

Building the Capacity of the Next Generation of Teachers in Asia: Promising Practices and Lessons Learnt

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Information and communication technologies (ICT) offer schools the opportunities to improve their student learning outcomes; when ICT are used in classrooms, students are provided with the opportunities to develop the skills and attributes that prepare them for an increasingly ICT-mediated globalised world. These skills and attributes include accessing information, communicating, building knowledge, representing ideas, problem solving, creating and developing ideas and products, collaborating, and learning how to learn. In these ICT-mediated classrooms, the role of the teacher is pivotal in designing and implementing effective teaching and learning activities that engage students in the development of such skills and attributes (Lim & Chai, 2008). Therefore, teachers have to be equipped with the necessary ICT in education competencies from their pre-service teacher education days onwards.

Despite the financial and human resource investments to equip pre-service teachers with these competencies in their programmes, a gap still exists between what they are taught in their ICT in education courses and how they use ICT to enhance student learning outcomes in real classrooms (Pope, Hare & Howard, 2002; Enochsson & Rizza, 2009). The challenge for teacher education then is to prepare teachers who can constantly learn, unlearn and relearn; and construct new practices with ICT to enhance teaching and learning in schools. This special issue aims to identify and analyse the strategic dimensions within and among Asian teacher education institutions (TEIs) and agencies that support the use of ICT to build the capacity of the next generation of teachers to teach and learn in 21st century schools and classrooms. More specifically, this issue aims to (1) document and examine the good practices and lessons learnt of ICT in teacher education across different sociocultural contexts; and (2) examine the support mechanisms for ICT in teacher education in different Asian countries.

ICT in Education Competencies for Pre-service Teachers

Defining teachers' competencies regarding the use of ICT is a complex task since ICT-mediated activities in schools may range from administrative issues such as monitoring and managing students' learning progress and communicating with various stakeholders including parents, to designing and implementing lesson plans, assessing students' performance, and engaging in their own professional learning (Lim, Chai & Churchill, 2011). Various standards and frameworks have attempted to develop standards regarding teachers' ICT in education competencies. Based on Shulman's (1986) pedagogical content knowledge (PCK), Mishra and Koehler (2006) develop the technological, pedagogical and content knowledge (TPACK) framework to understand the various domains of knowledge that teachers require to apply ICT for teaching and learning. Niess (2008) suggests that in order to enhance pre-service teachers' TPACK, teacher education programmes should impact their ways of thinking by preparing them to address the following issues in ICT-mediated classrooms: understanding varying students' needs; planning and designing learning environments to meet specific students' needs; developing instructional strategies to attend to student needs; identifying effective classroom management strategies to support students' learning; and assessing students' learning. TPACK then serves as an analytical theoretical framework for guiding and explaining teachers' thinking about ICT use to enhance teaching and learning.

Two papers in this special issue, one by Chai, Koh, Ho and Tsai (2012) and the other by Romeo, Lloyd and Downes (2012), have drawn upon the TPACK framework to examine the impacts of an ICT in education course and a national "Teaching Teachers for the Future" (TTF) project on pre-service teachers' competencies. The first paper examines the relationships among Singaporean pre-service teachers' perceptions of the constructs pertaining to TPACK and their perceived ability to integrate cyberwellness knowledge when designing Web-related learning. For the latter paper, TPACK provides a framework for the resources built in the TTF project, guides the development of a national student survey, and provides the project with a common language among its various stakeholders. In another paper, Dionys (2012) has described how the TPACK framework is adopted by the Teacher Training Department of the Ministry of Education, Youth and Sports (MoEYS) of Cambodia and VVOB (Flemish Association for Development Cooperation and Technical Assistance) to implement the Science, Environmental and Agricultural Life skills (SEAL) programme; the programme aims to enhance the integration of ICT in pre-service teacher education in Cambodia. Peeraer and Petegem (2012) also adopt the TPACK

framework to design a professional development programme to build the capacity of teacher educators in Vietnam.

Besides the TPACK framework, the revised ICT Competency Framework for Teachers (ICT-CFT) developed by UNESCO (2011) also provides a set of practical guidelines for the types of competencies that teachers have to develop by setting curricular goals and the expected teachers' ICT competencies in six aspects of a teacher's work: understanding ICT in education; curriculum and assessment; pedagogy; ICT; organisation and administration; and teacher professional learning. The teacher education institution capacity building toolkit described by Lim and Pannen (2012) in this special issue has drawn extensively on this framework. The authors document how the toolkit has been used by four Indonesian education universities to build their capacity for ICT in education. This framework and earlier version of a similar framework, more important, have informed the development of various national standards that identify the ICT in education competencies expected of teachers in countries such as Australia, Brazil, China, Japan, Rwanda, and the United States. For example, the International Society for Technology in Education (ISTE) in the United States developed the National Educational Technology Standards for teachers (NETS.T) together with the standards for students (NETS.S) and for administrators (NETS.A). The standards for teachers define a set of ICT in education competencies that teachers have to acquire to engage students in their learning.

These national standards have been used to guide the programme development and implementation phases documented in the papers by Chang, Chien, Chang and Lin (2012) and Yan, Xiao and Wang (2012) in this issue. The former group of authors refer to the "ICT Literacy Standards for Primary and Secondary Teachers" established by the Ministry of Education of Taiwan in 2008 to identify gaps in the existing teacher education courses and redevelop a Science teacher education course at the National Taiwan Normal University. The latter group refer to the Ministry of Education of the People Republic of China's set of professional standards for teachers – "Educational Technology Competency Standards for Primary and Secondary Teachers" established in 2004. They explain how the Modern Educational Technology Centre of East China Normal University enhances the educational technology course for pre-service teachers by emphasising on knowledge and skills transfer, focusing on common ICT and cutting-edge technologies, and creating a supportive learning environment by using an online platform.

Although national and international standards have been in place in some Asian countries for the last decade, South Korean teacher educators, Kim, Choi, Han and So (2012) in this issue highlight that due to the academic autonomy of universities, many governments have not formulated centralised policies for ICT in education for pre-service teacher education. This has led to the varied approaches of developing ICT in education competencies across teacher education institutions within the country and between countries. These authors examine the pre-service teacher education programme in three South Korean universities and identify common themes and challenges despite the differences in approach and practice among the universities. The approaches adopted by all three universities have focused on developing pre-service teachers' new media literacy skills and adaptive expertise; however, many of the pre-service teachers have indicated difficulties in integrating these new ideas into their classrooms, making sense of the various course activities in the programme, and understanding the design contexts in their projects.

Approaches to Developing ICT in Education Competencies in Pre-Service Teacher Education Programmes

Besides the paper from South Korea, the other papers in this special issue also document different approaches adopted by teacher education programmes to develop the ICT in education competencies of pre-service teachers and in some papers, examine the impact on pre-service teachers' competencies and their future practices in schools. Lan, Chang and Chen (2012) adopt a three-stage cyclical model of cooperation-based cognition, action and reflection (CoCAR) to implement a 18-week course to develop pre-service Chinese as a Foreign Language (CFL) teachers' online synchronous teaching skills in a Taiwanese university. They explain how the CoCAR model has benefited the pedagogical development of pre-service teachers and supported them in online synchronous teaching activity design and tool usage, and how it has created a conducive environment to develop technological and pedagogical knowledge. In the pre-service Science teacher education programme, Chang, Chien, Chang and Lin (2012) uses the Modelled, Analysis, Guided Development, Articulated Implementation and Reflected Evaluation (MAGDAIRE) model to enhance a science education course to develop the pre-service teachers ICT in education knowledge and skills. The authors highlight that pre-service teachers who have undergone this course have become more sensitive to the complex interactions between ICT, pedagogy and subject matters.

These approaches discussed by the authors in this special issue are consistent with three recent journal papers by Steketee (2005), Kay (2006), and Ottenbreit-Leftwich, Glazewski and Newby (2010). Steketee (2005)'s review of the approaches to ICT in education competencies development in pre-service teacher education programmes are based on journal papers between 2000 and 2004. She identifies and analyses four main approaches: (1) ICT competencies development, (2) ICT pedagogy, (3) subject-specific, and (4) practice-driven approach. Based on the review of 68 refereed journal papers from 1995 to 2005 that focuses on incorporating ICT into pre-service education programmes, Kay (2006) identifies ten different strategies adopted by programmes: (1) delivering a single ICT course; (2) offering mini-workshops; (3) integrating ICT in all courses; (4) modelling how to use ICT; (5) using multimedia; (6) collaboration among pre-service teachers, mentor teachers and faculty; (7) practicing ICT in the field; (8) focusing on education faculty; (9) focusing on mentor teachers; and (10) improving access to software, hardware, and/or support.

The most recent thorough examination of teacher education programmes regarding developing pre-service teachers' ICT in education competencies is by Ottenbreit-Leftwich and colleagues (2010) who analyse over 100 teacher education programmes. They propose a conceptual guide that addresses three main elements of teacher education programmes: approaches (information delivery, hands-on activities, practice in the field, observation or modelling, authentic experiences, and reflection), ICT content goals (e.g., NETS-T standards), and the broader context (e.g., stand-alone course, full implementation). With the conceptual guide, they aim to provide an instrument for TEIs to evaluate various experiences and select the most appropriate ones to achieve their goals of preparing pre-service teachers to use ICT in their future teaching.

The three reviews may have slightly different focus, but they share several commonalities of developing ICT competencies, subject/content knowledge, and pedagogical knowledge through campus-based courses such as ICT-mediated pedagogy course, and authentic learning experiences in courses such as the practicum. Chai, Koh, Ho and Tsai (2012) in this issue describes an ICT-mediated pedagogy course in Singapore entitled "ICT for Meaningful Learning"; the course has been designed to facilitate the pre-service teachers' development of TPACK-related knowledge so that they are well prepared for ICT integration in the classrooms. Similarly, the paper by Yan, Xiao and Wang (2012) documents a common approach adopted by Mainland Chinese universities of implementing an ICT-mediated pedagogy course in the pre-service teacher education programme that focus on how to integrate ICT into classroom practices. Pre-service teachers are expected to complete two compulsory ICT skills courses within their first two years of the teacher education programme; an ICT-mediated pedagogy course, and an integration of ICT within the teaching subject course. Such practices are also common in Australia; for example, at La Trobe University in Australia, first year pre-service teachers learn about Interactive White Boards (IWBs) in an ICT course in the first semester, and in a mathematics education course in the second semester, they are expected to apply their skills in using IWBs to enhance teaching and learning in the Mathematics classrooms (Campbell & Kent, 2010).

Although none of the paper in this special issue focuses on how the pre-service teachers' ICT in education competencies are applied and developed during the practicum, most of the papers acknowledge the pivotal role of practicum in the teacher education programme to develop these competencies. Education researchers have observed that pre-service teachers often adopt traditional teaching and learning practices in ICT-mediated classrooms based on their own experiences as students; these researchers argue that unless ICT in education is included as part of their practicum, pre-service teachers are likely to remain uncommitted and reluctant users (Bielefeldt, 2000; Willis & Sujo de Montes, 2002). Mehlinger and Powers (2002; p.68) explain that a field-based ICT in education course "provides authentic contexts for the learning of technology and offers a meaningful setting for teacher candidates to learn how technology tools can support learning in K-12 classrooms" and "provides teacher candidates with opportunities to observe professors modelling integrations of technology in teaching and learning".

In this regard, an increasing number of teacher education programmes have embedded ICT in education as part of the pre-service teachers' practicum experiences. Pre-service teachers are encouraged and supported to design classroom activities that centre on ICT-mediated teaching and learning. For example, as part of their ICT-mediated pedagogy course, pre-service teachers at the University of Notre Dame Australia design ICT resources for their practicum experiences (Steketee, 2005). Ward and Overall (2011) document how pre-service teachers use ICT in classrooms during their practicum as part of the requirement of the course. Pre-service teachers are provided with opportunities and support to integrate ICT into a teaching unit based on learning theories and current research, and spend quality time in high school classrooms with a mentor teacher. The findings suggest that these opportunities and support enhance pre-service teachers' competence and confidence in using ICT in the classroom.

Besides the approaches adopted by courses, Romeo, Lloyd and Downes (2012) in this special issue highlights the importance of teacher educators modelling the use of ICT for teaching and learning within their programme. These authors explain how ICT may become part of the everyday practices of teacher education programmes. These practices may include the use of ICT as communication platforms for pre-service teachers and teacher educators, use of learning management systems by teacher educators, delivery of courses in an ICT supported platform such as the wiki, and adoption of computer-mediated communication tools to facilitate supervision of programmes. Fleming, Motamedi and May (2007)'s study of 79 pre-service teachers reveals a positive relationship between the extent to which they are exposed to teacher educators or mentor teachers modelling the use of ICT in teaching and learning and their self-assessment of their own ICT in education competencies. Research studies have also shown that ICT in education competencies among pre-service teachers may be developed by learning with ICT rather than about ICT (Drier, 2001; Guy, Li & Simanton, 2002). Geer and Hamill (2007) use electronic journaling (via discussion forums) to promote collaboration between special education and general pre-service education teachers, during the field experience of their method courses. ICT is increasingly been used as a communication platform during pre-service teachers' practicum to connect them to one another, their supervising university teacher educators, and mentoring school teachers (Dawson & Dana, 2007; Mayer, 2000; Paulus & Scherff, 2008; Robertson, 2008). Digital portfolio has also been used in various teacher education programmes to allow pre-service teachers to monitor and manage their own learning (e.g. Chuang, 2010; Maher & Gerbic, 2009).

Addressing Issues and Challenges

Despite the reforms in teacher education programmes to develop pre-service teachers' ICT in education competencies, they are criticised for not being able to facilitate pre-service teachers' critical examination of the affordances of ICT and for teaching and learning (Angeli & Valanides, 2009; Goktas, Yildirim & Yildirim, 2008; Jang, 2008; Koehler, Mishra & Yahya, 2007; Lim & Chai, 2008); and as a result, there may be a gap between the ICT in education competencies that are developed in the teacher education programme and the use of ICT for teaching and learning in schools. This section identifies the issues and challenges faced by teacher education programmes to address this gap and how some of the papers in this special issue attempt to address this gap.

Pre-service teachers' development of ICT in education competencies is a complex process (Tondeur, Braak, Sang, Voogt, Fisser & Ottenbreit-Leftwich, 2012). Teacher education programmes need to support them in developing knowledge of good pedagogical practices, technical skills, and content knowledge, as well as how these concepts relate to one another (Koehler & Mishra, 2009). Koehler and Mishra (2009) introduce the concept of Technological Pedagogical Content Knowledge (TPACK). TPACK emphasizes the importance of preparing pre-service teachers to encompass an integrative knowledge base of technological knowledge and skills, as well as knowledge of learners, subject matter content, and pedagogy necessary for teachers to be competent to teach with technology in the classroom. ICT integration includes a spectrum of approaches to teaching and learning (Tondeur et al., 2012), however, the growth in technological, pedagogical, and/or content knowledge will not automatically contribute to the growth in TPACK (Angeli & Valanides, 2009). Education researchers (Angeli, 2005; Jang, 2008; Koehler et al., 2007; Wilson, 2003) observe that many existing pre-service teacher education programmes treat technological, pedagogical, and content knowledge as three isolated elements of technology integration. The most common criticism is the lack of linkages of courses/units in the programme that appears disconnected to the pre-service teachers (Hammerness, Darling-Hammond, Grossman, Rust & Shulman, 2005). Therefore, a single course is unlikely to equip pre-service teachers with all the necessary competencies for the ICT integration. It is expected that all courses need to build on one another and collectively support the pre-service teachers to progress beyond the mastery of basic ICT competencies (Lim, Chai & Churchill, 2011).

Connections with Pedagogical Approaches and Content Knowledge

Effective teaching with ICT needs to focus on the connections and interactions among subject content, pedagogy, and technology. Teachers with highly developed TPACK are more likely to design lessons that successfully integrate ICT for the teaching of subject matter (Chai, Koh, Tsai & Tan, 2011; Koehler & Mishra, 2005). If technology skill lectures are overly fragmented and unconnected to real classroom contexts, or irrelevant to both the development of pre-service teachers' subject matter knowledge and teaching knowledge, these types of training cannot provide pre-service teachers adequate knowledge to use ICT to enhance teaching and learning (Chien, Chang, Yeh & Chang, 2012).

The papers in this special issue have shown how the pedagogical approaches for most core or compulsory ICT

in education courses have shifted away from a transmission-based ICT skill training approach towards a more problem-based learning constructivist approach. Yan, Xiao and Wang (2012) explain how the Modern Educational Technology course in East China Normal University has been revised after the course coordinators and tutors conduct a comprehensive analysis of the pre-service teachers ICT knowledge and skills, aptitude for learning and the requirements of curriculum reform. However, they highlight certain ICT in education competencies that have to be developed at the programme level, such as, how to effectively use new ICT tools to support and enhance teaching and learning in different subjects. The courses reported in Kim, Choi, Han and So's (2012) paper have also shown the pedagogical shift of the core ICT in education courses towards more constructivist approaches where pre-service teachers become more media-fluent by designing, creating, and expressing themselves with technologies. Tsai and Chai (2012) in their position paper based on their analysis of the three short papers (Lim & Pannen, 2012; Yan, Xiao & Wang, 2012; Dionys, 2012) in this issue highlight that the third-order barrier of ICT integration in schools is the lack of designing thinking among teachers. Hence, pre-service teacher education programmes have to consider how the design thinking skills and dispositions of pre-service teachers may be developed.

Modelling of ICT Use for Teaching and Learning

When teacher educators regularly model the use of ICT in their pre-service teacher education classes, they expose pre-service teachers to various innovative ways of using ICT for teaching and learning (Steketee, 2006). It may then foster deep changes in their beliefs about the educational value of integrating ICT in enhancing their students' learning. Hence, teacher educators are expected to model the use of ICT across various contexts and contents with various pedagogies (Lim, Chai & Churchill, 2011). In the paper by Romeo and colleagues (2012), one of the key components of the TTF project involving all schools of education in Australia is capacity building in pre-service teacher education; where teacher educators work with more experienced colleagues or undergo a series of professional learning sessions to use ICT in their own courses. As a result, pre-service teachers have the opportunities to observe how their teacher educators deal with ICT integration; the shared process of authentic ICT integration is then more likely to develop pre-service teachers' competencies to cope with real life issues of ICT integration (Chien, Chang, Yeh & Chang, 2012). At the same time, teacher educators have to elucidate their tacit knowledge to pre-service teachers by explaining exactly what they are doing and thinking.

Assessment

Designing assessment is an integral part of the ICT curriculum development task. Assessment practices ranging from standardized performance tests to e-portfolio have been employed for the evaluation of pre-service teachers' competencies integrating ICT into classrooms (Lim, Chai & Churchill, 2011). There are four areas of assessment: teachers' ICT competencies, attitude and beliefs towards use of ICT, pedagogical reasoning and actual use of ICT in classrooms (Haydn & Barton, 2007). There are three principles that teacher educators may draw upon in the design of assessment: (a) linkage to curriculum. Assessments that are not linked to curriculum are not valid forms of assessment. (b) balance between process and product (Lim, Chai & Churchill, 2011). Various forms of assessment may be integrated and balanced in the curriculum for the evaluation of both the process and product of integrating ICT for classroom learning (Park & Ertmer, 2007). (c) authenticity of assessment tasks. Setting authentic assessment tasks help pre-service teachers to focus on acquiring the necessary competences and dispositions for the integration of ICT in the real world (Lim, Chai & Churchill, 2011). Kim, Choi, Han and So (2012) in this special issue have provided an example of how the principles may be applied to the design of assessment tasks in one of the case studies of South Korean universities, and have provided digital artefacts of these tasks.

Practicum

Practicum or field experience has been viewed as an important component of teacher education as it provides an authentic learning environment for pre-service teachers to make sense of and acquire the theoretical knowledge they have acquired (Dexter & Riedel, 2003; Sime & Priestley, 2005). It is common for TELs to encourage pre-service teachers to use ICT and reflect on its use during the practicum. The following two strategic foci have to be taken into consideration: (1) linkages to curriculum and assessment that would help pre-service teachers feel more prepared for the actual use of ICT in their future classrooms, and (2) support in schools. The effectiveness of promoting the use of ICT during practicum depends on the university supervisor and the mentor teachers' support and adequate access to ICT (Lim, Chai & Churchill, 2011). However, there are still many pre-service teachers who have not been given the opportunity to use ICT in classrooms due to lack of sufficient supporting conditions (Pope et al., 2005). Although some of the papers in this special issue (Lim & Pannen, 2012; Romeo,

Llyod & Downes, 2012) have mentioned the role of the practicum in developing the ICT in education competencies of the pre-service teachers, none of the papers provide details of how the ICT in education competencies of pre-service teachers may be developed and enacted.

Towards a More Holistic Approach of Developing ICT in Education Competencies of Pre-Service Teachers

It is crucial for pre-service teachers to graduate with a set of ICT in education competencies to be contributing members and in some cases, the change agents of the school community. Unfortunately, many new teachers still feel unprepared to use ICT for teaching and learning in their classrooms, criticising the pre-service teacher education programmes for not developing their ICT in education competencies adequately for the real world (Duran, 2000; Moursund & Bielefeldt, 1999; Bullock, 2004; Mehlinger & Powers, 2002). Conventional pre-service teacher education programmes have been criticized for their failure in facilitating pre-service teachers' critical re-examination of the connection between the affordances of ICT and their teaching and learning practices (Angeli, 2005; Enochsson & Rizza, 2009; Jang, 2008; Koehler, Mishra & Yahya, 2007; Lim & Chai, 2008; Mishra & Koehler, 2006).

Many TEIs in Asia have recognized these challenges and have been working out ways to redesign and refine their pre-service teacher education programmes to be able to not only meet the learning needs of the pre-service teachers, but also the schools and education systems (Goktas, Yildirim & Yildirim, 2008). The papers in this special issue intend to provide readers with some of these efforts by the various TEIs and teacher education agencies in Asia, spanning from Cambodia and Vietnam to Indonesia and Australia. The papers by Yan, Xiao and Wang (2012), Chang, Chien, Chang and Lin (2012), and Dionys (2012) have explained how the teacher education programmes have moved away from a piece-meal approach in the development of ICT in education competencies towards a more holistic one; this is being done by ensuring the vertical alignment between the ICT in education competencies standards, the programme learning outcomes and the course learning outcomes. While the papers by Romeo, Llyod and Downes (2012), and Lim and Pannen (2012) have documented how the capacity of TEIs may be built to ensure that they are better positioned to develop the ICT in education competencies of the pre-service teachers.

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