

A Framework for Developing Pre-Service Teachers' Competencies in Using Technologies to Enhance Teaching and Learning

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Abstract

This paper presents a framework for developing pre-service teachers' competencies in using technologies to enhance teaching and learning. It focuses on building the capacity of teacher education institutions (TEI) based on six strategic dimensions: (a) Vision and Philosophy; (b) Program (c) Professional Learning of Deans, Teacher Educators and Support Staff; (d) ICT Plan, Infrastructure, Resources and Support; (e) Communications and Partnerships; and (f) Research and Evaluation. This paper describes each of these six strategic dimensions and synthesizes these in the overall framework for developing pre-service teachers' competencies in generating technology- enhanced teaching and learning.

Introduction

The rapid advancement of information and communication technology (ICT) and its pervasive use in work and daily life have dramatically changed the way we live; the way businesses are conducted; and the way knowledge is constructed, distributed, challenged and improved upon. These ICT-driven developments challenge many assumptions of what students should learn in schools and how education should be delivered (Voogt, 2010). Students have to be able to solve complex problems, think creatively and critically, communicate and collaborate with others from diverse backgrounds with the support of technologies. Teachers in such learning environments have to assume the challenging role of a mediator and a knowledge broker: to provide strategic support to help students to become self-directed learners. This changing role of teachers has serious implication for their professional learning – from pre-service to induction and through to in-service teacher education (Chai & Lim, 2011; Kirschner & Selinger, 2003; UNESCO, 2008). The challenge for teacher education then is to prepare teachers who can constantly learn, unlearn and relearn; and construct new practices with technologies.

The framework is the product of the collaborative activities of scholars from three leading teacher education institutions (TEIs) in the Asia-Pacific region; with close consultation with and feedback from education deans, teacher educators and other teacher education stakeholders from the region. After weeks of face-to-face and online discussions, review of experiences and results of extensive prior literature review, the framework was articulated. This framework aims to support TEIs to develop pre-service

teachers' ICT in education competencies. Although the framework is initially developed to support TEIs in Asia-Pacific, the feedback received from colleagues and deans from the authors' presentations suggests that it is applicable to institutions across the world.

While teacher educators generally agree that using ICT in teaching and learning in schools is important, there are gaps in the existing pre-service teacher education program that may hinder the development of such competencies (Haydn & Barton, 2007). Many TEIs offer single ICT in education course as part of the pre-service teacher program that does not prepare teachers for the complexities of teaching and learning in ICT-mediated classrooms (Lawless & Pellegrino, 2007). Furthermore, research studies indicate that the use of ICT for teaching and learning among teacher educators in TEIs is generally low (Drent & Meelissen, 2008; Zhou & Xu, 2007). Many issues pertaining to digital equity, cyber wellness and social justice are also emerging from the pervasive use of ICT and they need to be adequately addressed in pre-service teacher education (Chou & Peng, 2011; Selwyn, 2008).

Given these challenges facing TEIs, this paper aims to build the capacity of TEIs to provide a meaningful context that allows pre-service teachers to critically examine their own pedagogical beliefs and explore the application of ICT in a more constructivist learning environment. While the traditional and constructivist approaches are not to be treated as a dichotomy; the stance of this paper is to promote more constructivist approaches that encompass not only meaning making of concepts and theories but also self-regulated learning and personal agency. As the use of ICT in schools by teachers includes a range of activities, this paper focuses mostly on developing pre-service teachers' competencies in the pedagogical use of ICT. Other competencies, such as ICT-mediated administration and communication may be better addressed during on-job-training.

Framework for Capacity Building of TEIs

Kirschner and Selinger (2003) emphasise the need for a framework of actions to extend beyond teachers, teacher educators and researchers to include students, industrial partners, government and society in general. Current research and reports on pre-service teacher's preparation for the use of ICT in education has several issues such as unclear documentation of contexts and courses, poor data collection, and small sample size (Kay, 2006). In order for teacher education to move forward, more rigorous research/design and development activities are needed (Angeli & Valanides, 2009; Haydn & Barton, 2007; Lawless & Pellegrino, 2007; Kay, 2006). This paper integrates these key activities in its proposed framework for TEIs to engage in the strategic planning of capacity building for ICT in education. This framework includes six strategic dimensions:

- (a) Vision and Philosophy;

- (b) Program: Curriculum, Assessment, and Practicum;
- (c) Professional Learning of Deans, Teacher Educators and Support Staff;
- (d) ICT Plan, Infrastructure, Resources and Support;
- (e) Communications and Partnerships; and
- (f) Research and Evaluation.

By considering these strategic dimensions, TEIs are more likely to generate coherent internal and external processes that would enhance their capacity in developing pre-service teachers' competencies for innovative use of ICT. To facilitate the strategic planning processes, further strategic foci in each dimension have also been written with some depth. By employing the framework, leaders of TEIs would be able to jump start their strategic planning processes and begin formulating strategic plans for their respective TEIs.

Figure 1 below depicts how we relate the six strategic dimensions. Deriving from the shared vision and philosophy, which we assume TEIs have to at least formulate some tentative statements for the rest of the dimensions to build upon, the program exemplified the vision and philosophy in the classrooms and beyond where the pre-service teachers are educated. It is supported by the other four strategic dimensions that provide the leaderships, structures and resources, partnerships and research and evaluation.

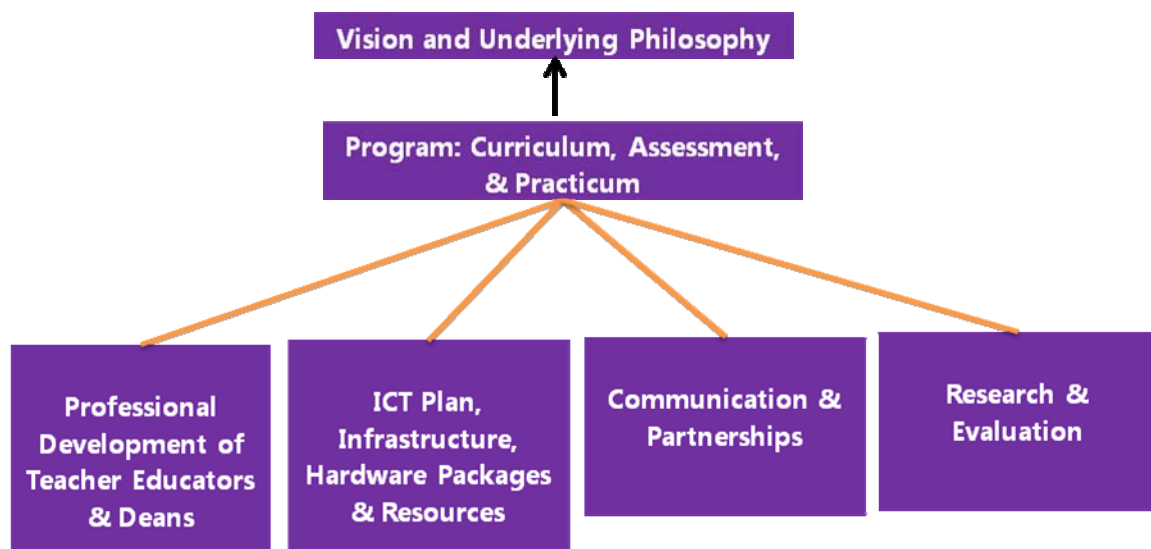


Figure 1: Framework for Capacity Building of TEIs

Strategic Dimension 1: Vision and Philosophy

The creation of a shared vision and its underlying philosophy provide institution leaders and teacher educators a vehicle for coherent communication about how ICT may be effectively

used for teaching, learning and administration in the teacher education institution (TEI). Within this dimension, the strategic foci are:

- Institutional Vision for ICT in Education
- Underlying Philosophy for Teaching and Learning with ICT
- Review of ICT in Education Vision

Institutional Vision for ICT in Education

Churchill and Lim (2007) point out that one barrier to ICT integration in education institutions is the lack of comprehensive vision by their leaders. The establishment of institutional vision is the primary means through which the organization defines its identity, articulates its aspirations, and fosters the commitment among its staff (Abelman & Dalessandro, 2008). Articulating a coherent vision for the TEI in terms of its ICT environments and its ICT-pedagogical foundation is a necessary and meaningful exercise. This involves institution leaders and teacher educators in co-constructing the rationale for change and ensuring that the changes are pedagogically driven.

The process of envisioning implies the importance of ownership of the vision by all members of the TEI; rather than a top down vision imposed by the senior management of the TEI. The formulation of shared vision and the development of strategic plans are therefore essential in that they direct the efforts of all staff within the TEI towards that shared vision (Lim & Khine, 2006). In addition, the relevance of the vision has to be established through environment scanning. For example, in preparing a new vision for European countries, Punie (2007) considers not only the needs of economic development and the trend in ICT advancements but also the social trends and challenges. A more comprehensive understanding of current and future trends leads to a more robust and relevant institutional vision for ICT in education.

Underlying Philosophy for Teaching and Learning with ICT

An inevitable part of envisioning involves introspection among teacher educators and leaders in the TEI to re-examine their roles in a changing time. Most educational technologists strongly advocate the use of ICT to facilitate the processes of knowledge construction (Selwyn, 2008). Underpinning such inclination is a strong commitment towards the philosophy of constructivism. Knowledge, from the constructivist point of view, are tentative ideas about the world and knowing is a process of constructing better understanding about some phenomena. Teaching and learning founded on constructivism is different from the practices that are founded on objectivism. An understanding of the current beliefs and perspectives that teacher educators and leaders hold may serve to unpack the underlying philosophy of the institutional vision.

Review of ICT in Education Vision

The vision of a TEI may be based on fundamental values that can last the test of time. However, given the current trends of ubiquitous computing devices and the emergence of Web 2.0 technologies, ICT in education visions have to be constantly revisited to stay relevant. Ministries of education in many countries have been constantly revising and fine-tuning their ICT in education visions and strategic plans. For example, the evolution of the policies associated with ICT in Singapore and Hong Kong reflects the proactive stance of these governments towards ICT. As such, the ICT in education vision developed by TEIs may need to be reviewed as the needs of schools and society change with the advancement of ICT.

Strategic Dimension 2: Program - Curriculum, Assessment, and Practicum

Well designed pre-service ICT courses equip teachers with essential ICT and pedagogical competencies to integrate ICT for content teaching (Chai, Koh & Tsai, 2010). This strategic dimension includes three strategic foci: Curriculum, assessment and practicum.

Curriculum

To design an effective curriculum for pre-service teachers, adequate instructional analysis is imperative. Education researchers have identified a range of contextual or learner-related variables that promote or inhibit pre-service teachers' use of ICT during their practicum or field experience. Contextual variables that influence pre-service teachers' use of ICT include access, time and support from mentoring teachers and other colleagues (Hadyn & Barton, 2007). Important learner-related variables include epistemological and pedagogical beliefs, self-efficacy and computer skills (Chai, 2010; Drent & Meelissen, 2008; Swain, 2006). These variables need to be considered in the design of the pre-service teacher curriculum. Task analysis refers to the analysis of how an expert performs his/her job. In designing pre-service teacher curriculum, teacher educators have to analyze how exemplary teachers use ICT effectively in schools.

In the design of curriculum, decision about the pedagogical approach is important. Recent developments in this area indicate introductory ICT courses have shifted away from a transmission-based skill training approach towards a more problem-based learning constructivist approach. However, most introductory educational technology courses adopt a combination of both approaches based on the objectives of the activities (see for example, Chai, Koh & Tsoi, 2010; Lim & Chan, 2007). In addition, teacher educators should model the

use of ICT in their pre-service teacher education classes. Modelling addresses the problems of pre-service teachers' inability to envision how ICT may be used in the classrooms and it may foster deep changes in teachers' beliefs (Dexter, Doering, & Riedel, 2006; Steketee, 2006).

Pedagogically meaningful use of ICT is about employing appropriate affordances of ICT tools to augment students' learning (Jonassen et al., 2008; Lim & Chai, 2008; Loveless, 2007). Depending on the content and the learner characteristics, meaningful use of ICT involves choosing the optimal technology to foster knowledge construction among students.

Assessment

Well-designed assessment tasks engage students in the learning process. Assessment practices ranging from standardized performance tests to e-portfolio have been reported in literature. There are four areas of assessment: ICT competencies, attitude and beliefs towards technology, pedagogical reasoning and actual use of ICT in classrooms (Haydn & Barton, 2007). These may be evaluated with project/artefacts analysis, surveys, short argumentative/reflective papers and classroom observations, which could all be part of an electronic portfolio.

Park and Ertmer (2007) report on their use of problem-based learning approach for an introductory educational technology course. It provides a good example of the multiple modes of assessment that are arguably balance in terms of process and product. The pre-service teachers were challenged by a trigger problem of applying for a new teaching position that requires the candidate to demonstrate their ability to integrate ICT through a portfolio. The teachers then plan draft lessons for specific groups of learners, detailing the resources and assessment methods to be employed. These drafts allow the teacher learning to be tracked over time.

Park and Ertmer's design of assessment are considered as authentic as the competencies required to complete the tasks are the same competencies that teachers need in school settings. However, one may argue that the authenticity of the assessment may be further enhanced by the conduct of the actual lessons. This leads us to consider the next important strategic focus.

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 theoretical knowledge and practice the skills they acquire. It is therefore common for TEIs to encourage pre-service teachers to use ICT and reflect on its use in classroom.

However, the effectiveness of promoting the use of ICT during practicum is dependent on the university supervisor and the mentor teacher's support and adequate access to ICT (Dexter & Riedel, 2003; Brown & Warschauer, 2006).

Among the literature, Brush and his colleagues' (2003) field-based model seems to be most radical. In their model, the pre-service teachers are required to design, implement and review ICT integrated lessons during their practicum. The pre-service teachers experienced learning of some content through lessons designed by experienced teachers through the modelled ICT integrated lessons. Subsequently, they critique and redesign the lessons, implement the lessons and reflect upon them. This model enhanced the pre-service teachers' attitude and skills towards using ICT in classrooms.

Strategic Dimension 3: Professional Development of Deans, Teacher Educators and Support Staff

The role of the deans, teacher educators and support staff is pivotal for the success of preceding strategic dimensions. Although the deans and teacher educators are experts in their respective disciplines, many of them lack the experience of using ICT for teaching and learning. Therefore, the continual professional development (PD) of deans, teacher educators and support staff on ICT in education is pertinent. One-off workshops and seminars are unlikely to address the PD needs that could transform teaching and learning practices. Therefore, this strategic dimension focuses on two strategic foci:

- Professional Development Culture
- Conducive Conditions for ICT Professional Development

Professional Development Culture

In order for teacher educators to transform practices with regards to the pedagogic use of ICT, they have to be provided with the opportunities to engage in reflective conversations about their existing practices and generate usable knowledge to inform their future practices (Schon, 1992). TEIs then have to facilitate the examination of teaching and learning activities and an understanding of the complexities of ICT-mediated learning environments by the deans, teacher educators and ICT support staff as part of their ongoing PD culture.

Research studies that examine the effectiveness of PD for developing ICT in education competencies have highlighted some key characteristics: longer duration (often with follow-up activities), meaningful and relevant activities for teachers' own contexts, access

to ICT in teaching and learning, and collaboration and community building (Lawless & Pellegrino, 2007). One-off workshops and seminars or one-size-fits-all professional learning workshops without ongoing support tend to fragment the professional learning (Jacobsen & Lock, 2004). However, due to the financial cost involved, ongoing, systematic PD with support for staff members in their own TEIs is rare (Rust, 2009).

Empowering TEI staff to manage their own PD trajectory as a dean, teacher educator and ICT support staff may enhance the effectiveness of PD programmes (Lieberman, 2009). TEI staff needs to have ownership of the changes associated with the use of ICT in teaching and learning, from self-reflection and re-evaluation, so that they understand clearly their practice, learning and goals (Fullan, 1999). This is consistent with research studies that emphasise the need for PD activities to be tailored to individual educator's needs (Lawless & Pellegrino, 2007). Therefore, support has to be given to the staff in developing and monitoring their PD plans in their learning communities. Monitoring the PD plans will have to go beyond the examination of development of ICT competencies and confidence; and changes to teacher educators' own practice. TEIs may need to examine the pre-service teachers' work and their ICT in education competencies, which are the intended outcomes of the staff PD activities.

Mentoring and peer coaching have become an important component of the PD of educators (Walkington, 2005). The collaborative nature of mentoring and peer coaching provide teacher educators with help, peer support, trust, acknowledgment, and control of their learning activity; providing a more whole institution approach towards PD; it emphasises on meeting the individual needs of teacher educators in the context of personal relationship. It provides a safe environment for reflecting on one's own practice, and reduces the solitary nature of classroom practices and replaces it with a much needed, healthy and beneficial relationship between teacher educators (Feiman-Nemser, 2001).

Conducive Conditions for ICT Professional Development

This strategic focus discusses the conditions that are necessary and sufficient to foster the preceding discussion of PD culture. The necessary conditions include access to ICT, release time for professional learning (Cuban, Kirkpatrick, & Peck, 2001), and relevance to teacher educators' own practice (Lim, 2007). Teacher educators, deans and ICT support staff's perceptions of ICT in education are crucial in determining their engagement in the PD activities. Such perceptions may be shaped by their belief systems about the pre-service teachers in their TEI, "good teaching" in their TEI context, and the role of ICT in everyday lives (Zhao, Pugh, & Sheldon, 2002).

Integral to the focus of conducive environments, the reward and incentive structure for PD is another significant condition. Professional development grants may be made available for staff to build their capacity in the use of ICT for teaching, learning and administration. These grants may be awarded on a competitive basis where individuals or teams submit proposals of their planned PD activities that may include building communities, developing mentors and peer coaches, or attracting visiting scholars. Besides grants, subsidies may also be made available for staff to undertake PD programmes organised by other training agencies. To ensure accountability, these grants and subsidies may then be tied to staff appraisal system for innovative and effective use of ICT in teaching and learning.

Strategic Dimension 4: ICT Plan, Infrastructure, Resources and Support

Establishing appropriate ICT plan, infrastructure, resources and support are critical components of the overall strategy for ICT integration. Within this dimension, the strategic foci are:

- ICT Plan
- ICT Infrastructure, Hardware and Resources
- ICT Support

ICT Plan

Implementation of ICT infrastructure, resources and support strategy must be guided by a carefully and strategically developed ICT Plan. This is a complex task, requiring careful coordination, consultations and financial resources. This also requires understanding and alignment amongst many socio-cultural aspects and integral components such as institutional policies, perspectives of key personals, knowledge of current and emerging technologies, as well as external forces such as government policies and global developments (see Lim, & Hung, 2003; Churchill, 2008). A committee that is made up of various stakeholders may be set up to develop the plan, guide the implementation and review and ensure adherence. The plan, however, must be open and flexible enough to accommodate the adoption of emerging technologies and associated practices.

ICT Infrastructure, Hardware and Resources

Setting up the ICT infrastructure requires consideration of available physical infrastructure (e.g., rooms for servers, computer rooms/labs, network points, wireless hubs, etc), human resources to set up and maintain this infrastructure, and availability of financial resources to support such a project. The key components of such infrastructure and hardware include

network, internet access on- and off-campus, computer rooms/laboratories, and laptop schemes for staff and students.

A number of software tools are required for effective teaching and learning. Appropriate selection, installation, configuration and management of these tools will ensure development of the TEI capacity to support teaching and learning not just in classroom environment but also anytime and anywhere (see Peñalvo, 2008). This system of tools will support the management of digital assets, course development, activities and administration of learning. Learning management system or LMS can usually facilitate the creation and delivery of course materials, tests, archive courses, track pre-service teachers' results, and keep statistics about usage of resources. Some LMS systems also include blogs, wikies and other so called plug-ins that extend basic functionality.

Individual teacher educators may develop content using publishing or authoring tools and upload these into their course spaces for their own pre-service teachers to access. Usually, such resources are not shared amongst teacher educators and courses. However, resources (e.g., courseware, notes, presentations, videos, images) are important assets. These can be reused and/or improved. A suitable repository of digital assets is required to support resource sharing and management. This system should be integrated with the LMS and allow a teacher educator to present resources from the repository in their course environments.

ICT Support

This support includes support for teacher educators (e.g., instructional design support, technical support, media production support), ICT support for pre-service teachers, and ICT support for administration. TCET (n.d.) suggest that “essential piece of the technology infrastructure that is too often overlooked is an adequate technical support staff – adequate in terms of the number of full-time technical support personnel and in terms of their skills an experience” (p.20). The list of support staff may include: network specialist, computer technical officer, programmer or system engineer, instructional designer, media/audio-visual specialist and web master.

Strategic Dimension 5: Communications and Partnerships

Communications and partnerships are two key inter-dependent pillars that support the capacity of TEIs for ICT in education. Effective communications between the TEIs and other organisations is an important aspect of partnership building where trust and respect are developed among the various stakeholders. ICT may enhance such communications as it affords anywhere and anytime communication, both synchronous and asynchronous.. Recent

evidence indicates that TEIs with tightly integrated programs that involve schools, ministries/departments of education, and private sector are more likely to produce effective teachers who stay longer in teaching (Darling-Hammond, 2006; Edwards & Mutton, 2007). Given the pertinence of engaging partners in teacher education, this section focuses on communications and partnerships. It explains the following two strategic foci:

- Institutional Approach Towards Partnerships on the Pedagogical Use of ICT
- Engagements with Local and Global Communities Facilitated by ICT

Institutional Approach Towards Partnerships

Although partnerships with other stakeholders of teacher education offer significant benefits for the TEIs in building their capacity for ICT in education, establishing and sustaining successful partnerships is challenging. Research studies have identified two key challenges faced by TEIs – logistical issues and organisational differences (Bartholomew & Sandholtz, 2009). The former includes time, rewards and incentives, and funding, and the latter includes missions, organisational structure and culture. Therefore, besides encouraging teacher educators and deans to establish partnerships, the TEI has to provide them the support to address these challenges. Since the establishment of partnerships is time intensive, the rewards and incentives system developed by the TEI is crucial to ensure sustained participation by teacher educators and deans, and also their partners. At the same time, financial resources have to be set aside by the TEI to launch and institutionalise the partnerships. Although external funding may be secured for some of these partnerships, funding from within the TEI is necessary to demonstrate its commitment to its partners. The TEI also has to build a long-term relationship with schools and education agencies where trust and openness are pivotal to the relationship.

Failure to establish connection between schools and TEIs inevitably leads to gaps between theory and practice for pre-service teachers (Levine, 2007). It results in difficulty in finding practicum placements for pre-service teachers to gain professional experience (Villegas & Davis, 2007), which is essential for the integration of theoretical knowledge and practical experiences. Hence, a strong TEI-school partnership model is critical to support such field experiences by pre-service teachers. Besides working together towards the shared goal of improving the quality of teachers and co-developing strategies to accomplish this goal, schools are more involved in the assessment of pre-service teachers. Teachers and their ‘wisdom of practice’ provide a different perspective of teacher education (Lieberman & Mace, 2008). Schools’ and teachers’ inputs help pre-service teacher education programs to be more relevant and responsive to the needs of schools.

A strong TEI-school partnership is also critical for the on-going PD for both mentor teachers and teacher educators. Mentor teachers have to be equipped with the science of teaching and learning to help pre-service teachers make sense of their practices, and teacher educators have to be equipped with a sense of reality into the everyday activities and practices of the school. The school-TEI partnerships may be further strengthened with the involvement of the education ministries or departments. The partnership between the TEI and education ministry share a common goal that cannot be reached by either party independently (Callahan & Martin, 2007). Besides undertaking commissioned projects, the partnership between the two parties on the use of ICT for teaching and learning may involve education officers and directors engage in the design and development of the curriculum and assessment tasks and teaching in the pre-service teacher education program.

There is growing belief that no one sector can effectively bring together the resources and capability to address or resolve the social and development issues we are facing (Tennyson, 2003). Public-private partnerships (PPP) as possible mechanisms for developing and sustaining public services have created growing interest from governments around the world (Moore, 2005). Today, some private corporations have the resources and desire to undertake social responsibility. PPP then focuses on the shared responsibility of both the public and private sectors towards the provision and maintenance of infrastructure and services for the general population.

Engagements with Local and Global Communities

Economic, ecological, social, political and cultural integration across nation states combined with the rapid advancement of technology have brought about transformations that are part of globalisation. Nowadays, the unfolding of an event in one part of the world affects lives in other parts. In such a new world order, our children and young people have to be prepared to be agents of change rather than just passive observers of world events (Davies, 2006; Torres, 2002). TEIs have to start engaging pre-service teachers in activities and conversations about preparing their students in understanding the nature of global issues and taking an active role in addressing them beyond the four walls of the classroom. TEIs may then start engaging local and global communities, facilitated by ICT, and make such engagements as integral parts of the pre-service teacher education curriculum and assessment.

Strategic Dimension 6: Research and Evaluation

This strategic dimension discusses fundamental issues relevant to building environment, services, tools, human capacity and commitments to educational research and evaluation involving ICT at teacher education institutions. Roblyer and Knezek (2003) write that

research involving ICT in education should: (a) have a commonly-held, theory-based agenda, (b) deliver evidence-based findings about how technologies enhance achievement and motivation; and (c) lead to shaping of practice in the field. Within this dimension, the strategic foci are:

- Evidence-Based ICT-Mediated Practices and ICT-Related Policies
- Evaluation

Evidence-Based ICT-Mediated Practices and ICT-Related Policies

Developing and sustaining institutional research capacity will ensure relevance and continuous advancement in teacher education programs. At the same time the research will provide platform for professional advancement of academics staff and increase in scholarly impact of the institution. Building and sustaining institutional research capacity is in particular important in the contemporary world as ICT continuously creates new opportunities and challenges for education. Constant research is needed to be in tandem with the ICT advancements to provide evidence to developments and changes in policies and practices. Needless to say, such research efforts would need to be supported by research grants, leave/PD structures. Setting up relevant research centers is another important means to generate the evidence needed for the effects of the numerous ways of using ICT in the classrooms. Such centres can serve as platforms for grouping of researchers with similar interests and research agendas. The centres can also provide consultations to individual researchers, organize seminars and conferences, produce publications, and manage connections with external institutions and schools.

Teacher educators own environments provide places for conducting research with emerging pedagogical practices and ICT in the context of teacher education. Teacher educators should be encouraged to formalize their experimentation with ICT by strategically collecting data, and aiming to present and publish outcomes of their effort (for example, see Churchill, 2009). At the more centralized level, a TEI can conduct formal studies of uses of ICT in classrooms and effects on teaching, learning and assessment in a teacher education program.

Schools provide another important context for research. Potential studies in schools might focus, for example, on the effect of ICT on student learning, teachers' pedagogical development, or school leadership and ICT policy. Studies conducted in schools with students and teachers provide important insights for pedagogical application of ICT, and inform possibilities and approaches for the PD of pre- and in-service teachers in such environments (see Tay, Lim & Khine, 2010).

One of the key problems with research involving ICT in education is in the application of research findings in actual practice in TEIs and/or schools. Often, research findings are reported in publications. However, the transfer of knowledge to practice is in some ways limited. Lim (2004) suggests that for a research to transform practices, schools should understand and accept its outcomes. Lim further underlines certain problems for transfer of knowledge: the culture of schooling does not support innovation, and the transfer is further affected by the lack of coordination of effort between research, design, development, policy and practice. It is therefore important to create multiple opportunities and platforms for the sharing of research findings to foster mutual understanding among the educational agencies. Regular seminars, online videos of case study and common online platforms may help in this aspect.

Evaluation

Research activities should be closely linked to processes of auditing and evaluation of a teacher education institution's ICT-mediated practices, policies, teaching, learning, curriculum and administration. Research can provide useful data for evaluation, and suggest areas that require attention. Regular and appropriately organized evaluation, as well as subsequent follow-ups on its outcomes, is an important tool for institutional improvements and development. An existing ICT policy and practices need to be regularly audited and evaluated in order to identify areas for improvements and revisions. It is critical that all the key stakeholders from a TEI are involved in the auditing, identification of gaps and areas for improvements, and revision. In addition, visits to other institutions, and reviews of good practices elsewhere, might play an important role in the overall evaluation of ICT practices and policy. Outcomes of evaluation should always lead to required revisions of practices and policy. In this context, any current evaluation needs to include evaluation of implementation of outcomes from the previous evaluation exercises.

In addition, a TEI will benefit from regular evaluation of teaching and learning for potential relevance, suitability of curriculum content, and appropriateness in term of dominant pedagogical practices and ICT uses. Regular evaluation of teaching and learning can be administered through processes such as pre-service teachers' evaluation of teaching, classroom observations, teaching staff performance appraisal, and engagements of external reviewers and examiners. Besides this summative evaluation, it is appropriate and beneficial that an institution promotes formative evaluation of teaching and learning. Formative evaluation will enable continuous improvements in teaching and learning as and when relevant areas for improvements are identifies. Teachers are to play leading role in administering and facilitating formative evaluation, and implementing required revision. In any case, data and outcomes of evaluation must be carefully considered, and discussions

regarding possibilities for revision and improvements in teaching and learning should take place within relevant departments and committees (e.g., a course program committee, or teaching and learning quality committee).

Concluding Remarks

We believe that the six strategic dimensions and its related foci are broad categories of strategic activities that TEIs need to be engaged in to remain relevant in today society. Each dimension posses its own challenges. When put together, the challenges are daunting and the implementation is unlikely to be smooth. Many misalignments and contradictions are likely to emerge. As such, we propose that it is essential that TEIs embark on collective and collaborative planning and implementation processes to foster the systemic change needed.

We hope that the framework will serve as an effective tool in this planning and implementation processes. Placing the framework in action needs to be managed and led by overall vision and willingness for advancement, sustainability, relevancy and innovation, and in consideration of specific needs and nature of a context. We call TIEs engaged with the framework to provide data and feedback to help improve and contextualize the framework further. It is also important to point the dynamic landscape of contemporary times, constant advances in technologies and changing needs of industries and societies. Our framework remains flexible and open to adjustment in order to meet emerging needs of the teacher education field. The six strategic areas of the framework are designed with ‘flexibility’ in mind and with goal to promote constant improvements of TEIs.

Our further work will concentrate to expand the framework with focus on capacity building and professional development of teaching and academic staff in higher education institutions. Technology is a mission critical component in overall operation of these institutions. Many of them have set up centers for advancement in teaching and learning, and to support staff with e-learning. We believe that the framework has potential to be adjusted and placed in this context as tool for capacity building and pedagogical development of higher education staff to effectively integrate technologies in teaching, learning, administration and research.

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