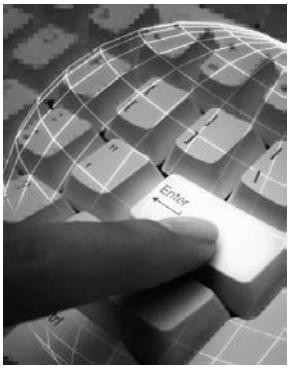

Developing Technology Together, *Together: A Whole-School Metacognitive Approach to ICT Teacher Professional Development*

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Professional development of teachers in information and communication technology (ICT) continues to be an urgent educational imperative. While many teachers are integrating ICT (with varying degrees of confidence and creativity), a significant number still remain hesitant, reluctant and daunted by the rapid rate of technological change. Far from being a simple process, ICT professional development necessitates not only personal and professional changes for individuals, but changes in school culture including institutional attitude and support for professional learning, reflection and professional discussion, readiness to embrace change, collegiality, trust and encouragement to take risks. Grounded in research about what influences teachers' adoption and integration of ICT, this paper describes a three-year action research initiative that led to the development of a whole-school metacognitive approach to ICT teacher professional development known as Technology Together. The paper will describe the approach and findings from the research, indicating that the metacognitive approach can be successfully implemented within a whole-school environment. Data suggests that the process can have a positive impact on the culture of the school and that the outcomes were most significant at schools who implemented the process most consistently with the foundations of the metacognitive approach.

> Educators have had a checkered history in the use of ICT over the last twenty-five years. While the ICT pioneers continue to traverse unmapped areas, the middle and late adopters are finding it difficult to continue without knowing their destination (Doherty, 2005).

Research in relation to professional development for teachers in ICT has, for some time, been pointing to the limitations of traditional approaches, and in particular a focus on training in specific skills for individual staff (Tearle, 2003). Ertmer and her colleagues, (Ertmer, Gopalakrishnan, & Ross, 2001; Ertmer, Ottenbreit-Leftwich, & York, 2006-2007; Ertmer, 1999; Ross, Johnson, & Ertmer, 2002; Snoeyink & Ertmer, 2001), together with writers such as Ropp (1998), Higgins and Mosley (2001) and recently Levin and Wadmany (2006–2007) emphasise the importance of a clear focus on teachers' attitude, values and beliefs as a primary focus in supporting teacher learning.

Ertmer (1999) encourages us to challenge the traditional focus on first order barriers (those extrinsic to teachers including lack of access to computers and software, insufficient time to plan instruction, and inadequate technical and administrative support), and encourages a focus on second order barriers (those intrinsic to teachers, including beliefs about teaching, beliefs about computers, established classroom practices, and attitude to change). As Ertmer (1999, p.48) elaborates 'second-order barriers require challenging one's belief systems and the institutionalized routines of one's practice'.

In Australia, a number of key policy documents have begun to bring these issues into the spotlight for teacher learning and several key documents (Downes et al., 2001; MCEETYA ICT in Schools Taskforce, 2006; Moyle, 2006; QSITE, 2006; Zammit et al., 2007) together with UNESCO's (2002) report have emphasised the:

- complexity of change associated with ICT integration and learning;
- criticality of school culture in approaching this change;
- importance of whole-school strategies;
- value of fostering collegial dialogue and building learning communities;
- potential of mentoring in supporting teacher learning;
- role of reflection in improving practice and transferring theory to practice and practice to theory; and the
- centrality of school leaders.

It is thus recognised that effective ICT professional development requires changes in attitude, values and beliefs that develop confidence for ongoing learning and adaptability to change (Phelps & Ellis, 2002b; Phelps, Graham & Kerr, 2004). Such approaches require teachers to challenge their pedagogical beliefs and practices and there is a strong case for approaches to professional development that promote life-long learning; where teachers are required to be more self-directed in identifying what they need to learn and in undertaking the actual learning. Yet in many schools, embedding this culture of acceptance of continual change and the need for ongoing learning represents a significant challenge. As emphasised by Downes et al. (2001, p.18), such models are 'often messy, more difficult to account for, and longer in duration making them more difficult to account for time and results.'

The approach to ICT professional development for teachers described in this paper represents an attempt to provide schools with a very practical but research-based model and process that is flexible to meet the needs of individual schools. The paper will describe the theoretical foundations of the approach, and the research which led to its development and refinement. We also present some of the key findings of the research and depict the value of the approach by drawing on the voice of participants themselves.

The Research Aims

This research sought to develop a holistic and flexible approach to ICT professional development for primary and secondary teachers. Underpinning the research was a focus on developing teachers' *capability*—their ability to continue learning and adapting to technological change. In summary, the research aimed to:

- document the metacognitive influences on teachers' use of ICT within a whole-school context;
- determine the effectiveness of a metacognitive approach in supporting teachers' ICT learning;

- develop and refine practical approaches to schools' implementation of the approach;
- understand the role of school executive in influencing teachers' ICT use; and
- produce professional development resources that could support schools' implementation of the approach.

The project represented a joint research and development initiative of the Catholic Education Office (CEO), Lismore Diocese and Southern Cross University and received funding for three years from the Australian Research Council (ARC).

Theoretical Framework: The Metacognitive Approach to Computer Learning

'Metacognition' refers to knowledge concerning one's own cognitive processes, and the active monitoring and regulation of these processes in the pursuit of goals (Flavell, 1976). It involves both self-appraisal (reflection about what you know and how you think) and cognitive self-management (the ability to plan and implement appropriate strategies and to monitor, adjust and 'trouble shoot' performance) (Jones & Idol, 1990; Paris & Winograd, 1990).

Metacognitive approaches to teaching are beneficial in that they have the capacity to enhance learners' self-responsibility for monitoring their learning and focus on promoting positive self-perceptions, affect and motivation (Paris & Winograd, 1990). Such approaches can support learners to be aware of the knowledge and skills they do or do not possess, and to use appropriate strategies to actively implement or acquire them. Metacognition is a key element of learner self-regulation, where students activate and sustain thoughts, behaviours and affects, which support the attainment of their goals (Schunk & Zimmerman, 1994). In contexts of rapid change and unfamiliar content domains, such as are inevitable with technology, this understanding of 'how' to learn provides distinct advantages (Ropp, 1997). The metacognitive approach thus encourages teachers to think about themselves as computer learners, taking control over their own learning processes and developing confidence and willingness to try new ICT integration ideas.

This research drew upon a model of metacognitive learning developed through prior research (Phelps, 2002, 2007; Phelps & Ellis, 2002a; Phelps, Graham & Kerr, 2004) and informed by complexity theory (Phelps, Hase & Ellis, 2005). The model assumes that learning is influenced by three key components: affects (feelings, attitudes, and beliefs), motivation, and strategies. It encourages teachers to reflect on these three key components as they have influenced their past and present and are likely to influence their future. Through cycles of planning, acting, observing and reflecting, teachers work toward changing their perspectives and values.

Further to this, the model identifies a range of elements that impact on teachers' ICT learning; factors such as self-efficacy, anxiety, support, encouragement, perceived usefulness, pedagogical orientation, goal orientation, attitude to time, volition, problem-solving, playfulness, memory and retention, help seeking, learned helplessness and attribution. Understandings of the influence of these elements is shared and discussed as part of the metacognitive learning process, and teachers use these understandings to analyse and strengthen their own learning.

Teachers are also prompted to see that becoming a proficient computer-user is more about their attitudes and learning strategies than it is about having some magic personal quality or set of skills. Even for teachers who are relatively comfortable with their computer skills, the metacognitive approach can prompt them to move outside their current comfort zone and try new things with their students.

At the heart of the metacognitive approach, therefore, is the process of reflection. Consistent with Ertmer and Newby (1996), reflection is seen as key to the development of 'expert learners'.

The Research Process

Action research was considered the most appropriate methodology for the project. This involved two research cycles conducted over two years, with seven schools participating in 2005 and a different nine schools participating in 2006. Of these 16 schools, 14 were primary schools and two were secondary schools. Schools engaged in three micro-cycles (one per term), with learning from schools involved in 2005 being passed on to, and built on, by schools in 2006.

Participants worked closely with University and CEO staff to develop, test and refine the metacognitive approach. The process was facilitated in schools by key staff, referred to as Companion Mentors (CMs), who also played the role of co-researchers.

The research was informed by a wide range of data, including pre- and post-intervention surveys, workshop evaluations, planning and implementation documents, journals completed by teachers, notes from staff discussions, samples of work, observations and critical reflections, as well as interim and final reports written by schools. A focus was placed on triangulation and member-checking of all data, with an emphasis on maintaining the 'teacher voice'. A Reconnector Workshop held in 2007 with representatives from most schools confirmed data, findings and recommendations in the final project report.

The process of professional development being developed through the research became known as *Technology Together*.

The Initial Context for Schools

The 16 schools selected to participate in the study were all drawn from the north coast of NSW, Australia (a region extending some 500 km) and included schools from small rural townships (the smallest primary school having 4 teachers) to larger regional centres (the largest primary school having 36 teachers and the largest secondary school, 66 teachers). Socioeconomically, the communities served by the schools also varied considerably.

Prior to their involvement in the research, schools were characterised by highly diverse ICT contexts. Some had very adequate infrastructure while others were quite under-resourced with outdated and less functional equipment. Some were moving toward establishing lab environments, and others toward classroom-based hardware. Access to data projectors for classroom use was patchy, with some schools having no mobile data projector that teachers could use in their rooms. Two schools had newly purchased interactive whiteboards. Of the 14 primary schools 10 employed a model of all teachers being responsible for ICT use with their class, although four had just moved to this model. Four other schools employed a specialist ICT teacher, with classroom teachers being expected (to varying degrees) to reinforce or integrate ICT. The two secondary schools ran ICT learning programs for year seven students with specialist teachers, although all teachers were expected to integrate (again to varying degrees of success).

Previous professional development approaches also varied considerably. Of the 16 schools, seven mentioned only internally initiated and delivered strategies; four mentioned only externally (CEO) initiated strategies and four mentioned a combination of the two.

A survey completed by most teachers prior to the project (using a 5 point Likert scale) revealed that significant differences existed between selected schools in relation to frequency of teachers' ICT use ($F=4.714$; $df=321$; $P=.000$), frequency of use with students ($F=4.388$; $df=306$; $P=.000$), attitude toward ICT ($F=1.977$; $df=322$; $P=.017$), anxiety ($F=2.498$; $df=322$; $P=.002$), reflection and metacognition ($F=2.381$; $df=322$; $P=.003$), learning independence ($F=1.790$; $df=322$; $P=.035$), pedagogical beliefs ($F=3.069$; $df=322$; $P=.000$) and confidence in skills ($F=2.748$; $df=322$; $P=.001$). Schools selected in 2005 and those selected in 2006 exhibited statistically significant differences *only* in relation to level of anxiety ($F=52.326$; $df=300$; $P=.000$).

Overall, teachers reported low levels of confidence for independent learning (overall M=3.10, SD=.65). They were more confident learning with maximum direction (… if there was someone giving them step by step instructions M=4.40), but were also willing to engage with independent learning if support was readily available (…if I could call someone for help if I got stuck M=4.11). Teachers who were confident with computers were most likely to employ exploratory learning strategies, enjoy new challenges, learn independently and regularly set goals. Teachers who perceive colleagues as a good support were less likely to be confident in their computer use, indicating that inappropriate support for less confident teachers (i.e. doing it for them) diminishes confidence and that more ICT confident teachers were not gaining support from less experienced colleagues. The pre-intervention survey indicated that reflection, in itself, does not lead to enhance confidence, independence or frequency of use, however it was associated with encouraging collegiality and goal setting, both of which were associated with confidence, independence and frequency of use.

The majority of teachers were engaged with a very basic and restricted range of ICT activities (mainly e-mail, word processing, PowerPoint, searching the Web, programming and lesson planning and research for lessons). Only a small number mentioned broader uses such as scanning, burning CDs or DVDs, subscribing to mailing lists or blogging and very few mentioned diverse and innovative use of ICT such as moviemaking, animation creation, music notation, sound recording etc. Time was cited as the biggest factor impacting on teachers' own use of computers, followed by internal factors (confidence/self-doubt/fear).

Strategies Trialled by Schools

Through the action research process schools were required to develop, adapt, trial and evaluate whole-school implementation strategies consistent with the metacognitive approach. These strategies can broadly be considered as related to (a) facilitation of the process, (b) goal setting, (c) mentoring and support and (d) reflection, discussion and celebration of achievements.

In most schools, facilitation of the process was through an identified team of CMs. This generally involved one member of executive (typically the assistant principal, but in some cases the principal) and 1–3 other teachers, usually drawn from different stages. CMs were not necessarily the most ICT competent teachers but were generally chosen for their ability to motivate and work with other staff. CMs did not necessarily do all the 'mentoring' but were facilitators of learning and coordinators of the process.

In relation to goal setting, a successful strategy was for mentors and small-groups of teachers (sometimes a grade or stage) to meet and talk through goals. Print and online resources guided teachers to set skill goals, integration goals, personal/ recreational goals, metacognitive goals and leadership goals and teachers were strongly encouraged to move outside their comfort zone. A number of schools found it useful to have a focus on individual goal setting for one term, so teachers could concentrate on their own learning needs, followed by a term focusing on classroom integration.

In some instances formal structures for mentoring and support were put in place, where a mentor was allocated regular time to meet with staff, either on a roster or by request. In other schools more emergent processes were employed with teachers being prompted to choose their own partnerships. Such flexibility allowed individuals more control over their learning process, with some teachers choosing an 'expert-novice' model and others a 'like-to-like' mentoring dynamic.

The majority of schools allocated regular time in the first 5–20 minutes of staff meetings to focus on reflection, discussion and celebration. A variety of reflection and discussion scaffolds were trialled and refined, including journal booklets. While responses from teachers to the journals were mixed and highly influenced by school culture and implementation strategy, CMs and school executive generally viewed them as valuable, particularly when preceded by structured discussion.

The degree to which schools' implementation of Technology Together was consistent with the foundational principles of the metacognitive approach varied considerably and was influenced by a range of practical and cultural factors. Of the sixteen schools, four were determined (by the researchers, with confirmation from schools themselves) as having a weak to medium level of consistency in their implementation of the metacognitive approach. Ten schools could be considered as having a medium to strong level of consistency, with two schools' approaches being strong to very strong. It needs to be remembered here that these 16 schools were themselves developing and refining the approach, and (particularly in the first year of implementation) had minimal pre-established resources and processes to draw on.

For individual teachers, involvement in Technology Together typically involved setting learning goals for each term (sometimes focused on their own skill development but most often related to classroom integration), then working with a mentor if they needed assistance to get started, with mentors placing a strong focus on fostering independent learning. Teachers would then actively discuss their learning with their colleagues in structured or semi-structured discussion, reflection and celebration sessions; with a focus not just on what they learnt but how they learnt, and their growing level of confidence. By way of example, the following story was told by one CM:

> One Year 3 teacher approached the CM and indicated that she was interested in doing something with digital photography. The CM indicated that she might consider using Photostory. The CM sat with her for 5–10 minutes, indicating that he didn't have long to show her the program but emphasising that she could pick up what she could and then could explore with class to find anything she couldn't do. The CM showed her where to put the photos so that the kids could access them (Assignment folder). She was very hesitant about the activity and wanted to get a teachers' aide to teach the students how to do it the first. The CM nudged her to set it as a challenge for herself; to try it and see what happens with the lesson. He told her to get the kids to open it up and he promised her that the kids would be able to work it out OK. The CM also suggested to her that she use the 'Ask three then me'…and if you don't know then just say that we can explore together. When the CM asked how the lesson went she said that they had been a bit noisy but she was really happy with the learning (School P).

Most schools indicated that Technology Together was substantially different to the ICT professional development approaches previously implemented in their school. Comments made in final reports indicate that, as a whole school approach, it reached greater numbers of staff, prompted more discussion and sharing about technology and formalised ICT professional learning. In comparison to methods previously employed, the approach acknowledged that each teacher was starting at a different place, encouraging them to identify and pursue personally relevant goals and putting them in charge of their own learning. It was also substantially different to give teachers choice over their learning strategies and support people. Importantly, however, participants differentiated the Technology Together approach from previous professional development strategies in that it built confidence by encouraging novices to teach each other and broke down perceptions of one person as expert, hence building collegiality and collaboration. The proactive promotion of reflection and acknowledging feelings, as well as the emphasise on celebra-

tion of achievements was considerably different for many schools. The 'non-finite' nature of the process was seen as positive and many schools indicated that they wanted to continue aspects of Technology Together in following years.

Findings in Relation to the Metacognitive Influences on Teachers

As already indicated, the metacognitive approach aims to assist teachers to become more self-directed learners through explicit discussion and 'teaching' of individual learning strategies, such as exploratory learning, problem-solving strategies, risk taking and learning with and from students. It was difficult, at times, for CMs to find a balance between reassuring teachers and catering to their preferred learning approaches (often 'just show me') versus challenging them to adopt new, more effective approaches. However, feedback from CMs at the Reconnector Workshop indicated that they believed it was very important to do so. They recommended the need to:

- focus on the process of learning as much, if not more, than the end product;
- show examples of, and explicitly teach, a variety of learning strategies;
- provide opportunities where teachers 'let go' of control and become willing to experiment and take risks;
- support at each new challenge and ensure teachers know where to find help;
- use positive peer support, since seeing others succeed motivates learning; and
- celebrate success at all levels.

As one teacher commented:

> Teachers are recognising that to be an effective ICT user, one does not have to, and indeed can not, know it all. However, the key to success in this arena is the willingness to experiment, problem solve and 'have a go' (School D).

Teachers need to be prepared to take risks with their own learning and embrace ambitious goals. They also need to be prepared to expose to their students their lack of confidence, knowledge or skill with ICT. In schools where Technology Together was most successful the notion of learning with and from students was explicitly discussed with the whole-school community, and teachers were encouraged to share their experiences of trying new things with their class. Promotion of risk taking was most effective when it was strongly reinforced and/or modelled by executive staff.

> Teachers are far more willing to engage their students through ICT's and the students are increasing their capabilities as well. Probably far more significant though is the fact that some teachers are now willing to explore different models of teaching ... Being initially reticent at being a co-learner with the students or even having the students teach the teacher has been replaced with excitement in exploring ways in which both student and teacher can learn together (School F).

Hesitancy to problem solve and seek help appropriately was evident within many school contexts. Schools that explicitly discussed help-seeking and problem-solving did evidence changes in teacher attitudes; in their willingness to problem-solve themselves, but also not to be afraid to seek help if needed. Making exploratory learning strategies explicit, modelling, prompting and providing tips all proved beneficial.

> One of the frequently discussed aspects of ICT in the classroom was the retelling of disastrous lessons or failed strategies. These were excellent opportunities for mentors to discuss problem solving and the learning which did occur as a direct result of the mishap or failure. Often teachers would begin to realize that failure and adversity provide rich opportunities for collaborative problem solving. Crucially, teachers were encouraged to reflect with their class about these situations and be explicit with their students about strategies for solving problems and collaborating with others (School P).

Integral to the metacognitive approach is a focus on perceived usefulness and motivation, with the evident goal of enhancing teachers' use of ICT in their classrooms, and supporting innovative pedagogy. Much of the current research around exemplary technology-using teachers would suggest that those who make meaningful use of technology do so in learner-centred, constructivist environments (Ertmer, Gopalakrishnan & Ross, 2001; Ertmer, Ottenbreit-Leftwich & York, 2006–2007). However, this research highlighted a readiness issue in relation to a focus of professional development on pedagogy, with some teachers expressing an overriding need to focus on their own skills first. This reinforced the need to retain the focus on personal and recreational goals. A cyclical process of reflecting on pedagogy and skills was felt to be most beneficial.

Schools varied greatly in their ability to adapt to change. While every school will have individuals who feel more (or less) confronted by change, whole-school communities can display and reinforce attitudinal patterns and traits. Problems arose, and in some cases were not overcome, where past practices and school culture had coloured staff attitudes and assumptions about professional learning. Experiences reinforced the criticality of close examination of school's history and culture prior to implementing Technology Together (Phelps, Graham & Watts, submitted).

Practical Issues in Implementing the Metacognitive Approach

There was widespread support for the whole-school approach. Initially 'whole school' referred to all teaching staff (including executive); however, experience led to the inclusion of support staff such as teachers' aides and, in some circumstances, administrative staff. Successful implementation of Technology Together was dependent upon identifying the right people to facilitate and lead the process and there were benefits in involving less technological-literate staff in key roles. Where CMs were ICT confident, active engagement of less confident staff in sharing, demonstrating and supporting others resulted in most positive outcomes. In larger schools most success was experienced by involving CMs from each stage or grade in key roles, but with an overall coordinator who facilitated the process across the school. While we began the research with a clear focus on mentoring models, it became clear that the notion of mentoring was neither appropriate for all schools nor consistent with the metacognitive approach. Using alternate terms such as 'learning partners' and/or building the concept that all teachers were supporting each other was more consistent. Schools which suggested these changes indicated that this reinforced the idea that no one knows everything and that the process is about learning together.

The metacognitive approach is founded on teachers setting their own learning goals within a scaffolded and supported environment. Resources to assist teachers identify 'what they don't know' and what they want to try were strengthened through the project. The resultant Orange Booklet, which contained a range of potential ideas in a checklist format, was viewed very positively by CMs, as was the notion of meeting staff at their point of need.

> During the year many staff noted that they felt less intimidated and more supported because there was no expectation that they would all reach the same level

> of competence or capability...Through playfulness and exploration teachers were able to commence their journey at their level, in their comfort zone, and as confidence increased they then extended their capabilities (School N).

A major factor influencing success of the process was timing of involvement. While no time is ever 'quiet' for schools some terms and years bring specific commitments and pressures. Introduction of A-E reporting in 2006 was one such factor, as were school reviews. The timeline for implementation (i.e., 3 terms) proved too short for most schools. An 18 month period was felt to enable involvement of all staff in pre-planning. Most success was experienced where schools approached Technology Together as a cyclical process, stepping back, refining and replanning activities each term.

Another issue impacting on implementation of the approach in a number of schools was that some teachers felt confronted or threatened by the term 'metacognition', seeing it as 'academic' and theoretical and many remained unclear about the approach. Acceptance would seem to rest heavily on how the approach is introduced and this needs to be sensitive to school culture.

The relevance of Technology Together in secondary schools remains largely unproven due to low consistency of implementation, particularly in the secondary school participating in 2006. Factors inhibiting implementation in secondary schools included infrequent whole-school staff meetings, pedagogical tensions (secondary teachers generally being content rather than process driven), the need to drive the process from within faculties, and the workability of release time. There was, however, support for the importance and urgency of involving secondary schools in the process.

External accountability (perceived to be provided by the university researcher) was viewed as a critical success factor by some schools, but was downplayed by others. However, most schools agreed that an external facilitator was important in providing fresh perspectives, revitalising and challenging schools, as well as transferring ideas between schools. A visit once a term was seen as essential.

Staff and stage meetings were undoubtedly the preferable place for routine reflection and discussion to occur. A range of strategies were suggested and participating schools were encouraged to try approaches appropriate to their own context. In many of the 2006 schools, reflection became associated with journal writing, even though both written and verbal, individual and group strategies were suggested. Notable differences existed between schools in their receptivity to journaling. For some it was approached positively, while for others it was a significant source of tension. Stronger encouragement to vary approaches may have minimised these problems.

While teachers' repeatedly claim that their ICT use is limited by time, the research illustrated that provision of release is not, in itself, a simple solution. Much learning occurred in Technology Together schools outside the context of release and teachers needed encouragement to take release even when it was available. Release is most effective when managed within the structures of the Technology Together process (i.e., goal setting, mentoring, reflection on strategies and showcasing achievements). That said, teachers did highly value release time. Even if they weren't necessarily active in requesting it, release was essential in conveying that the process was valued and supported. Time allocation was essential for the effective planning by project leaders.

It was never intended that the metacognitive approach would be reliant on level of school infrastructure, but rather a philosophy of 'making the most of what we have'. There were, however, times when lack of basic hardware did hold teachers back from pursuing challenging goals. Availability of some additional infrastructure, such as data projectors or newer classroom computers, would have encouraged greater risk taking and ambitious goal setting.

Ultimately, the successful implementation of the metacognitive approach lay with the skills and understandings of those facilitating the process. Some CMs seemed to embrace, understand and embody the metacognitive process expertly and (generally) it was in these schools where greatest success was recorded. Many CMs experienced significant outcomes in terms of their own leadership development. The role provided experience in managing and leading change, working with and coordinating staff, facilitating professional development and leading short and long term planning. Such experiences are valuable preparation for management roles and concord with the qualities sought by teacher accrediting bodies.

Outcomes from the Research

Interim and final reports were compiled by schools themselves, based on a series of questions that sought to prompt documentation of both descriptive and evaluative data, as well as to scaffold schools to critically reflect on ways that the process could be improved further. These reports documented a range of positive outcomes, including both practical initiatives, as well as more subtle changes in teachers' attitudes, values and day-to-day practice. The focus on teachers setting and pursuing goals that were personally challenging led to a diverse range of initiatives being implemented, ranging from enhanced efficiency of Web searching, using learning objects and creation of homework grids to composing digital music, stop-motion animation, using Google Sketch-Up and creating digital narrated stories.

Schools also reported outcomes for teachers in relation to their values, attitudes, beliefs and learning strategies. For example, schools indicated that Technology Together prompted teachers to:

- realise the importance of practising skills in order to retain learning;
- ask questions, make mistakes and get curious;
- admit that they don't know how to do things and get help instead of giving up;
- be less fearful of being judged;
- recognise that they have the capacity to solve a computer problem themselves;
- be willing to learn with and from their students; and
- realise they don't need to know everything to have a go.

In the words of one primary school participant:

> Before involvement with *Technology Together* teachers were in denial about what they could and couldn't do and they were struggling with ICT… it is easy for people to hide what they don't know. The process built communication that is open and honest and put an emphasis on moving places… There is a sense that the school now realizes that it can't become dust collectors (School J).

Overall Findings

A comparative analysis of pre- and post-intervention survey data was conducted. As with pre-survey data, overall means were determined for each school and for each year (i.e., overall means for 2005 and 2006 post-intervention). Table 1 (page 130) provides a summary of the change in means on each factor in both 2005 schools and 2006 schools, as well as schools overall (combining 2005 and 2006 schools). This analysis indicated that there were improvements on all factors when measured across all schools in each year and overall.

ANOVA and t-tests were conducted with post-intervention data to determine whether there were significant differences between the end-

Table 1: Comparison of Means Pre- and Post-Intervention by Year and Comparison of Post-Intervention Means Between Schools and Between Years

	2005 schools	2006 schools	Overall mean (all schools)	Difference between schools (post)	Difference between years (post)
Length time spent on a computer each day	Increase (pre: 1.57, post: 1.66)	Increase (pre: 1.86, post: 2.06)	Increase (pre: 1.74, post: 1.90)	F=1.83 (df=267) P=.031 *	F=4.74 (df=266) P=.011# *
Frequency of teacher use (7 point scale)	Increase (pre: 6.41, post: 6.55)	Increase (pre: 6.47, post: 6.63)	Increase (pre: 6.44, post: 6.60)	F=2.05 (df=267) P=.013 *	F=.888 (df=266) P=.508
Frequency of use with students	Increase (pre: 4.64, post: 4.88)	Increase (pre: 4.89, post: 4.98)	Increase (pre: 4.79; post: 4.94)	F=2.74 (df=267) P=.001 **	F=.294 (df=266) P=.668
Support and encouragement	Increase (pre: 3.61, post: 3.93)	Increase (pre: 3.67, post: 3.99)	Increase (pre: 3.64, post: 3.97)	F=2.13 (df=273) P=.009 **	F=.627 (df=272) P=.535
Attitude	Increase (pre: 3.30, post: 3.54)	Increase (pre: 3.46, post: 3.61)	Increase (pre: 3.39, post: 3.88)	F=1.76 (df=273) P=.040 *	F=.128 (df=272) P=.462
Non-anxiety	Increase (pre: 3.48, post: 3.69)	Increase (pre: 3.68, post: 3.85)	Increase (pre: 3.59, post: 3.78)	F=.86 (df=273) P=.608	F=.891 (df=272) P=.151
Perceived usefulness	Increase (pre: 3.71, post: 3.87)	Increase (pre: 3.70, post: 3.84)	Increase (pre: 3.70, post: 3.85)	F=1.81 (df=273) P=.033 *	F=.044 (df=272) P=.693
Reflection and metacognition	Increase (pre: 3.03, post: 3.31)	Increase (pre: 2.96, post: 3.21)	Increase (pre: 2.99, post: 3.25)	F=2.17 (df=273) P=.008 **	F=.172 (df=272) P=.343
Learning independence	Increase (pre: 3.15, post: 3.29)	Increase (pre: 3.26, post: 3.60)	Increase (pre: 3.21, post: 3.48)	F=1.808 (df=273) P=.034 *	F=4.831 (df=208) P=.001# **
Pedagogical beliefs	More constructivist (pre: 2.45, post: 2.38)	More constructivist (pre: 2.46, post: 2.38)	More constructivist (pre: 2.46, post: 2.38)	F=3.66 (df=272) P=.034 **	F=3.345 (df=271) P=.984
Skill confidence	Increase (pre: 3.54, post: 3.80)	Increase (pre: 3.68, post: 4.03)	Increase (pre: 3.62, post: 3.93)	F=1.10 (df=272) P=.355	F=8.176 (df=272) P=.042 *

** significant at the .05 level; ** = significant at the .005 level; # equal variances not assumed (<.05)*

points of individual schools or between years. Table 1 also summarises this data. This analysis indicates that, following implementation of *Technology Together,* there were significant to highly significant differences between schools on all measures except anxiety and skills. This contrasted to the situation prior to the research where differences between schools existed on these two measures (anxiety and skills) but not in relation to length of time on computers, support and encouragement and perceived usefulness. When the differences between years were compared in relation to post-intervention data, significant differences were observed in relation to length of time on the computer and skill confidence, and highly significant differences between schools were observed in relation to learning independence.

A paired sample t-test was also conducted to compare the pre-intervention and post-intervention means of each of the schools on each of the factors. Table 2 outlines levels of significance (** p< .01 * p<.05) and indicates that there were statistically significant or highly significant increases for many schools on at least one factor, but particularly in relation to attitude, learning independence and skills. Schools that recorded statistically significant or highly significant improvements on at least five of the eleven measures were Schools D, F, G, N and O (all with strong to very strong consistency in their implementation of the metacognitive approach).

Together with the post-intervention survey, staff were also asked to provide responses to a series of questions seeking evaluative feedback on the *Technology Together* process itself. Teachers were asked to indicate how valuable various aspects of the process had been in supporting their learning. In both years the release time was noted as most valuable (2005 M=4.36; 2006 M=4.41, followed by principal support for the program (2005 M=4.36; 2006 M=4.34). Also rated highly were the fact that ICT was the focus in the school for the year (2005 M=4.15; 2006 M=4.05) and that teachers were talking about and sharing what they were doing (2005 M=4.14; 2006 M=4.32). Participants in 2006 valued the role of the facilitators/mentors considerably more than those in 2005 schools (2005 M=3.88; 2006=4.25). ICT goal setting and reflecting on achievements were perceived as less valued by teachers. Notably, goal setting was perceived more positively in the second cycle of the project (2005 M=3.72; 2006 M=3.90); which perhaps reflects the improved strategies and resources in place to support this process. Documenting achievements (likely to have been interpreted as the journaling process) was perceived as least valuable, and was substantially lower in the second year when more focus was placed on journaling by schools (2005 M=3.09; 2006=2.79).

Although the more negative reaction to goal setting and documenting achievements might be interpreted as a disincentive for employment of the metacognitive approach, such feedback must be interpreted within a wider context. Feedback on the benefits of these processes in terms of teacher learning and increased professionalism were strongly stated by a number of executive and CMs and are strongly advocated in current research and educational policy (see the introduction to this paper). This data would suggest that, despite the fact that we have been talking about reflection in teacher professional practice for many years, we should not be complacent about the degree to which teachers are familiar with, or appreciative of, this process or the difficulties of implementing such approaches in whole-school contexts. While teachers may find it challenging to be active in driving and monitoring their own learning, this is not necessarily a negative thing. It does, however, indicate that strategies for supporting these processes in schools might be strengthened further (and have been in subsequent developments of *Technology Together*).

Most notably, the data indicated that schools where implementation was strongly consistent with the metacognitive approach were more likely to record high evaluative responses. Schools where implementation was weaker provided lower evaluative feedback (with one school representing an anomaly to this pattern).

Table 2: T-test Comparing Pre-Iintervention and Post-Intervention Means of Each of the Schools on Each of the Factors

	School A df=7	School B df=22	School C df=6	School D df=14	School E df=26	School F df=9	School G df=12	School H df=3	School I df=7	School J df=7	School K df=6	School L df=25	School M df=5	School N df=28	School O df=8	School P df=13	ALL SCHOOLS df=102[1]
Length time spent on a computer each day	t=.000 P=1.00	t=-.224 P=.825	t=-1.441 P=.200	t=.642 P=.531	t=.681 P=.503	t=-.557 P=.591	t=-.762 P=.461	(a)	t=.357 P=.732	t=-1.000 P=.351	t=-.311 P=.766	t=-1.087 P=.287	t=-1.000 P=.363	t=-.297 P=.769	t=-2.828 P=.022 *	t=-.322 P=.752	t=-7.789 P=.000 **
Frequency of teacher use	(a)	t=-.188 P=.853	t=-1.00 P=.356	t=-2.572 P=.022 *	t=-.440 P=.664	t=-1.500 P=.168	t=.000 P=1.000	(a)	t=-1.000 P=.315	t=-2.646 P=.033 *	t=-.795 P=.457	t=-1.000 P=.327	t=1.581 P=.175	t=1.000 P=.326	t=-2.309 P=.050 *	t=-1.749 P=.104	t=10.003 P=.000 **
Frequency of use with students	t=1.00 P=.363	t=-.152 P=.880	t=-1.581 P=.175	t=-3.167 P=.007 **	t=-1.094 P=.287	t=-.452 P=.662	t=-1.000 P=.339	t=.658 P=.578	t=.683 P=.516	t=1.000 P=.351	t=.000 P=1.000	t=-1.594 P=.123	(b)	t=-.122 P=.904	t=-2.049 P=.080	t=.377 P=.712	t=1.158 P=.248
Support and encouragement	t=.000 P=1.000	t=-.956 P=.350	t=-.564 P=.593	t=-4.361 P=.001 **	t=-4.857 P=.000 **	t=.969 P=.358	t=-.774 P=.454	t=-1.800 P=.170	t=.000 P=1.000	t=-2.164 P=.067	t=.548 P=.604	t=-.547 P=.589	t=-1.671 P=.156	t=-5.874 P=.000 **	t=-4.333 P=.003 **	t=-1.121 P=.283	t=-4.812 P=.000 **
Attitude	t=-1.007 P=.348	t=-.989 P=.333	t=-.894 P=.406	t=-2.428 P=.029 *	t=-1.227 P=.231	t=-3.303 P=.009 *	t=-2.556 P=.025 *	t=-3.729 P=.034 *	t=-1.541 P=.167	t=-.624 P=.553	t=-.799 P=.455	t=.198 P=.845	t=-2.641 P=.046 *	t=-2.600 P=.015 *	t=-1.474 P=.179	t=-1.624 P=.128	t=-4.008 P=.000 **
Non-anxiety	t=-2.546 P=.038 *	t=-.354 P=.727	t=-.141 P=.892	t=-3.464 P=.004 **	t=-1.130 P=.269	t=-3.096 P=.013 *	t=-1.873 P=.086	t=-2.931 P=.061	t=-1.426 P=.197	t=-1.578 P=.156	t=-.115 P=.912	t=.068 P=.945	t=-1.118 P=.314	t=-3.154 P=.004 **	t=-2.345 P=.047 *	t=-.749 P=.467	t=-3.389 P=.001 **
Perceived usefulness	t=-1.016 P=.343	t=-1.103 P=.282	t=-1.103 P=.312	t=-1.894 P=.079	t=.511 P=.613	t=-2.606 P=.028 *	t=-2.202 P=.048 *	t=-1.924 P=.150	t=-.864 P=.416	t=-.676 P=.520	t=.789 P=.460	t=-.159 P=.875	t=-.121 P=.908	t=-2.182 P=.038 *	t=-2.174 P=.061	t=-.984 P=.343	t=-3.029 P=.003 **
Reflection and metacognition	t=-1.073 P=.319	t=-1.056 P=.302	t=-.630 P=.552	t=-3.231 P=.006 *	t=-1.876 P=.072	t=-1.268 P=.028 *	t=-2.275 P=.042 *	t=-.2.357 P=.100	t=-1.240 P=.255	t=-2.453 P=.044 *	t=-.668 P=.529	t=-.129 P=.898	t=-2.169 P=.082	t=-3.632 P=.001 **	t=-1.078 P=.313	t=-1.226 P=.242	t=-4.159 P=.000 **
Learning Independence	t=-1.499 P=.178	t=-1.809 P=.084	t=-1.146 P=.295	t=-3.362 P=.005 **	t=-4.698 P=.000 **	t=-2.847 P=.019 *	t=-2.878 P=.014 *	t=-2.598 P=.081	t=-1.871 P=.104	t=-1.239 P=.255	t=-1.119 P=.306	t=-.534 P=.598	t=-3.782 P=.013 *	t=-1.684 P=.103	t=-2.121 P=.067	t=.273 P=.789	t=-2.036 P=.044 *
Pedagogical beliefs	t=.856 P=.420	t=.798 P=.434	t=.387 P=.712	t=-.269 P=.792	t=2.230 P=.035 *	t=1.020 P=.334	t=-.635 P=.538	t=1.441 P=.245	t=.000 P=1.000	t=-.700 P=.506	t=1.389 P=.214	t=-2.053 P=.051	t=.000 P=1.000	t=.734 P=.469	t=1.901 P=.094	t=1.035 P=.320	t=2.032 P=.045 *
Skills	t=-4.593 P=.003 **	t=.791 P=.437	t=-2.733 P=.034 *	t=-3.050 P=.009 *	t=-2.716 P=.012 *	t=-3.657 P=.005 **	t=-2.862 P=.014 *	t=-2.255 P=.109	t=-4.117 P=.004 **	t=-4.017 P=.005 **	t=-1.839 P=.116	t=-3.023 P=.006 *	t=-1.683 P=.153	t=-5.262 P=.000 **	t=-2.462 P=.039 *	t=-2.979 P=.011 *	t=-2.665 P=.009 *

(a) The correlation and t cannot be computed because the standard error of the difference is 0. (b) unable to be calculated due to non-variance in post-means.

[1] df=102 for most questions except Length of time (df=205), frequency of teacher use (df=206) and frequency use with students (df=197).

** p<.05 ** p< .01 Areas of significance (p<.05) and high significance (p< .01) have also been shaded for ease of readability.*

Discussion and Conclusion

This research would suggest that the metacognitive approach *can* be successfully implemented within a whole-school environment and that it can have a positive impact on the culture of the school and ICT use by teachers. As indicated by participating schools, the *Technology Together* approach can:

- change teachers' understandings of technology integration and promote a positive attitude to ICT;
- motivate teachers to experiment and try new things;
- change teachers' attitude to professional learning and their confidence to learn;
- create a 'can do' attitude across a school;
- enhance school leaders' relationships with teachers;
- change teachers' relationships with their students; and
- lead to culture change and to the building of a learning community.

> *Technology Together* has proven to be an outstanding success at (our school)…The attitude of teachers to ICT in general terms has also undergone a momentous change. It is now taken for granted that ICT is a part of every day teaching and learning at our school. ICT enjoys a much higher profile and discussion surrounding it is common place (School D).

That said, the research has also highlighted the complex range of factors that influence teachers' ICT learning. In fact, it is this very complexity which led to the development of the metacognitive approach. As highlighted by Levin and Wadmany (2006-2007, p.172) 'educational change involving information technology is an individual process, unique to each teacher… even when working with groups in a supportive and dynamic learning community, which has a guiding culture, teachers respond differently to similar educationally innovative ideas'. While the metacognitive approach can provide schools with a framework, ideas, tips, resources and suggestions, together with stories and 'real life' examples of teachers' experiences, it cannot guarantee outcomes in all schools. Much relies on school leadership, the school culture and the personal capabilities of those in the schools implementing the process.

Ultimately, teachers need to have ownership over the process and be motivated and engaged, and while *Technology Together* suggests ways of building this commitment, as the research has shown, there will always be some staff who remain resistant to ICT integration, or to ongoing professional learning and change more broadly. *Technology Together* can provide guidance in these circumstances and tips on how to gradually and subtly engage all teachers, but teachers (just like students) can not be *made* to learn. By working at the level of changing school culture, it is believed that even the most reticent teachers can be, at least in some way, influenced by the process and carried along with the current of culture change.

> …Change is a process, not an event. The change process has started at (our school). We have felt uncomfortable, frustrated, intimidated and overwhelmed. We have experienced failure. However, now we know that we are not alone. We know that there are others who can help us and there is more than one way to solve a problem. We have also felt success, we have been innovative, and we are excited by the progress we have made this year (School E).

References

Doherty, L. (2005, October 1). Where worlds collide and pupils leave teachers behind. *Sydney Morning Herald,* p. 65.

Downes, T., Fluck, A., Gibbons, P., Leonard, R., Matthews, C., Oliver, R., et al. (2001). *Making better connections: Models of teacher professional development for the integration of information and communication technology into classroom practice.* Canberra: Commonwealth Department of Education, Science and Training.

Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 47*(4), 47–61.

Ertmer, P., Gopalakrishnan, S., & Ross, E. (2001). Technology-using teachers: Comparing perceptions of exemplary technology use to best practice. *Journal of Research on Technology in Education*, *33*(5), http://www.iste.org/inhouse/publications/jrte/33/5/ertmer.cfm?Section=JRTE_33_5

Ertmer, P., Ottenbreit-Leftwich, A., & York, C. (2006–2007). Exemplary technology-using teachers: Perceptions of factors influencing success. *Journal of Computing in Teacher Education, 23*(2), 55–60.

Ertmer, P. A., & Newby, T. J. (1996). The expert learner: Strategic, self-regulated and reflective. *Instructional Science, 24*, 1–24.

Flavell, J. H. (1976). Metacognitive aspects of problem solving. In L. B. Resnick (Ed.), *The nature of intelligence* (pp. 231–235). Hillsdale, NJ: Erlbaum.

Higgins, S., & Mosley, D. (2001). Teachers' thinking about information and communications technology and learning: Beliefs and outcomes. *Teacher Development, 5*(2), 191–210.

Jones, B., & Idol, L. (1990). Introduction. In B. Jones & L. Idol (Eds.), *Dimensions of thinking and cognitive instruction* (pp. 1–13). Hillsdale, NJ: Lawrence Erlbaum.

Levin, T., & Wadmany, R. (2006-2007). Teachers' beliefs and practices in technology-based classrooms: A developmental view. *Journal of Research on Technology in Education, 39*(2), 157–181.

MCEETYA ICT in Schools Taskforce. (2006). *Learning in an online world: Leadership Strategy*. Carlton South, Melbourne. http://icttaskforce.edna.edu.au/icttaskforce/webdav/site/icttaskforcesite/users/root/public/learning_online_contemp.pdf

Moyle, K. (2006). *Leadership and learning with ICT: Voices from the profession.* Canberra: Teaching Australia.

Paris, S. G., & Winograd, P. (1990). How metacognition can promote academic learning and instruction. In B. Jones & L. Idol (Eds.), *Dimensions of thinking and cognitive instruction* (pp. 15–51). Hillsdale, NJ: Lawrence Erlbaum.

Phelps, R. (2002). *Mapping the complexity of computer learning: Journeying beyond teaching for computer competence to facilitating computer capability.* Unpublished PhD, Southern Cross University, Lismore.

Phelps, R. (2007). The metacognitive approach to computer education: Making explicit the learning journey. *AACE Journal (International Forum on Information Technology in Education), 15*(1), 3–21. http://www.editlib.org/index.cfm?fuseaction=Reader.ViewAbstract&paper_id=19964

Phelps, R., & Ellis, A. (2002a, 3–6 December). *Helping students to help themselves: Case studies from a metacognitive approach to computer learning and teaching.* Paper presented at the International Conference on Computers in Education (ICCE 2002), Auckland, New Zealand: http://icce2002.massey.ac.nz/

Phelps, R., & Ellis, A. (2002b). *A metacognitive approach to computer education for teachers: Combining theory and practice for computer capability.* Paper presented at the Linking Learners: Australian Computers in Education Conference (ACEC2002), Hobart, Tasmania: http://www.pa.ash.org.au/acec2002/

Phelps, R., Graham, A., & Kerr, B. (2004). Teachers and ICT: Exploring a metacognitive approach to professional development. *Australian Journal of Educational Technology, 20*(1), 49–68.

Phelps, R., Graham, A., & Watts, T. (submitted). The whole-school context of ICT integration: Acknowledging diversity in culture, practices and leadership. *Improving Schools*. http://www.sagepub.com/journalsProdDesc.nav?prodId=Journal201678

Phelps, R., Hase, S., & Ellis, A. (2005). Competency, capability, complexity and computers: Exploring a new model for conceptualising end-user computer education. *British Journal of Educational Technology, 36*(1), 67–84.

QSITE. (2006). Guidelines for effective ICT related professional development for Queensland teachers. *Quick,* (100), 21–22.

Ropp, M. M. (1997). E*xploring individual characteristics associated with learning to use computers and their use as pedagogical tools in preservice teacher preparation*. Unpublished PhD, Michigan State University. http://www.educ.msu.edu/homepages/ropp/Dissertation/PrelimPages.html

Ropp, M. M. (1998, 1st June). *A new approach to supporting reflective, self-regulated computer learning.* Paper presented at the Society for Information Technology and Teacher Education 98: http://www.educ.msu.edu/homepages/ropp/SITE/SITE.html

Ross, E., Johnson, T., & Ertmer, P. (2002). *Technology integration and innovative teaching through collaboration, reflection and modelling: Research results from implementation of a staff development model.* Available: http://www.edci.purdue.edu/ertmer/docs/AECT02.pdf.

Schunk, D., & Zimmerman, B. J. (Eds.). (1994). *Self-regulation of learning and performance: Issues and educational applications*. Hillsdale, NJ: Lawrence Erlbaum.

Snoeyink, R., & Ertmer, P. (2001). Thrust into technology: How veteran teachers respond. *Journal of Educational Technology Systems, 30*(1), 85–111.

Tearle, P. (2003). Enabling teachers to use information and communication technology for teaching and learning through professional development: Influential factors. *Teacher Development, 7*(3), 457–471.

UNESCO. (2002). *Information and Communication Technologies and Teacher Education*. Paris: UNESCO. http://www.eldis.org/static/DOC10100.htm

Zammit, K., Sinclair, C., Cole, B., Singh, M., Costley, D., Brown, L., & Rushton, K. (2007). *Teaching and leading for quality Australian schools: A review and synthesis of research-based knowledge*. Sydney: Teaching Australia.

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~~President's Message continued from p. 115~~

~~representatives gathered via teleconference in early April of 2008 to discuss the feasibility and possible design of future collaborative efforts to create viable methods of assessing higher order learning outcomes required of 21st century learners. Participants included Walter Heinecke (University of Virginia), Gerald Knezek (University of North Texas), Kimberly Lawless (University of Illinois at Chicago), Cheryl Lemke (Metiri Group), Deborah Lowther (University of Memphis), and Bill Penuel (SRI International). Especially interesting to me were the ideas generated related to possible work groups (by 21st C. skills/terms), open source assessments, the vision for a "total package" approach involving both student skills and teacher models, and the potential to influence policy through bringing the right groups together. Participants will teleconference again prior to NECC and some members of this group will be presenting at the 2008 SIGTE Forum discussing next steps in this effort. (See table on page 134 for date/time of the forum.)~~

~~SIGTE and Reauthorization of the Higher Education Act: Preparing Teachers for Digital Age Learners~~

~~We have been appreciative that throughout the year Hilary Goldmann, ISTE's Director of Government Affairs, has kept in touch with SIGTE officers and members regarding the status of the reauthorization of the Higher Education Act. The bill to authorize a program to prepare teachers for digital age learners (H.R. 5848) was referred to the House Committee on Education and Labor on April 17, 2008. SIGTE participated in conceptualizing the original proposal for this legislation to replace the discontinued PT3 program. (Visit http://www.govtrack.us/congress/bill.xpd?bill=h110-5848 to learn more.)~~

~~SIGTE Wiki Holds Resources for SIGTE-Sponsored Workshop on Podcasts and Vodcasts~~

~~Serving as SIGTE Communications Officer, Teresa Foulger has done a wonderful job of developing the initial SIGTE wiki pages. When we asked for additional volunteers to assist with the SIGTE-sponsored workshop at NECC 2008, Peggy George (retired Arizona State University West faculty member) used the wiki to give the workshop a boost by posting resources about podcasting, vodcasting, digital storytelling, music and image resources, RSS, and K-12/higher education examples. Peggy's description of the resource list suggests that it can be used before, during, and after the workshop. SIGTE members are encouraged to post material of potential interest to other members. You can find the wiki at http://sigte.iste.wikispaces.net/~~

~~In conclusion, you can see that SIGTE members have been working together during the past year, not only to prepare for NECC, but linking together for our own professional development and connecting our advocacy to major issues related to technology and teacher education. We invite you to participate in these efforts both at NECC and in the year to come!~~