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Building teacher educator TPACK: Developing leaders as a catalyst for change in ICT Education

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Teacher educators with TPACK are critical to the development of the ICT competence of the next generation of teachers. To effect real change in ICT education leaders must be developed amongst teacher educators as well as teachers. An Australian university implemented a supported program of professional development for teacher educators as they implemented innovative ICT-rich practice. This paper reports on data collected before, during and after the process to inform planning. Areas identified where teacher educator TPACK was lacking were used to inform the professional development process. For a variety of ICT competences teacher educators were generally convinced of the usefulness but not so convinced of their own confidence. Enablers of learning identified by teacher educators, who had engaged in innovative practice, showed that they were building TPACK that would equip them to be leaders and thus catalysts for change in ICT education.

Keywords: TPACK; teacher educator; leader; competence; ICT education; change catalyst; TTF

Introduction

The current focus on ICT in education makes it a necessity that all teachers develop their competence in this area. This is equally applicable for teachers at all levels of education, thus teacher educators need to develop these competences to model best practice for future teachers. Part of the challenge in ICT education is having catalysts to inspire the change that is necessary. Important catalysts for such change are technology leaders but transformation of ICT education only occurs these leaders are involved with pedagogy and learning (Tan, 2010). This paper reports on the building of teacher educator Technological Pedagogical Content Knowledge (TPACK) (Mishra & Koehler, 2006b) at an Australian regional university in an attempt to develop leaders who can be catalysts for change within the delivery of teacher education. In a climate of change in education it is critical to identify competences that can be used to inform the process of developing leaders. Through awareness raising and targeted professional development, teacher educators at the institution were supported in implementing innovative ICT-rich teaching. This helped to build their TPACK and thus, as leaders, contribute to changes in the way that ICT education is addressed. Data is reported that was collected to inform the process and effect change.

A climate of change

Education is undeniably immersed in a climate of change. In the last two decades education has moved from a focus on the 3Rs, reading, writing and arithmetic, to include Information and Communication Technology (ICT). ICT in education, or ICTE (E for Education), now refers to what was previously called Information Technologies (IT) in education. The term IT was believed to place too much emphasis on technical skills and not enough on the cognitive skills needed to be ICT literate (ICT Literacy Panel, 2007). While communication with peers and accessing information are frequent uses of ICT, there has been less frequent use of ICT that involves creating, analysing or transforming information (MCYEETA, 2007). Changed expectations are evident in the ICT Literacy definition: “using digital technology, communications tools, and/or networks to access, manage, integrate, evaluate, and create information in order to function in a knowledge society” (ICT Literacy Panel, 2007, p. 2).

The teacher is one of the driving forces contributing to change, a process influenced by both the school organisation and the local environment (ten Brummelhuis & Kuiper, 2008). Desire to integrate ICT into their teaching is not sufficient to effect this change, teachers also need confidence and competence (Bingimalas, 2009).The impact of those driving forces can be viewed through Finger and Russell’s (2005) two cyclical modes of influence on ICT adoption in schools: societal expectations and government policy.

Societal expectations are that Australian students will leave school with the necessary skills and knowledges that will allow them to take their place in the community as confident and productive users of ICT who

understand the impact of ICT on society (MCYEETA, 2007). Such expectations are not restricted to Australia. For example, Katz (2005) explained that in the United States of America (USA) society expects that college leavers have skills in researching and communicating via technology to enable them to function in society. Societal expectations have been a catalyst for governments to review, develop and implement policies pertaining to ICT in education.

Public policy has developed to the extent that the implementation of ICT in education has become a key component of election campaigns. Election promises have included putting computers on every student's desk from Year 9-12 and grants for schools (public and independent) to upgrade their ICT infrastructure and/or hardware. The *Digital Education Revolution* (Department of Education, 2008), implemented following a successful election campaign, committed to: new computer equipment in secondary schools; the rollout of *National Broadband Network;* and increased access to online content. After the Australian Government recognised the need to train teachers to teach using these new technologies, a follow-up initiative, the *Teaching Teachers for the Future* (TTF) project (http://www.ttf.edu.au/), was implemented to enable pre-service teachers to increase their level of proficiency in ICTE. Training pre-service teachers was considered to be more effective than training existing teachers, many of whom are either resistant to change (Watson, 2006) or within ten years of retiring (Owen, Kos, & McKenzie, 2008). Teacher educators with sufficient TPACK were essential to the TTF project.

To effectively build teacher educator TPACK, and to measure the achieved levels of knowledges, some guidance is required as to what competences are necessary. There is limited literature available specifically on teacher educator TPACK but as teacher educators are teachers the literature on teacher competence in ICT education is considered relevant. In the quest to develop leaders amongst the teacher educators it is also necessary to investigate literature on leader competence in ICT education.

Teacher competence in ICT education

Teacher competence in ICT education has been defined as "a collection of knowledge, skills, understandings and attitudes that are inextricably bound up with context and pedagogy" (Webb & Downes, 2003, p. 2), just being able to perform basic computer functions (skills) is no longer sufficient as ICT competence for teachers. Since then ICT knowledges have been clarified by Wen and Shih (2008) as encompassing explaining, organising, analysing, assessing and synthesising. While ICT skills are relatively easy to measure, the testing of cognitively-related ICT knowledges is more difficult and makes the articulation of teacher competence in ICT education more challenging. To date there has been no internationally recognised test of ICT knowledges that measures the ICT competent individual (Perez & Murray, 2010)**.** However four frameworks for assessing teacher competence in ICT education, which have been developed and used, are now presented.

First, the *ICT skills test*, developed by the Department for Education (United Kingdom), tested pre-service teacher ICT competencies. This was a mandatory component of teacher qualification but has since been abolished "as new teachers have greater abilities in ICT than they had 10 years ago" (Department for Education, 2012)**.** Such skills-based tests only measure ICT skills (Lim, Chai, & Churchill, 2010) and not ICT literacy, that is, the ability for teachers to use ICT actively, collaboratively and constructively.

Second, the *ICT Literacy Assessment*, launched in the USA in 2005 by the Educational Testing Service (ETS), measured ICT proficiency, cognitive proficiency and technical proficiency (ICT Literacy Panel, 2007). This assessment was designed to support initiatives to improve ICT literacy on college campuses and involves simulations of authentic technology environments in which critical-thinking skills must be used to perform tasks (ETS, 2004). The *ICT Literacy Assessment* is now called the *iSkills* assessment.

Third, an instrument to assess teacher *Technological Pedagogical Content Knowledges* (TPACK), has been developed by Mishra and Koehler (2006a). The TPACK framework (Figure 1), has been used by many institutions and projects, including the TTF project, as a self-audit survey of teacher, teacher educator and pre-service teacher TPACK (Schmidt et al., 2009). The survey, and its many adaptations, aim to measure teacher knowledge of content, knowledge of pedagogy and knowledge of technology and the various intersections of these knowledges.

Fourth, the *ICT Elaborations* (AITSL, 2011b) were designed as a framework to assist pre-service teachers to provide evidence of their ICT-based practice as aligned with the Australian *National Professional Standards for Teachers* (AITSL, 2011a) when applying for accreditation. The development of this framework was based on the TPACK framework. Thus far these elaborations have only been developed for the graduate teacher level and not for the proficient, highly accomplished or lead levels.

Comparing these four frameworks, it has become clear that since the *ICT skills test* was developed more than a decade ago the description of teacher competence in ICT education has placed a much stronger focus on cognitively-related aspects of using ICT. While the above frameworks describe certain competences necessary for all teachers there are further competences teachers need to be leaders in ICT education. The frameworks described above did not articulate different levels of competence. Following is a consideration of frameworks that describe levels of competence in an attempt to identify what is important in leader competence in ICT education.

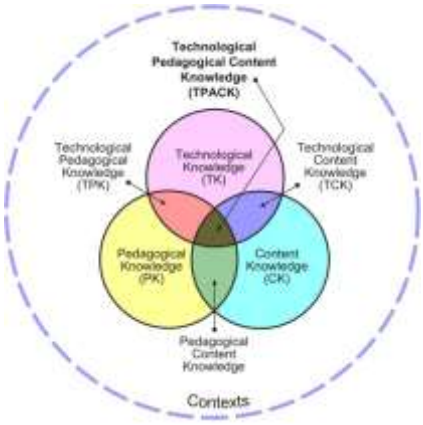
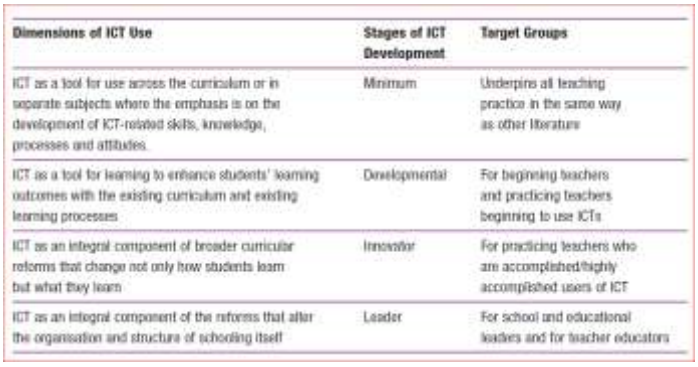


Figure 1: TPACK framework and its knowledge components (Mishra & Koehler, 2006a)

Leader competence in ICT education

What makes a leader competent in ICT education? There has been little research in this area and to date there has been no definition of leader competence in ICT education published although one study in Australian schools in 2002 investigated school principals as ICT leaders (Tan, 2010). However, some researchers and organisations have worked towards describing underpinning principles for a framework to identify an ICT competent leader. These are considered below to assist in identifying key competences necessary to be a leader in ICT education.

In 2002 the *Raising the Standards* project published a proposal for the development of an ICT competency framework for teachers, as ICT had the unrealised "potential to transform how, what, where and why students learn what they do" (DETYA, 2002, p. 3). This was the first framework to include leader as a stage in the development of ICT competence. The Dimensions of ICT use (Figure 2) show four stages of ICT development; *Minimum*; *Developmental*; *Innovator* and *Leader*. Four aspects of the proposal are of interest to defining leader competence. First, the clarification of the difference between the Innovator and the Leader stages of ICT development. For Innovator, the dimension of ICT use indicates an impact on how students learn and what they learn, while for Leader the dimension indicates impact on the organisation and the structure of schooling itself. Second, the target groups for the Leader stage include teacher educators as well as school leaders and educational leaders. This is one of the few times that teacher educators have been explicitly included in competence documents and that teacher educators are therefore expected to be leaders. Third, the descriptions of two of the key groups, school leaders and teacher educators, makes it clear that teacher educators have a further responsibility to inform their own practice and to provide effective role modeling for the pre-service teachers. Fourth, practicing teachers who are highly accomplished users of ICT are distinguished from school leaders in the descriptions of the key groups. The expectation is that a school leader fosters appropriate role modeling and develops a vision to support staff, policies and structures to ensure that ICT education is realised.



Dimensions of ICT Use	Stages of ICT Development	Target Groups
ICT as a tool for use across the curriculum or in separate subjects where the emphasis is on the development of ICT-related skills, knowledge, processes and attitudes.	Minimum	Underpins all teaching practice in the same way as other literature
ICT as a tool for learning to enhance students' learning outcomes with the existing curriculum and existing learning processes	Developmental	For beginning teachers and practicing teachers beginning to use ICTs
ICT as an integral component of broader curricular reforms that change not only how students learn but what they learn	Innovator	For practicing teachers who are accomplished/highly accomplished users of ICT
ICT as an integral component of the reforms that alter the organisation and structure of schooling itself	Leader	For school and educational leaders and for teacher educators

Figure 2: Dimensions of ICT Use (DETYA, 2002, p. 21)

A *Lead* level of competence was also distinguished from a *Highly Accomplished* level in the *National Professional Standards for Teachers* (AITSL, 2011a), in particular for ICT competence in Focus area 2.6 *Information and Communication Technology* (ICT). The highly accomplished level of competence expects teachers to "model high-level teaching knowledge and skills and work with colleagues to use current ICT to improve their teaching practice and make content relevant and meaningful" (p. 11), whereas the lead level of competence expects teachers to "lead and support colleagues within the school to select and use ICT with effective teaching strategies to expand learning opportunities and content knowledge for all students" (p. 11). This is similar to the expectation in the *Raising the Standards* proposal.

An empirical study of school technology leadership research allowed Tan (2010) to identify eight major knowledges, skills and attribute areas for technology leader competence: leadership and visioning; learning and teaching; productivity and professional practice; support, management and operations; assessment and evaluation; knowledge of problem solving and information technologies; social, legal and ethical issues; organisational relations and communications. Whilst these have been important areas of competence there is no indication of what these would look like at a leader level. Of these eight areas which cover similar competences to teaching standard frameworks, there are two which do not appear at levels below leadership. These are: leadership and visioning; and support, management and operations, both of which involve engagement at the institutional level and not necessarily at the classroom level.

So, what does leader competence (LC) look like in ICT education? The following set of seven competences was developed from the above analysis of leader competence. First, a leader must have achieved the ICT competence standards for teachers at a highly accomplished or innovator level. This provides three relevant competences: LC1- integrate technology with content and pedagogy (TPACK) to impact on how students learn and what they learn; LC2 - model high-level ICT-rich teaching knowledge and skills; and LC3 - collaborate with colleagues to use current and innovative ICT to improve their teaching practice and make content relevant and meaningful to expand learning opportunities for all students. Then there are four further competences which would only be expected of leaders: LC4 - foster appropriate role modeling of ICT-rich teaching knowledge and skills; LC5 - contribute to the operation of the organisation to facilitate ICT-rich learning; LC6 - contribute to the development of a vision to support staff, policies and structures to ensure that ICT education is realised; and LC7 – take responsibility to inform their own practice.

This set of competences is proposed as a framework to inform the development of leaders in ICT education in any educational institution. It should be noted that leadership qualities can be exhibited without being in an official leadership position. This proposed framework, combined with the TPACK framework, underpinned the research-facilitated development of teacher educator TPACK and teacher educators as potential leaders in ICT education at the University of New England.

Context

Teacher education at the University of New England is delivered by academics in the School of Education (SoE). The research being reported was undertaken during 2011 when the SoE had 79 non-sessional academic staff and more than 2600 students. A major rewrite of the SoE awards to address Australian Curriculum (ACARA, 2012) requirements and to reconfigure the placement of professional experiences provided an ideal opportunity to also consider the place of ICT Education and to address the lack of explicit teaching of TPACK. This process was supported by the SoE participation in the national *Teaching Teachers for the Future* (TTF) project that aimed to improve delivery of teacher education so that graduating pre-service teachers were able to demonstrate effective and innovative use of ICT in education.

The TTF project targeted the four Australian Curriculum areas, English, Mathematics, Science and History, with each of the 41 institutions involved being expected to implement strategies in two of the four areas. Although UNE focused on Science and Mathematics as their "designated" curriculum areas, work was also undertaken in English and History. Teacher educators were provided with support, an ICT Pedagogy Officer (ICTPO), as they planned, implemented and evaluated innovative ICT-rich learning experiences for the pre-service teachers. For the designated curriculum areas, there was a higher level of innovativeness in ICT inclusion and of ICTPO support uptake. For more detail see Reading and Doyle (2012).

Study

As a major component of their commitment to the TTF project, the SoE worked towards building the TPACK of their teacher educators. The progress of this knowledge building was tracked through the collection of data at three critical phases in the process: Phase 1 *Mapping of Pre-service Teacher Education Units*; Phase 2 *Teacher Educator TPACK Survey*; and Phase 3 *Teacher Educator Most Significant Change Stories*. As well as the three data collection phases, there was an intervention in the form of professional development and support for the teacher educators. The research reported in this paper covers all three phases, Phase 2 in detail and the other phases in summary form as the detail has been reported previously, Phase 1 in Reading and Doyle (2011) and Phase 3 in Reading and Doyle (2012).

Phase 1 aimed to clarify what was currently being done in existing units in relation to ICT use in the delivery of content and to the teaching of TPACK. This was designed to clarify that there was an issue in relation to what the teacher educators were delivering in the undergraduate units offered. The intervention, throughout 2011, involved provision of professional development and support for the SoE teacher educators, especially through the ICTPO. This included personalised support for the teacher educators in the four targeted-curriculum areas and more general group-level support for those in other teaching areas. Phase 2 aimed at measuring the TPACK of the teacher educators to inform planning for both professional development and rewriting of units. This data collection, undertaken during the intervention, was designed to show the magnitude of the issue. Phase 3 aimed to study the four cases of the teacher educators who had been the main focus of the intervention. This data collection, undertaken after the intervention, was designed to capture detail of the significant changes that had occurred, from those most directly involved in the intervention.

Methodology

Phase 1 collected data in May 2011 from the unit descriptions and unit coordinators. The mapping was completed across eight criteria that covered two perspectives*: ICT aspects of Unit Delivery*, with the criteria, Curriculum, Pedagogy, Assessment and Resources; and *ICT Knowledges*, with the criteria, Technological Knowledge (TK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK). Each criterion was scored at one of four levels: Undeveloped, Fundamental, Proficient and Innovative, as defined by Lim et al. (2010).

Phase 2 was designed in close alignment with the survey completed by the pre-service teachers as part of the national TTF project (ESA, 2012) and was similar to other surveys developed for such purpose (e.g., Schmidt et al., 2009). The survey included demographic items and likert-scale items related to a variety of aspects of the use of, and teaching with and about, ICT. The wording of these questions is included in the figures provided in the results sections. All teacher educators in the SoE were invited to complete the survey online.

Phase 3 was designed to follow the Most Significant Change Story protocol provided by the TTF project (ESA, 2012). In each of the four curriculum areas two-page stories were created, from focus group discussions, about the learning that took place as the teacher educators changed their thinking about ICT whilst undertaking the implementation of innovative ICT in teaching. Identified enablers of learning were categorised as either exogenous (non-manipulative) or endogenous (manipulative) and the endogenous enablers were further categorised as associated with contextual learning, active learning, social learning or reflective learning.

Results

Phase 1 Mapping of Pre-service Teacher Education Units

The mapping involved 13 pre-service teacher education awards with 125 different units and 51 unit coordinators. Generally teacher educators were better at using ICT to deliver the curriculum than addressing ICT Knowledges within the curriculum. Occurrences of proficient and innovative levels of practice are reported as these provide a benchmark for identifying potential leaders. Teacher educators provided a variety of reasons

why they were not teaching about ICT and not using ICT to support teaching but did state that were keen to learn new ICT skills; appreciated resources suggested by pre-service teachers; lacked time to learn due to excessive workload; and needed help with ICT skills.

There was proficient use of ICT in the support of pedagogy and provision of ICT tools as part of the resources in many units. The use of ICT in assessment occurred mostly at the fundamental level. For many units where ICT use was addressed in the delivery, there was a sustainability issue because this was not described well in the curriculum documents. An innovative level of ICT use only occurred in three units and this was spread across pedagogy, assessment and resources.

Proficient teaching about TK only occurred in two units and when less proficient teaching occurred it was often achieved through the requirement to use ICT rather than explicit teaching of ICT skills. Proficient teaching about TCK was evidenced in units teaching about specific curriculum areas, especially Mathematics, Science and English. Teaching TPK was evidenced in very few units and not at the proficient level. Teaching about TPACK that transforms learning was only evident in a few units and even then only at a fundamental level. An innovative level only occurred in three units, and was across the TK, TCK and TPK criteria.

Phase 2 Teacher Educator TPACK Survey

There were 29 respondents from a possible 102 teacher educators. Demographic data collected indicated that they were representative of the SoE academic staff with: 20 female and 9 male; and an concentration of age with 22 between 50 and 59 years old; only 2 less than 50 years; and 5 more than 59 years.

The data is reported as teacher educator (TE) use of ICT (Tables 1 to 3) and TE support of pre-service teacher (PST) use of ICT (Tables 4 to 6). As there were only 29 respondents, the likert-scale items (from 0 to 6 for confident/useful level) have been summarised to reflect how *Confident (C)* as any response at a level of 3 or greater (i.e., moderately confident to extremely confident) and, similarly, how *Useful (U)* as any response at a level of 3 or greater. A count of less than 20 (out of 29) is considered less than satisfactory. Those not represented in these counts were either less confident/useful or unable to judge. Generally the number *unable to judge* is low but where it is above 3 (approximately 10% of 29, considered a reasonable limit) the result is indicated in the relevant table.

Table 1 shows the number of respondents who indicated confident/useful to competences in relation to TE use of ICT in professional knowledge. This clearly shows that while the TEs believed these competences were useful, they were not yet confident in their own abilities. A clear lack of confidence exists in: personalising learning activities, in particular for Aboriginal and Torres Strait Islander PSTs.

Table 1: Teacher educator use of ICT in professional knowledge

(n=29 respondents)	C*	U**
demonstrate knowledge of the range of ICT to engage pre-service teachers	21	25
teach strategies that are responsive to pre-service teachers diverse backgrounds	21	25
teach strategies that are responsive to pre-service teachers learning styles	20	25
teach strategies to support pre-service teachers from Aboriginal and Torres Strait Islander backgrounds	14	25
teach strategies to personalise learning activities for pre-service teachers	19	26
access, record, manage, and analyse pre-service teachers assessment data	24	28
teach specific subject areas in creative ways	23	28
engage with colleagues to improve professional practice	25	27
collaborate for professional purposes, such as online professional communities	23	27

* How *confident* are you that you have the knowledge, skills and abilities to use ICT to…
** How *useful* do you consider it will be for you, as an academic, to be able to use ICT to…

Table 2 shows the number who indicated confident/useful to competences in relation to TE use of ICT in professional practice. Again, this clearly shows that while the TEs believed these competences were useful, they were not yet confident in their own abilities. A clear lack of confidence exists in: demonstrate how ICT can be used to support literacy learning; demonstrating how ICT can be used to support numeracy learning; designing ICT activities that enable PSTs to become active participants in their own learning; and evaluating how ICT use has helped to achieve specific subject area goals.

Table 3 shows the number who indicated confident/useful to competences in relation to TE use of ICT in

professional engagement. Although useful was low for a couple of competences, it is still clear that the TEs believed these competences were useful but they were not yet confident in their own abilities. A lack of confidence exists in: manage challenging pre-service teachers behaviour by encouraging the responsible use of ICT; and being aware of digital citizenship to promote pre-service teacher demonstration of rights and responsibilities in using digital resources and tools.

Table 4 shows the number who indicated confident/useful to competences in relation to TE support of PST use of ICT in professional knowledge. Again, useful was high but it is still clear that the TEs believed these competences were useful and that they were not yet confident in their own abilities. The only competence that demonstrated reasonable confidence was in being able to support PSTs to use ICT to provide motivation for curriculum tasks and to demonstrate what they have learned.

Table 5 shows the number who indicated confident/useful to competences in relation to TE support of PST use of ICT in professional practice. The TEs believed these competences were useful but they were not yet confident in their own abilities. There was no competence where the TE demonstrated reasonable confidence.

Table 2: Teacher educator use of ICT in professional practice

(n=29 respondents)	C*	U**
design learning sequences, lesson plans and assessment that incorporate ICT use by pre-service teachers	23	26
select and organise digital content and resources	22	28
use ICT for reporting purposes	24	27
demonstrate how ICT can be used to support literacy learning	19	26
demonstrate how ICT can be used to support numeracy learning	17	23
design ICT activities that enable pre-service teachers to become active participants in their own learning	18	28
select and use a variety of digital media and formats to communicate information	21	29
evaluate how ICT use has helped to achieve specific subject area goals	19	25

* How *confident* are you that you have the knowledge, skills and abilities to use ICT to…
** How *useful* do you consider it is for you, as an academic, to be able to use ICT to…

Table 3: Teacher educator use of ICT in professional engagement

(n=29 respondents)	C*	U**
manage challenging pre-service teachers behaviour by encouraging the responsible use of ICT	19[1]	21[2]
be aware of digital citizenship to promote pre-service teacher demonstration of rights and responsibilities in using digital resources and tools	18[3]	23
demonstrate an understanding of safe, legal and ethical use of digital information and technologies	20	25
identify personal and professional learning goals in relation to using ICT	21	26
reflect on relevant ICT research to inform professional practice	23	27
use a range of ICT resources and devices for professional purposes	24	27

* How *confident* are you that you have the knowledge, skills and abilities to use ICT to…
** How *useful* do you consider it will be for you, as an academic, to be able to use ICT to…
[1] 7 unable to judge; [2] 4 unable to judge; [3] 4 unable to judge

Table 4: Teacher educator support of pre-service teacher use of ICT in professional knowledge

(n=28 respondents)	C*	U**
provide motivation for curriculum tasks	20	24
develop functional competencies in a specified curriculum area	17	22
actively construct knowledge that integrates curriculum areas	19	23
actively construct their own knowledge in collaboration with their peers and others	19	23
analyse their knowledge	18	23
synthesise their knowledge	19	24
demonstrate what they have learned	21	24
acquire the knowledge, skills, abilities and attitudes to deal with on-going technological change	17	24

* How *confident* are you that you have the knowledge, skills and abilities to support pre-service teachers' use of ICT to…
** How *useful* do you consider it will be for you, as an academic, to ensure pre-service teachers use ICT to…

Table 6 shows the number who indicated confident/useful to competences in relation to TE support of PST use of ICT in professional engagement. Again, the TEs believed these competences were useful but they were not yet confident in their own abilities. The only competence that demonstrated reasonable confidence was in being able to support PSTs to gather information and communicate with a known audience.

Phase 3 Teacher Educator Most Significant Change Stories

The four stories, one for each of Science, Mathematics, English and History, provided interesting insight into the experiences, and related enablers of learning, of the teacher educators as they developed innovative practice in ICT-rich education. Of most interest are the 18 endogenous enablers (Table 7) identified because these can be manipulated to optimise teacher educator learning. Context appears to have impacted on responses from the teacher educators. One example is the teacher educator who became involved in the experience through personal interest and demonstrated strong awareness of the impact of Social Learning and Reflective Learning enablers. Another example is the teacher educators who worked most collaboratively with the ICTPO clearly and demonstrated a strong focus on pre-service teacher learning, including pre-service teacher capabilities and enthusiasm, rather than their own learning.

Table 5: Teacher educator support of pre-service teacher use of ICT in professional practice

(n=28 respondents)	C*	U**
integrate different media to create appropriate products	16	23
develop deep understanding about a topic of interest relevant to the curriculum area/s being studied	17	21
support elements of the learning process	19	24
develop understanding of the world	18	22
plan and/or manage curriculum projects	19	23
engage in sustained involvement with curriculum activities	18	23
undertake formative and/or summative assessment	17	26
engage in independent learning through access to education at a time, place and pace of their own choosing	19	24

* How *confident* are you that you have the knowledge, skills and abilities to support pre-service teachers' use of ICT to…
** How *useful* do you consider it will be for you, as an academic, to ensure pre-service teachers use ICT to…

Table 6: Teacher educator support of pre-service teacher use of ICT in professional commitment

(n=28 respondents)	C*	U**
gain intercultural understanding	17	23
acquire awareness of the global implications of ICT-based technologies on society	18	22
communicate with others locally and globally	19	22
understand and participate in the changing knowledge economy	19	22
critically evaluate their own and society's values	17	21
facilitate the integration of curriculum areas to construct multidisciplinary knowledge	18	24
engage in sustained involvement with curriculum activities	17[1]	22
critically interpret and evaluate the worth of ICT-based content for specific subjects	16	24
gather information and communicate with a known audience	21	25

* How confident are you that you have the knowledge, skills and abilities to support pre-service teachers' use of ICT to…
** How *useful* do you consider it will be for you, as an academic, to ensure pre-service teachers use ICT to…
[1] 4 unable to judge

Table 7: Endogenous enablers of teacher educator learning (about ICT in education)

Contextual Learning	have a personal interest; participate in webinars; raise awareness through ICTPO contact; recognise potential of use of ICT for learning
Active Learning	learn in the workplace; teach in a unit with ICT embedded; utilise technical support; utilise ICTPO support; identify with ICTPO as mentor
Social Learning	collaborate with ICTPO; collaborate with others; learn together through teaching together; learn together with pre-service teachers; become part of a learning community
Reflective Learning	ask colleagues for ideas; challenged by others; change perspective on ICT use in education; change view of lecturer & pre-service teacher relationship

Discussion

Based on the framework of Leader Competences (LCs) developed, the mapping and the TPACK survey indicated that there were few innovators in ICT education amongst the teacher educators in the SoE at UNE and potentially only one leader. This provided a challenge for those tasked with developing leaders to be catalysts for change in ICT education. First, innovators had to be nurtured and then with prolonged engagement came the hope that some of them would develop into leaders. These first two phases provided detailed information about TPACK in teaching and learning and identification of aspects where improvement was needed. The intervention to support teacher educators was designed specifically to address three of the recommendations that came from the mapping: ICT Knowledges be incorporated into all units, enthusiasm for new ICTs be nurtured amongst teacher educators; and ICT innovation be reconceptualised for teacher educators. The survey showed teacher educators agreed that most competences listed were useful but the general lack of confidence in their competence helps to explain why the teacher educators were not using ICT more widely or more innovatively in their practice, as shown by the lack of proficient and innovative practice in the mapping. The survey also showed that the teacher educators were more confident in the use of ICT to deliver their units, i.e., their own TPACK, than in teaching about ICT knowledges, i.e., helping the pre-service teachers develop their TPACK.

In the intervention, the teacher educators in the designated curriculum areas were especially encouraged to develop their TPACK (i.e., LC1), model teaching with ICTs (i.e., LC2) and to collaborate with colleagues (i.e., LC3) and thus operate at an innovative level. The intervention was designed to provide the opportunity to research practice (i.e., LC7), which was embraced by the Science, Mathematics and English teacher educators. Those in Science also fostered appropriate role modeling (i.e., LC4) by teaching in a virtual world where the pre-service teachers would also teach. The teacher educator change stories made it clear that they were collaborating with colleagues (i.e., LC3) and changing their perspective on ICT education (i.e., ready for LC6).

Conclusion

Awareness-raising through the mapping and survey, together with the professional development offered to all members of the SoE, has helped to build teacher educator TPACK at UNE. While positive steps have been made towards the development of leaders they do not yet exhibit all the necessary competences of leaders in ICT education. However, these potential leaders are already catalysts for change. Since the completion of the project some of these teacher educators have continued to develop their competence, for example, in English two more teacher educators became role models for their pre-service teachers with the encouragement of the teacher educator directly involved in the project (i.e., LC4).

There are two main limitations to this study. First, the low number of survey respondents, 29 out of 102, together with a high concentration of respondents in the age category 50 to 59 years, means that the confidence levels reported may not be truly reflective of the SoE. Second, the survey was a self-audit of ICT knowledges and self-audits have been shown in the past to generally show a higher level than actual performance (see, e.g., Braddlee & Mathews-DeNatale, 2006).

This study has implications for both teaching and research. The UNE SoE created an action plan to further the work begun by the TTF project in building teacher educator TPACK. This plan especially encourages actions to assist more teacher educators to become leaders in ICT education and thus catalysts for change. Already, some are requesting assistance to develop their own TPACK and incorporate TPACK in their teaching. Other institutions could use the proposed leader competence framework (LCs) to inform the progression of their teacher educators towards leader competence in ICT education. Obvious implications for research are to: develop a more formal description of leader competence in ICT education; and develop alternatives to self-

audits for reporting TPACK. All teacher education institutions should continue to build teacher educator TPACK so that more leaders are developed to be catalysts in this ICT education climate of change.

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