Hong Kong Home Economics Teachers' Preparedness for Teaching with Technology

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Abstract: In Hong Kong as elsewhere the government has undertaken a series of initiatives to increase the incidence, and effectiveness, of application of information and communication technology (ICT) in education. This paper reports on a study of ICT adoption by Home Economics teachers in Hong Kong. Although participants reported having access to ICT for classroom use, moderate levels of ICT skills, and positive attitudes to ICT, most reported limited classroom use with that being for traditional didactic lessons. Based on the data, including teacher perceptions of barriers to ICT use and needs for development, TPACK (http://www.tpck.org/) is used to explain the observations and suggest a way forward.

Background

The rapid adoption of information and communication technology (ICT) in modern communities and workplaces requires that there should be related changes in the mix of knowledge and skills possessed by school leavers. ICT is central to the challenges faced by education systems as they adapt but it is also important in the solutions, both as a subject of study and a tool for enhancing learning and teaching. Many of the new required skills relate to facility with ICT and new approaches to pedagogy emphasizing collaborative learner activity rely upon ICT for access to both information and collaborators (Partnership for 21st Century Skills, 2007).

Governments and education systems around the world have recognized the need for change and have announced related initiatives. Since 1998, the government of the Hong Kong Special Administration Region (HKSAR) has announced a series of such initiatives, which have included funding for computers and Internet access for schools together with professional development for teachers. The goals of the initiatives have been described as preparing school leavers to be creative, inquisitive learners, with a broad knowledge base, global outlook, ability to process information effectively, and positive attitudes toward life-long learning (Education and Manpower Bureau, 1998). These goals align closely with those typically identified for the twenty-first century skills (Partnership for 21st Century Skills, 2007), and were to be supported by a switch away from traditional didactic pedagogies toward student-centered approaches based on constructivist understandings of learning and incorporating ICT in ways consistent with the new skills emphasis.

The HKSAR initiatives for teacher professional development included establishment of four levels of Information Technology (IT) competency (Education and Manpower Bureau, 1998):

- Basic level (BIT) requiring 18 hours of training for word processing, Internet, and common educational software use;
- Intermediate level (IIT) requiring 30 hours of training for basic ICT tools and use of teaching resources from Internet and intranet for lesson preparation and teaching;
- Upper Intermediate level (UIT) requiring 30 hours of additional training for networking, simple computer problems and understanding characteristics and uses of different IT tools and resources; and
- Advanced level (AIT) requiring part-time studies of up to 120 hours over two years to understand computer managed instruction systems, evaluate instructional software, design instructional materials using IT, and select appropriate equipment for a school's needs.

An interim review of the initiative (Law, 2001) reported that the emphases were on providing ICT infrastructure in schools, enhancing teachers' ICT competency, and supporting ICT use in schools with curriculum resources and support personnel. At the time of the review there was already evidence of greatly improved ICT infrastructure in schools and of improvements in teachers' skill levels. Improvements in teachers' skills were such that by the end of the 2002/2003 school year all 50 600 teachers in Hong Kong had successfully completed the BIT program, 77% had passed the IIT, 27% had achieved the UIT and 6% had achieved the AIT (Education and Manpower Bureau, 2004).

The interim review (Law, 2001) found that, although there was an increase in ICT use by Hong Kong teachers, it was predominantly supporting an expository pedagogical approach. More than 70% of the teachers used computers mainly for preparing teaching materials; more than half of teaching time was spent on lectures and demonstrations; and there was little time for students' individual work and even less for small group work incorporating ICT. To that time implementation of the policies had made no noticeable changes in terms of the anticipated new learner-centered paradigm or in achieving the goal of developing the attitudes and capabilities for lifelong learning.

A more recent study with a focus on mathematics and science education (Law, Pelgrum, & Plomp, 2008) found that teachers across the several countries studied continued to use traditional approaches to teaching despite greatly improved access to ICT. Although ICT access in Hong Kong classrooms compared favorably with that in other countries, the impact of ICT on learning and teaching was not meeting expectations and Hong Kong students' skills for collaboration, research, and self-learning were not as good as those of students in comparable countries such as Singapore. Hong Kong mathematics and science teachers were making frequent use of ICT in the classroom but that use was limited to PowerPoint and similar teacher-directed applications indicating little movement toward the desired student-centered learning approaches envisaged by the authorities (Education and Manpower Bureau, 1998).

Thus, although the initiatives of the HKSAR appear to have been successful in areas such as improving teacher access to ICT and ICT skills, they have been less successful at encouraging changes in pedagogy and in developing the twenty-first century skills desired for school leavers. The study described in this paper considers these issues in relation to Home Economics education in Hong Kong.

Theoretical framework

Educational change is a complex process because its success depends on changes in teachers' beliefs and teaching styles that emerge through personal development in social contexts (Fullan, 2007). Fullan described the numerous factors that affect the implementation of educational change as belonging to three broad groups, namely, characteristics of the change process itself (need, clarity, complexity, practicality), characteristics of the local context (district, community, principal, teachers), and external factors (government and other agencies). Any theoretical framework for understanding and effecting change in schools must take account of these factors.

Research into the integration of ICT in learning and teaching has identified barriers that need to be overcome. Ertmer (1999) classified such barriers in two broad groups. First-order barriers are extrinsic to teachers and include such resource-linked issues as lack of technical support and inadequate skills. Second order barriers are intrinsic to teachers. They include attitudes toward teaching, beliefs about computers, and willingness to change. More recently, Hew and Brush (2007) reviewed a large number of studies dealing with barriers to ICT integration and identified a set of six representative barriers that they were able to group according to Ertmer's (1999) typology. Their first-order barriers comprised lack of resources, institutional factors, subject culture, and assessment. Their second-order barriers were attitudes and beliefs, and knowledge and skills.

In respect of subject culture, Home Economics teachers share an interdisciplinary emphasis on knowledge and skills across three major areas of Food and Nutrition, Dress and Design, and Family Studies. According to Keane (2002), because of the practical nature of the subject and its relationship to everyday life, it is important that it should be taught in ways that reflect societal trends, including the application of ICT. Croxall and Cummings (2000) in a study of New Mexico Home Economics teachers found that they tended not to incorporate ICT regularly for teaching but were willing to do so when given access to equipment and facilities. The major barriers to adoption were lack of hardware and software rather than any attitudinal disinclination.

The present study was designed to investigate the adoption of ICT by Hong Kong Home Economics teachers in the light of prior research about educational change, barriers to ICT use by teachers, ICT initiatives in Hong Kong, and adoption of ICT by Home Economics teachers in other contexts. Figure 1 summarizes a theoretical framework representing the desired change from traditional teaching to twenty-first century approaches with influences from the factors identified by Fullan (2007) and the barriers described by Hew and Brush (2007). The general framework should apply equally well to other subjects in the school curriculum.



Figure 1: Theoretical Framework for Adoption of ICT in Home Economics Teaching

This chapter describes and explains patterns of ICT adoption by Hong Kong Home Economics teachers. In addition to the theoretical framework (Figure 1) which guided the study, this chapter draws upon Technological Pedagogical Content Knowledge (TPACK) (Mishra & Koehler, 2006; Koehler & Mishra, 2008) as a framework for understanding the data. TPACK is an extension of the work of Shulman (1986) who first suggested that it is not sufficient for teachers to have knowledge of pedagogy and content separately but that the critical area of knowledge is pedagogical content knowledge (PCK) shown in Figure 2 as the intersection of circles representing pedagogical and content knowledge. Shulman's formulation encouraged teacher education programs to attend to the ability of teacher candidates to apply knowledge of pedagogy to their content knowledge, transforming and presenting to better support learning. Mishra and Koehler (2006) extended the model to the intersections of technological knowledge with both pedagogy and content and in the central region of triple overlap that represents TPACK.



Figure 2: Technological Pedagogical Content Knowledge (TPACK) [after Mishra and Koehler (2006)]

Methodology

This study used a mixed methods approach to explore patterns in the adoption of ICT by Hong Kong Home Economics teachers. Initial data collection used a questionnaire comprising mostly closed questions. That was followed by interviews and classroom observations conducted with a small group of teachers selected as representative of different levels of ICT use. The questionnaire reflected elements in the theoretical framework (Figure 1) and prior studies of ICT adoption by teachers in Hong Kong and elsewhere. Its six sections covered basic demographics, school ICT facilities and use, ICT use by teachers outside school, perceptions of the effect of ICT on learning in Home Economics, perceived barriers to ICT integration, and general attitudes to computers.

Printed questionnaires designed to facilitate optical scanning for data entry were distributed to each of 350 Hong Kong secondary schools known to offer Home Economics, with a request to the teacher in charge of Home Economics to provide copies to any other Home Economics teachers in the school. Purposive sampling based on responses to the questionnaire was used to recruit teachers for interview in order to ensure representation of different levels of use and IT competence. Six teachers, representing high (at least weekly) and low (less than monthly) frequency of ICT use for teaching, were selected and interviewed. Data from the questionnaires were analyzed using SPSS. Interviews were transcribed and analyzed thematically.

Results

Of 435 Home Economics teachers known to be in Hong Kong schools at the time of distribution, 252 (58%) completed and returned a questionnaire. Table 1 presents the distribution by age of teachers' reported levels of IT competence on the model established for Hong Kong teachers (Education and Manpower Bureau, 1998). There was a significant relationship between reported IT competence and age [$\chi 2 = 45.7$, p < 0.001], reflecting a generally higher level of competence for younger teachers. There is an anomalous result for the over 50 years age group where 25% had achieved UIT (compared to 8% for the next younger group). This may have resulted from departure from the workforce of older teachers without IT skills or from more experienced teachers being able to spend more time working with IT because of their decreased need for extensive basic preparation work.

	IT Competence Level				
Age	Basic (BIT)	Intermediate (IIT)	Upper Intermediate (UIT)	Advanced (AIT)	Ν
21-30	2	27	38	0	67
31-40	6	66	32	0	104
41–50	14	44	5	0	63
Above 50	2	7	3	0	12
Total	24	144	78	0	246

Table 1: Distribution of reported IT competence levels by age group

On average, teachers in all age groups agreed that they had adequate IT skills to facilitate teaching, with a mean rating of 3.5 on a 5-point scale, although younger teachers typically reported significantly higher levels of agreement [F (3, 244) = 6.8, p < 0.001]. The effect of HKSAR efforts to increase teachers' IT competence is visible in Table 2 where respondents reporting higher levels of IT competence were significantly more likely to agree that they had adequate skills for teaching with ICT [F (2, 246) = 15.4, p < 0.001]. This is consistent with all teachers having achieved BIT and 90% having reached at least IIT, with more younger teachers reaching the higher levels.

IT Competence Level	Overall	Mean	SD	Post Hoc Tests (S-N-K)
Basic (BIT)	24	2.9	0.93	BIT < IIT < UIT
Intermediate (IIT)	145	3.4	0.87	
Upper Intermediate (UIT)	80	3.9	0.66	
Total	249	3.5	0.86	

Note: Mean for 5 point scale, 1 = strongly disagree to 5 = strongly agree

Table 2: IT competence and perceived adequacy of skills for teaching with ICT

Table 3 presents mean scores on a series of items about general attitudes toward computers. Overall attitudes were positive, although teachers who had completed higher levels of IT competency (IIT or UIT) generally expressed significantly stronger agreement. The lowest scoring item was one related to strength of technical knowledge. Attitudes were not significantly related to either age or years of teaching experience. Teachers also reported moderate levels of agreement with statements about IT making Home Economics more interesting and resources easier to locate with means of 3.9 and 4.1, respectively, on a 5-point scale. They also agreed that the use of ICT in teaching could improve a variety of student outcomes including problem solving, collaboration skills, creativity, and communication skills.

Statements	Mean score
My attitude to computers is very positive	5.26
I strongly enjoy working with computers	4.65
I am highly confident in my computer abilities	4.18
Computers strongly motivate students to do better work	4.37
My technical knowledge is very strong	3.87
I am very independent with computers	4.12
Note: Mean for 7 point scale $1 = $ untrue to 7 = very true	

Note: Mean for 7 point scale, 1 = untrue to 7 = very true

Table 3: Teachers' attitudes toward computers (N = 249)

Table 4 summarizes teachers' reported use of computers for teaching in class (hours per week) and outside of school hours (hours per day), typically at home. No significant relationship was found between teachers' age, level of IT competence, or years of teaching experience and their use of computers for teaching. However, there were statistically significant relationships between computer use outside of school and both age [F (2, 243) = 11.2, p < 0.001] and IT competence [F (2, 245) = 14.5, p < 0.001]. Younger teachers and those with higher levels of IT competence reported higher levels of computer use at home.

Age	Ν	Teaching with computers (h/wk)		Computer use outside (h/d)	
		Mean	SD	Mean	SD
21-30	67	1.51	.79	2.3	1.32
31-40	104	1.53	.74	2.7	1.07
41-50	63	1.54	.91	1.3	0.91
Above 50	13	1.38	.77	1.0	0.78
Total	247	1.52	.80	1.7	1.16

Note: Mean for 5 point scale, 1 = strongly disagree to 5 = strongly agree

Table 4: Computer use in and out of school by age group

A very large proportion (93.3%) of the respondents had an Internet connected computer at home. This is a substantially higher proportion than for Hong Kong in general, for which recent data suggests about 77% of homes have broadband Internet (Hong Kong Trade Development Council, 2009). Of the teachers with computers at home, daily use was reported as less than 1 hour (30%), between 1 and 2 hours (36%), between 2 and 3 hours (20%), or more than 3 hours (13%). Common uses were word processing or typing (93%); email, newsgroups or sending e-cards (54%); and preparing lessons or other work related activities (33%).

Most of the teachers (79.4%) reported having computers available in their Home Economics classrooms and that most of those computers (77.4%) were connected to the Internet. Although a small number (1.2%) reported never having used a computer in the classroom, teachers who did not have computers in their classrooms nominated strategies including bringing their own laptop or booking other computers within the school for those occasions when they might want to use a computer for teaching. Other computer-related hardware reported as available in Home Economics classrooms included data projectors (67.5%), printers (43.3%), and scanners (2.8%).

Table 5 summarizes reported classroom uses of ICT. They are consistent with previous studies of ICT use in Hong Kong schools (Law, 2001; Law, Pelgrum, & Plomp, 2008), which found that the most common classroom uses were consistent with a traditional expository pedagogy. Levels of use were modest, with most teachers (61.5%) reporting less than 5 hours per week of computer use for teaching on average and very few (8.8%) reporting that they used the computer for more than 10 hours per week in their teaching. Frequency of reported use was

correspondingly low with 40% reporting use at least weekly, 53% once or twice per month or term, and 8.7% once or twice a year or not at all.

Uses of computer	% of Teachers
Lecturing or demonstration	88.9
Preparing notes for teaching	83.7
Student learning activities or student presentation	54.8
Communicating with students	8.3
No use	1.2
Other	2.0

Table 5: Teachers' use of computers in the Home Economics room

In response to a series of questions about ICT resources in the schools, teachers agreed (mean = 3.4 on a 5-point scale) that their schools had good ICT support but disagreed that they had sufficient time to practice ICT skills (2.2) and implement ICT in class (2.5). They also disagreed that they had sufficient access to hardware in their classrooms (2.5), to relevant software (2.3) and online resources (2.4), or to professional development specific to Home Economics (2.5). In relation to their ICT needs, they agreed that they had adequate IT skills to facilitate Home Economics teaching (3.5) but also that they needed further development in both IT skills (3.9) and integration of ICT for teaching Home Economics (3.9). They disagreed that there were sufficient IT resources for teaching specific elements of the Home Economics syllabus (2.4 to 2.7). Although they agreed that they had experienced problems when using ICT in teaching Home Economics (3.5) they were reasonably satisfied (3.2) with the level of technical support available to them.

Of the six teachers who participated in interviews, five were at UIT level of competence and one at IIT. All expressed the opinion that the IT courses they had undertaken were skill-based with a focus on using specific software rather than on application to curriculum or pedagogy. Relevant comments included:

The application of ICT in class after completing the course depends on the individual teachers. You forget how to use the software after the course. [Teacher E]

After completing the IT training courses, skills were often not practiced or used as it was time consuming to make teaching aids, e.g. online questions, it is complicated. It would be easier just to make a paper worksheet. It would be better if the courses are subject-related. [Teacher C]

- I would like to attend courses on how to use IT in Home Economics, to make lessons more interesting and lively. [Teacher V]
- I would rather have some sharing sessions with some Home Economics teachers on how to use IT in the subject as I only know a few things to do with ICT. So that would be my first priority. It would be good to have a group of teachers developing some teaching materials together and I would be willing to share my IT resources. [Teacher 1]

Discussion

Overall the teachers described in the presentation of data above appear to be technically and attitudinally prepared for teaching with ICT. Most of them (90%) had achieved at least the IIT level of IT competence and 32% had gone on to the UIT. They generally agreed that they had adequate IT skills for teaching, expressed positive attitudes toward the use of ICT in general, and agreed that ICT had value for promoting learning outcomes for students, in addition to making Home Economics more interesting and facilitating the location of relevant resources. Further evidence of their acceptance of ICT is apparent in the large proportion that had Internet connected computers at home and made use of them for a variety of purposes including work-related activity. All of this evidence suggests that these Home Economics teachers are positively disposed toward using ICT in their classrooms and to engaging in the change process at the center of Figure 1.

However, the level of reported use of ICT for teaching in Home Economics classrooms was low, suggesting that the change process has been retarded by the presence of one or more barriers preventing the positive forces described in the previous paragraph from having their maximum effect. Considering the six barriers identified in the model (Figure 1), attitudes and beliefs appear to generally favor the change and, given there was

wide agreement that schools had good ICT support and that school management was supportive, institutional factors also appear not to be major inhibitors of change. Time spent using computers for teaching was not related to either age or IT competence level, implying that lack of general IT skills was not the relevant barrier. Teachers did report some resource constraints, especially in the area of specific Home Economics software and this is likely a partial explanation of the limited use of ICT for teaching. Questionnaire data indicated that lack of time, for practice with ICT and for preparing resources, was an issue for the teachers and the interviews included mention of teachers' need to maintain focus on the curriculum and associated assessment. Thus the demands of assessment may be limiting teacher freedom to adapt curriculum and pedagogy to integrate ICT, which is consistent with research reported by Becker (2000). In relation to the sixth barrier, subject culture, there were indications in the interview data that the practical nature of Home Economics may have had some effect, with teachers suggesting that class time was needed for practical activities and that live demonstrations were more effective than alternatives mediated by ICT.

Although all teachers had completed at least the IT professional development (PD) for the most basic level and most had completed 50 to 80 hours of PD for IT skills, consideration of the data using the TPACK model as a guide reveals some critical areas of interest as indicated in Figure 3. For the purposes of this analysis it can be assumed that all of the teachers were appropriately certified and had the necessary knowledge of content (CK), pedagogy (PK), and pedagogical content knowledge (PCK). Moreover, based on the teachers' own agreement that their IT skills were adequate, it is fair to assume that technological knowledge (TK) is sufficient or developing toward that point within the current PD provisions. The area remaining in question comprises the intersections of TK with PK and CK, shown as the shaded area in Figure 3.



Figure 3: TPACK and priority areas for professional development

In both the questionnaire and interview data there were indications that teachers were seeking both more subject specific ICT resources and professional development targeted to the use of ICT in teaching Home Economics. In other words, they expressed uncertainty about the intersection of their TK and CK, suggesting that their technological content knowledge (TCK) is in need of further development. The data about modes of use of ICT in the classrooms (Table 5) indicates that most use is for preparation or presentation of traditional expository lessons. Taken together with the data indicating their need for more PD about teaching Home Economics with ICT, this suggests that technological pedagogical knowledge (TPK) is also in need of further development. Given that TPACK lies at the intersection of TCK and TPK, it seems clear that this will be an area of need too.

The scale of the ICT in education initiatives undertaken by the HKSAR government leaves little room for doubt about the strength of the commitment to change at that level. It is clear too that much has been achieved in the areas of providing computers and associated infrastructure and in developing the essential ICT skills of teachers. However, in order to build upon those foundations and tap the reservoir of positive attitudes among these teachers, it seems necessary to provide for subject specific PD to enable teachers to effectively connect their existing CK and PK with their developing TK, generating TCK, TPK and TPACK. This appears to be the missing link required to accomplish the change process depicted in Figure 1, which represents a significant shift in teacher behavior that

requires development of new capabilities with technology. A study of PD to support teachers of science changing to inquiry-based teaching and the development of an investigative classroom culture found that it was "only after approximately 80 hours of professional development that teachers reported using inquiry-based teaching practices significantly more frequently-about two-tenths of a standard deviation-than the average teacher" (Supovitz & Turner, 2000, p. 973). A similar quantum of PD might be required to facilitate the development of TPACK and effective integration of ICT by Home Economics teachers, although it is possible that total PD time required for development of basic IT skills and TPACK could be reduced through designing PD in which skills might be learned in context.

Similar considerations should apply in the design of programs for pre-service preparation of teachers to ensure that newly graduating teachers are equipped to make effective use of ICT in their classrooms. As for inservice teachers, it will not be sufficient for programs to treat content, pedagogy and technology separately. The most critical areas for the desired changes to be successful appear to be in the areas of overlap of technological knowledge with the other forms of knowledge.

Substantial progress has been made toward effecting the change envisaged by the HKSAR authorities. The challenge now is to develop and deploy Home Economics teaching resources and the professional development to support teachers in overcoming the final barriers to success.

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