ICT in education in Hong Kong and in support of the government’s recommendation for greater collaboration between institutions (UGC, 2002 & 2004).

In line with the UGC (2002) recommendation to “assess the need for staff [and students]... to develop new skills to respond effectively to technological and other changes in higher education” (p. 27), a high percentage of research investigated teacher and student attitudes towards using technology in education. Studies on student attitudes to technology (e.g. Cheung & Huang, 2005) also mirrored international research (e.g. Garland & Noyes, 2005) which includes the examination of student learning experiences and providing insights into the benefits that different study modes encompass (Jefs & Colburn, 2002; Pow, 2006). A large number of studies either hinted at or clearly identified the present limitations of both pre-service and in-service courses and programmes, and staff development and training of teachers at all levels in using technology appropriately in educational contexts. For example, papers identified the need to expand the integration of ICT into the pre-service curriculum in teacher education programmes in Hong Kong and to provide

essential support to enable existing teachers in further and higher education to acquire and use technology to support student learning. The research suggests that teachers who are more trained in ICT are more likely to use technology for their personal use and more likely to integrate ICT appropriately into their classrooms and that novice users should focus on user-friendly applications to things they can use (or find useful) themselves. These studies mirror international research which highlights the need for appropriate education and training of teachers in using technology and in providing adequate support that avoids the one-off style workshop for teachers and instead offers a broad range of professional development opportunities for teachers to improve their understanding and use of ICT. Longitudinal collaborative research on a larger scale examining teacher needs across Hong Kong's tertiary institutions would provide a more persuasive document to influence policy on this matter. Though there were a considerable number of papers on vocational education and training, all were descriptive case studies of particular practices and there were very few studies on workplace training and skills development, indicating the need for more research in this area.

### **Conclusion**

This paper reviewed published research on the use of ICT in higher education, adult education and vocational training in Hong Kong from January 1998 to January 2007, and indicated areas in which further work would be beneficial to assist Hong Kong tertiary institutions move towards meeting the challenges contained in government reports. The published papers were wide-ranging, informative and enriching in scope and evidenced the important role of ICT in tertiary education. The majority of publications were based on empirical inquiry findings of 'successful' case studies to guide present and future practice. While these examples of educational technology applications are important for building our understanding, they are but the first steps towards developing unified theoretical and conceptual frameworks that allow us to develop and identify themes and constructs that can be applied across the case studies. The predominance of these atheoretical perspectives ultimately can constrain the use of education technology and can limit our vision (Selfe, 1990). Whereas theoretical frameworks can provide us with conceptual lenses to view the world and help us identify relevant issues while discarding irrelevant ones to help shape future thinking.. It was concluded that future study could benefit from a greater balance between empirical research and theoretical enquiry and to identify more strategically significant cross-institutional research to support the government's vision of making Hong Kong a regional education hub.

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