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Teachers and ICT: Exploring a metacognitive approach to professional development

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Professional development for teachers in information and communication technology (ICT) is currently a major priority for school systems in Australia and internationally. The metacognitive and reflective approach to professional development described in this paper is a response to the limitations of directive approaches to ICT learning within a context of rapid technological change. It proposes a capability based approach which strives to develop lifelong computer learning strategies. An important characteristic of the metacognitive approach is that, rather than specific objectives or outcomes being 'imposed' on learners, participants are encouraged to identify, articulate and pursue personally relevant goals, including those related to skills, attitudes, confidence, values and understandings, integration and school leadership. This paper reports on a research project which investigated the applicability of such an approach to teacher professional development. The approach was found to have significant outcomes in terms of computer skill development, and in influencing teachers' approaches to their own and their students' learning.

The context of teacher professional development in ICT

Computer technology plays an integral role in our personal and professional lives. The ability to utilise this technology has become the new literacy for the 21st century and is of critical importance in enabling Australia to compete successfully in the global community. For future generations to maximise their capability to operate within competitive and technologically driven economies, it is critical to foster computer abilities at every level of the schooling process, and teachers are central to this endeavour. Just as literacy and numeracy have become imperatives in school education, so too has 'technacy' (Seemann, 2000). For instance, in an initiative paralleling past and current approaches to literacy and numeracy education, New South Wales (NSW) will, in 2004 or 2005, implement state wide computer skills assessments for all Year 10 students, with plans for the later introduction of testing for Year 6 students (NSW Board of Studies, 2001). Such an initiative reflects the emphasis on computer skills not only at the state level, but nationally and internationally, and highlights the critical importance of all teachers assuming responsibility for the integration of computer technology across Key Learning Areas (KLAs). As Lai (1999, p.12) states, 'It is teachers' attitudes towards technology, their beliefs in teaching and learning and their styles of teaching that determine how students use the Web and what sort of learning experience will be acquired'.

The recent Inquiry into the Provision of Public Education (Esson, Johnson & Vinson, 2002) has highlighted significant concerns relating to teacher professionalism, including a critical need to redress the lack of fiscal support for teacher professional development. In particular, teacher professional development in computer technology has become a major priority at state and national level. The release of the Review of Teacher Education in NSW (Ramsey, 2000) highlighted the critical importance of computer education for all pre-service and practising

teachers. In this report ICT was seen as 'one of the most significant challenges now confronting teacher education, teachers and schools' (p.68). Given the ageing population of teachers, particularly in Australia (Esson, Johnson & Vinson, 2002; Ramsey, 2000) the majority of practising teachers did not receive pre-service training in computer use. Yet teachers have experienced increasing expectations to incorporate computer technology into their teaching. They are required to have a broad range of skills to use a wide range of software and adapt these skills to a diverse set of classroom situations. Additional pressure stems from expectations that teachers model positive, self efficacious attitudes to their students (Delcourt & Kinzie, 1993; Russell & Bradley, 1997).

It has been stated that teachers in general are not confident in their use of computers (Russell & Bradley, 1997) and that there is historical resistance surrounding their use (Albaugh, 1997). Few teachers have received pre-service training in computer use and many have high computer anxiety and low computer self efficacy. Furthermore, for many teachers the gap between perceived technological competence and learning to use computers in their teaching is often threatening and overwhelming (Ropp, 1998). Given the isolated and independent nature of their work, if teachers encounter difficulties there is often very little assistance or support available to them (Becker, 1994, 2000).

Numerous studies point to limitations of professional development programs offered to practising teachers (Niederhauser, 2001; Russell & Bradley, 1997; Williams, 1998) and various alternative models are beginning to be proposed and trialed (Bell & Coultas, 1996; Holtzberg, 1997; McKinnon, 1989; Strudler, McKinney & Jones, 1999; Williams, 1998). As Lundin (2002) points out, despite years of concerted effort in all Australian states, it is unlikely that more than fifty percent of teachers have a basic standard of computer skills. ICT professional development is essential but with computer technology evolving at such a rapid rate, directive style training becomes inadequate or out of date in a very short period of time, months not years. Technology is too diverse and evolves too rapidly for teachers to be reliant on workshops and seminars (Melczarek, 2000). 'There are cases where teaching specific skills inspires some teacher education students to adopt a technology mindset to approaching curriculum planning. However, for the most part, this transmission model of technology adoption fails' (Ferdig, 1998).

Indeed, in the area of educational IT training, the more general criticism of teacher professional development made by Barth (1986) might be considered particularly relevant in that 'most forms of teacher development activity leave untouched the incompetent, insult the capable and at best, are ineffectual'. A further indicator of the ineffectiveness of many training programs for teachers is provided by Loveless (1995, p.xii): 'It is not possible to consider the use of IT in classrooms without reflecting upon one's beliefs about learning and teaching. IT capability can be seen as much more to do with an approach to ways of learning and working than as the development of a set of skills'.

Esson, Johnson & Vinson (2002) highlight that, for too long, there has been a focus on 'training and development' rather than 'professional development' and their report points to the potential value of reflective approaches which are part of an everyday process of improvement in the natural setting. Learning to use computers involves learning to adapt to change, to be flexible, intuitive and above all persistent, and learners who know how to be self directed and independent will be more successful than those dependent on structured routines or guidelines (Ropp, 1997, 1998). Effective professional development requires more than skills training; it involves changes in attitude, values and beliefs that develop confidence for ongoing learning. These issues obviously present challenges to teacher preparation and professional development programs. They point to a need to move away from skill objectives to focus more on teachers' approaches to learning, their beliefs, attitudes and metacognitive understandings. It entails helping individuals come to terms with the nature of technological change and their own abilities to confront this change. Of implicit importance here is a focus on effective learning strategies which empower learners to continue to learn computer skills throughout life.

There is a strong case to be made, therefore, for approaches to professional development where teachers are required to be more self directed in identifying what they need to learn and in undertaking the actual learning. Teachers need to develop adaptive computer learning skills. They need to develop self efficacious approaches to information technology, an ability to learn from colleagues, support personnel and students (Rea, Hoger & Rooney, 1999); in essence, they need to engage in self directed and lifelong computer learning. Research such as that by Zhao et al. (2001) emphasises the importance of a positive attitude to integration, enthusiasm, lack of anxiety and approach to learning and teaching as key factors in adoption of technology by teachers. These are aspects rarely addressed in directive style professional development programs.

Why a metacognitive and reflective approach?

'Metacognition' refers to knowledge concerning one's own cognitive processes, and the active monitoring and consequent regulation of these processes in the pursuit of goals or objectives (Flavell, 1976; Flavell, Miller & Miller, 1993). Paris and Winograd (1990) and Jones and Idol (1990) discuss two dimensions of metacognition: 'self appraisal' and 'self management'. Self appraisal refers to reflections about one's knowledge state and abilities, including what you know, how you think, and when and why to apply knowledge and strategies. Cognitive self management refers to 'metacognitions in action' (Paris & Winograd, 1990, p.18), or the ability of the individual to plan and implement appropriate strategies and to monitor, adjust and 'trouble shoot' their performance.

The benefits of metacognitive teaching approaches lie in their ability to transfer responsibility for monitoring learning from teachers to learners, and in promoting positive self perceptions, affect and motivation among learners (Paris & Winograd, 1990). Metacognition has also been explored by Zimmerman (1986; 1994) in his discussion of self regulated learners. Self regulation is the process whereby 'students activate and sustain cognitions, behaviours and affects, which are systematically oriented toward attainment of their goals' (Schunk & Zimmerman, 1994, p.309). Ertmer and Newby (1996) extended Zimmerman's notion of self regulated learning in their discussion of 'expert learners', a concept which adds the ingredient of reflection. By way of definition, Ertmer and Newby state that 'expert learners use the knowledge they have gained of themselves as learners, of task requirements, and of specific strategy use to deliberately select, control and monitor strategies needed to achieve desired learning goals' (Ertmer & Newby, 1996, p.1). In other words, they are aware of the knowledge and skills they do or do not possess, and use appropriate strategies to actively implement or acquire them. 'Expert' learners are therefore self directed and goal oriented. In contexts of rapid change, expert learners' metacognitive strategies provide distinct advantages: 'When asked to deal with novel situations, the specific cognitive skills and learning strategies we have available become more critical than the limited content knowledge we may possess' (Ertmer & Newby, 1996, p.7). As has been pointed out by Ropp (1997; 1998) in novel situations, an understanding of 'how' to learn by using specific cognitive skills and strategies distinguishes expert learners from novices who may have an equal unfamiliarity with the content of the domain. It is these approaches to learning, and the desire to empower learners to continue to support their own professional learning in ICT beyond the period of the intervention, which underpin this research.

Background to the study

During 1999-2002 an action research project investigated the use of a metacognitive approach to undergraduate pre-service teacher computer education (Phelps, 2001; Phelps & Ellis, 2002a, 2002b, 2002c; Phelps, Ellis & Hase, 2001). A metacognitive process was developed and refined and strategies and prompts were formulated to scaffold students' engagement in productive reflection and relevant metacognitive engagement. In particular, participants are prompted to consider: their past and current feelings, attitudes, beliefs and motivations regarding computer use; their computer self efficacy and attributional patterns; their educational or social concerns

regarding ICT; their past, current and potential ICT learning strategies; and goal setting and goal achievement. This metacognitive approach to computer education was found to be beneficial in helping students overcome computer anxiety and in developing appropriate lifelong learning strategies for computer use.

This paper focuses on subsequent research which aimed to investigate the relevance and transferability of this approach to the context of professional development of teachers in ICT. In particular, this research aimed to:

- Explore the relevance of the metacognitive and reflective approach with practising teachers;
- Trial the implementation of the approach within a professional development framework, including issues of remote delivery supplemented with face to face workshops, support materials and online interaction;
- Identify issues impacting on the successful implementation of the approach for teacher professional development; and
- Identify areas for refining the model and process.

The Catholic Education Office, Lismore Diocese, expressed an interest in working with Southern Cross University in trialing this approach to ICT professional development of their teachers. In particular, they wished to focus initially on secondary teachers throughout the Diocese. The Lismore Diocese extends from Tweed Heads in the North of NSW to Laurieton on the Mid-north Coast of NSW, with 10 secondary schools educating 6835 students and employing 550 teachers. The geography of the Diocese posed challenges for access to professional development because of the time and cost involved in travel. The format for the professional development thus needed to take account of this consideration.

It was not feasible to provide release for teachers and workshops were held on weekends. However, the negotiated professional development framework was structured to allow participants the option to complete two assessment tasks in order to obtain accreditation for one unit at postgraduate level, thus enabling credit toward a Graduate Certificate or Master of Education.

Methodology

Promotional information was distributed to all secondary teachers in the Lismore Diocese. Volunteer participants were sought and, following a very high level of interest in the program, a sample of 40 teachers was selected by the collaborating partner organisation to include a balance of experienced and inexperienced, anxious and confident computer users. This sample of 40 represents 7% of the teachers within secondary schools in the Lismore Diocese. The research followed a pre-test, intervention and post-test approach. The professional development experience extended over a period of two school terms and involved participants in attending 2 workshops, interacting with self paced print, CD and Website based resources, and participating in online communication. The metacognitive process was scaffolded through the first workshop and the print based 'Thinking' module, which involves teachers in identifying their initial feelings, motivations and beliefs, and the appropriateness of various learning strategies in achieving their own self identified learning goals. They were also required to reflect on at least one school or classroom based initiative. It was expected that teachers who chose to complete the assessment tasks and fully engage with the readings and theory would spend approximately 150 hours of learning (to be equivalent to that required in a postgraduate level course). However, it was explicitly acknowledged that a portion of this learning would occur as a result of rigorous reflection on their day to day classroom practice.

Data were collected from participants before and during the intervention using pre- and post-intervention surveys, together with reflective journals maintained by participants; observations made by researchers during workshop interventions; online interactions; unstructured interviews with participants and documentation of discussions with CEO personnel. Interviews were also

conducted with around one third of participants 6 months following the intervention, to determine the longer term outcomes of the professional development intervention and the rate of adoption and integration of technology in their teaching practice.

Of the 38 participants returning the initial survey, 20 (53%) were male and 18 (47%) were female. The average number of years' teaching experience was 19, with a minimum of 3 and a maximum of 28. The most common age bracket of participants was 41-45 with 11 teachers below the age of 40 and 17 above the age of 46. One teacher was in the age bracket 26-30 and one teacher was 60+. Of the 38 respondents, 8 were from Maths, 6 from English, 5 from Personal Development, Health and Physical Education (PDHPE), 5 from Science, 4 from Technology and Applied Science (TAS), 4 from Human society and its Environments (HSIE), 2 from Religious Education, 2 from Languages other than English (LOTE) and one each from Agriculture and Visual Arts.

Characteristics of participants

There were two very distinct groups of participants, differing markedly in terms of their level of computer use, their perceptions of encouragement and support, their attitudes, feelings, learning confidence and skills in relation to computers. While the majority used computers for approximately 1 hour per day each day, 4 teachers used computers less frequently than monthly, with one teacher 'never' having used computers. Twenty-one percent (21%) 'never' used computers with their students and only 8% did so daily. While the majority of the teachers felt encouraged and supported in their computer use approximately 29% did not. The majority expressed a positive attitude toward computer use but again, 14% did not like working with computers and 35% indicated at least some level of computer anxiety. The majority liked the challenge of learning new computer skills but 16% did not. Notably 31% of participants did not feel that they were effective computer learners. Between 36 and 41% of participants indicated they would not be confident learning in contexts of high independence, while 46% indicated some degree of confidence in such contexts. Levels of perceived usefulness were, however, very high across the participant group.

Less than half of participants indicated that they employed some form of reflection in their computer use (notably this question was asked before the topic on reflective practice was covered with participants). Only 29% of participants indicated that they reflected regularly about their attitude toward computers (49% did not) and 24% of participants indicated that they regularly adjusted their computer learning strategies. Participants were also asked to indicate their level of confidence in performing various computer skills. More than 80% of participants were confident with tasks such as opening up a document or a program, printing a document or finding a specific Web site, and more than 50% were confident with such skills such as installing software, setting up a computer, creating a bookmark or favourite, and performing basic email functions. However, less than 50% of teachers could confidently perform other skills such as saving images from the Web, changing the 'effects' of a graphic, producing a school newsletter creatively and professionally, using a spreadsheet or a Webquest. When asked to describe their overall confidence with computer skills 45% indicated mid to high confidence and 33% indicated low to very low confidence. Thus, while some of the participating cohort were highly experienced and confident with computers, about one third were not.

Findings and outcomes

Fostering self regulated goal setting and achievement

An important characteristic of the metacognitive approach to ICT professional development is that, rather than specific computer learning objectives or outcomes being 'imposed' on learners, participants are encouraged to identify, articulate and pursue personally relevant goals. Focus is placed on assisting participants to identify individual goals, including those related to skills,

attitudes, confidence, values and understandings; integration or practice and/or school leadership. Participants were encouraged to state their initial aspirations at the first workshop and then to continually revisit these goals while engaging metacognitively with the learning process and content. An analysis of teachers' 'restated goals', expressed through their journals or through the discussion list, did include changes in skills based and integration based goals, but notably, metacognitive goals assumed greater centrality in this restating. Examples included developing increased confidence; having a go at solving computer problems before seeking assistance; not being concerned to make mistakes; able to assist their own students to encompass self directed learning; to complete the course well; to become more "capable" and, as one participant stated, 'to review my "relationship" with computers and maybe make it a partnership!'

Many participants actively monitored and reassessed their goals throughout the journaling process, gaining affirmation from their goal achievement and the realisation that they were able to take on more and more ambitious goals: "I think I may have achieved many of my goals in the first few weeks!" (Teacher 21, discussion list, 8 August, 2002). Similar statements were expressed in the following: "It is interesting - the further I go in the course the more my goals are changing. A few weeks ago I was determined to concentrate on using spreadsheets but as I gain more confidence I am looking further afield into becoming more proficient at email, searching the net and general computer use". For some teachers this active role in goal setting came 'naturally' and was a positive aspect of the course, allowing them to focus on areas most relevant to them, and implement their learning through their day to day classroom activities, as expressed in the following:

> When I am in charge of my own learning my goals continually change. This leads me to reflect on the philosophy of Just in Time learning... Self-driven learning leads me to continually move my goal posts in order for my learning to continue, either forward or sideways. As I move forward with my use of computers I find that I am continually wanting to do more and new things with them - each possibility opens up another, and I seek the learning which enables me to attain my new goal... I continue to explore, accomplish new skills, transfer learning, take short cuts, and do what I need in order to reach my goals.

For others the active involvement in goal setting was more difficult: "It is very difficult to set goals for yourself when you do not understand much of what you want to learn. How do I know my goals when I do not know what would be of most use to me?" While the self paced learning resources scaffolded teachers through a range of skill developing activities, and exposed them to a range of implementation ideas, the degree to which various teachers embraced these ideas and challenges did vary considerably.

Learning outcomes were diverse, reflecting the variant backgrounds of individual participants, and included Web based research lessons with students, PowerPoint presentations for parents, staff or students, lessons using specific applications such as spreadsheets or databases, enhanced use of technology in producing newsletters, activity sheets and templates or exam papers and use of Web based simulation resources instead of text books. For some teachers, using spell checking, copy and pasting or sending emails for the first time were big achievements in themselves and all were equally acknowledged and validated. The metacognitive approach thus enabled a group of teachers with highly diverse computer knowledge, skills and experience to undertake productive professional development and meet individual learning needs and goals.

Diversity in outcomes

The production of a Web based teaching and learning resource consolidated the skills and pedagogical understandings gained through the program. It led participants to confront and overcome initial hesitancies and build computer confidence and a wide range of skills. This task resulted in tangible pedagogical outcomes and resources with immediate practical application in

the classroom. Many teachers came to realise that taking on new computer learning challenges was not only possible but enjoyable.

The metacognitive approach was also found to have broader outcomes and implications than simply an approach to ICT professional development. ICT became a medium to engage teachers in confronting broader issues about their own, their students' and their fellow teachers' learning. The metacognitive approach actively fostered the formation of support structures and networks which could support teachers' learning beyond their involvement in the professional development initiative. As such, it would seem to hold potential as a vehicle to support change processes within the school environment. Overall, participants indicated that the professional development initiative met (or exceeded) their expectations. The selection process was generally seen as fair, it was supportive to have other participants at their school, and the workshop timing and location was generally seen as appropriate. Issues in the implementation of the metacognitive approach included personal illness, the pressured pace of time for teachers, and the willingness of some teachers to engage with a 'different' type of learning experience. Around half indicated that the workload was appropriate while half deemed it to be excessive.

Teachers' reactions to the metacognitive process

There were both strongly positive and strongly negative reactions to the metacognitive approach, and in particular the need to engage with metacognitive 'theory'. The majority of teachers were positive or highly positive, while a small number of teachers (three in particular) provided less favourable feedback. While this divergence in reaction had been evident in previous research with pre-service teachers (Phelps, 2002) it was far more pronounced with this group of practising teachers.

Positive reactions are perhaps best encapsulated in comments from those for whom the approach made a notable and significant impact. One teacher, for instance, continued to reflect on the notions of competency and capability (Phelps, 2001) as discussed at the first workshop and noted:

> I have made a conscious effort to become a more capable user. When presented with a problem in the past I would invariably make a mental note and move onto something else, hoping that I could ask someone's help at a later date. The result - the problem was often not addressed.

This teacher went on to relate a successful recent instance of problem solving on his home computer: 'This certainly would not have been an outcome in the past'. Similar views were conveyed by another teacher:

> I found Newman's article enlightening... Because of lack of time some people do the task for you instead of explaining what to do and letting you do it. My independent nature holds me back from seeking help, as well as the desire not to be a pest to others. I'm sure there is also the 'embarrassment' factor just as there is for the students we teach (who by the way I am always encouraging not to be).

There were, however, some participants who did not perceive as much value in the approach. For some teachers this manifested simply in superficial or minimalistic engagement with the process. A number of teachers expected 'quick fixes' and 'how tos'. Notably, the metacognitive approach did explicitly acknowledge that all computer users need such ready support and 'answers' at various times in their learning, and learners were strongly encouraged to seek help and assistance when needed. This encouragement included the identification of mentors, and ready access to the facilitator of the process (the first author) via phone or email at any stage, strategies which most learners embraced. The metacognitive approach openly discussed theory concerning help seeking, and assisted teachers to develop strategies, networks and attitudes to enable them to seek out such help when needed.

One teacher in particular developed quite an antagonistic attitude to the learning approach, commenting in the discussion list about the "lack of practical application". A meeting with this teacher highlighted the dissonance between his expectations of the course and the metacognitive approach, with this teacher citing specific examples of wanting to be shown how to do particular things (for example, inserting a symbol in a Word document). Notably, it was easy to provide these 'directions' to this teacher via the discussion list the following day, however it was unclear whether this teacher's concerns were overcome through this demonstration of possible and appropriate 'help seeking' strategies. While such reactions do speak of the precarious and unpredictable success of this approach, most teachers responded either neutrally or highly positively to the approach. It was interesting to read another participant's journal reflections regarding the above teachers' discussion list contribution:

> One of the students posted a notice on the discussion board about the lack of practical application in our course. I think his problem isn't lack of practical application but rather he hasn't read (understood) the philosophical underpinnings of the course. There's lots of practical stuff on the disk but the process is more important than the details.

Some participants experienced initial concerns and difficulties in 'getting started' and needed further guidance and reassurance as provided via the discussion list and informal conversations. A number of teachers were 'up front' in acknowledging their discomfort in keeping a journaling, although they also perceived benefits.

Broader outcomes of the metacognitive approach

A significant and somewhat incidental outcome of the metacognitive approach was participants' capacity and willingness to apply their metacognitive learning and reflection not only to their own professional development but to their interactions with their students and fellow teachers in their school. One teacher, for instance, spoke of encouraging students to problem solve and explore before asking for help; another reflected on the relevance of appropriate attribution and adaptive help seeking to students with special needs, and another on his renewed determination to resist 'spoon feeding' students. Yet another identified a need to promote more discovery learning through their teaching.

A number of teachers were also able to observe and identify computer anxiety and inappropriate learning attitudes, approaches and strategies amongst their teaching colleagues, and some took active steps to support their peers to develop computer confidence. As noted by one participant:

> I believe I now understand it is not only the end result but the process of getting there that enables me to feel confident. This has helped me understand better where my "less computer literate" colleagues are.

Another teacher provided some insightful reflections regarding their own and their colleague's willingness to learn with students, reflecting that it was refreshing when teachers could own up to their own inadequacies and show students a human side. They noted how students' self esteem could be raised by knowing that it is alright not to be extremely efficient with computers, or that they could help others. Similar ideas were expressed by another teacher:

> As teachers we must encourage our students by modelling for them the behaviour of "appropriate attribution". If they see us encounter problems and watch as we take steps to solve them they will be encouraged to explore a little more themselves.

The metacognitive approach also actively fostered the formation of structures and networks which could support teachers' learning beyond their involvement in the professional development initiative. As previously noted, teachers were encouraged to locate mentors, either within their

schools or from friends and families. Part of the approach was to help participants to appropriately balance their own help seeking and problem solving strategies. The importance of fostering support within this framework is encapsulated in the following quote:

> The exercise made me realise I am very keen to ask questions... but I know now that I need to have more restraint and ask more self questions first and even rethink my questions. It is part of that person in me that is always in a rush and would like that little slave at my beck and call.

Collaborative learning formed a very positive influence for a number of teachers, building networks within the school which would support ongoing learning. Not only did participants receive support and motivation from mentors but they also, in many instances, provided it to others, as described in the following:

> I acted as a little bit of a guide to my co-learners from school. I didn't actually teach them anything they didn't already know, but I did give some advise and help with a few small things that I hope assisted their own learning processes. That was a very powerful experience too as it seemed to fortify the knowledge I had gained, and gave me the confidence to continue to try new things.

The process of 'teaching others' was (and will continue to be) a valuable reinforcement for these participants' confidence and skills. The broader outcomes of this support structuring and the attention directed at 'appropriate' help seeking would be interesting to follow up with participants in future interviews.

Issues in implementing the metacognitive approach

The most significant factor influencing teachers' successful completion of the professional development approach were personal issues such as illness of participants or participant's families. These issues were particularly pronounced given that the initiative stretched over a period of some 17 weeks and unforeseen hurdles inevitably arose in teachers' personal and professional lives. The pressured pace of time at school was identified by many as impacting on their help seeking and exploratory learning approaches.

Teachers involved in the initiative inevitably do encounter technical difficulties. Part of the metacognitive approach is to explicitly acknowledge technical problems as an inevitable part of computer use and (hence) as unavoidable in the experience of engaging with the professional development experience. At times, however such complications can seem to be overwhelming for the computer learner, as was expressed by Teacher 40:

> I seem to be lost in a mire of hardware problems and barely able to address the issues or areas of interest in the course that I would like to become involved with and learn about. I've seriously considered just quitting because I am physically unable to use the equipment - or in fact it just doesn't work.

However, as demonstrated in Teacher 40's continuation in these reflections, the metacognitive approach can assist in confronting and working though such issues: 'this sounds to me like the excuses that non-users have or those who are avoiding learning because it is all too new or too difficult or too threatening etc. I don't want to quit...'. And she didn't!

A number of issues also emerged within schools in terms of teachers' abilities to implement planned classroom implementation projects. Examples included access to digital projectors, suitability of rooms for projection, and timetabling issues with computer labs. However teachers were able to acknowledge that these were all the 'normal' hurdles that are an integral part of ICT integration in classroom practice. Reflecting on these issues supported them to work through the

problems and seek solutions, and also, in some cases, prompted teachers to instigate changes in processes within their schools.

Another issue with the approach, and one which goes hand in hand with the inherent flexibility, is that some teachers were not personally challenging or confronting in their goal setting and achievement. Teacher 27, for instance, demonstrated a broad and general engagement with the Unit content, covering all topics but at a general and non-personally challenging level. This participant also didn't provide a great deal of evidence of taking on challenging learning experiences. Teacher 38, in contrast, was incredibly comprehensive in critically engaging with the resources, theory and issues explored in the course. This participant didn't, however, demonstrate broad skill development or classroom implementation, although developing some specific skills such as bookmarking. Notably, this individual was in an administrative position and therefore was less able to implement learning in the classroom.

A brief case study of Teacher 10 might also illustrate the point. Teacher 10 undertook a thorough engagement with the readings and the issues relating to ICT in learning and teaching but did not focus on his own skill development. Despite various offers of support and assistance these were not taken up, perhaps indicating issues with help seeking and a fear of appearing incapable or 'unintelligent'. For this teacher, unfortunately, his initial goal to 'get out of the mindset' that he could avoid computers was not met; the avoidance seemed to continue, despite his acknowledged 'unwillingness to try and a lack of persistence in getting an outcome'. While there was little evidence of personal skill development for Teacher 10, this participant did work through some attitudinal and acceptance concerns:

> What I need, I believe, is to see a use of computers with different eyes. I need a paradigm shift so that when facing a task involving the use of my computer, that I see it as a game, as a challenge...

He did conduct a lesson using digital projection of graphics downloaded from the Web, although a great deal of assistance seemed to have been given. Following this experience Teacher 10 reflected that '...the feeling that this is a far simpler process than I had anticipated was very encouraging'. Engagement with issues surrounding ICT integration was, however, an important stage for Teacher 10, even if he had not been 'ready' to embrace skill development as part of the course:

> I am now seeing technology as one of the strategies that is essential to achieve certain outcomes. Six months ago I would have said that the parameters were far more limited in the range of strategies that I would consider adopting within the classroom.

A small number of teachers' held dissonant initial expectations of the initiative. In one case this led to continued antagonism toward the approach (as already documented). In another teachers' case the statement was simply made that 'when I signed up this workload was not made clear to me' (Teacher 39). It would seem that a critical issue in the success of the approach is accurate and informative promotion of the initiative such that all participants are aware of the expectations and processes.

The impact six months onwards

Interviews were conducted with those teachers indicating their willingness to be contacted six months after the professional development initiative to determine longer term outcomes. These interviews clearly indicated that teachers' confidence with using computers had increased significantly as a result of the course. Comments such as the following were not uncommon:

> I was very dependent now I am more independent. I thought I was pretty bad with computers. Now I have so much more confidence. So my outlook has changed and

> this has changed my approach and strategies I use. Before I had a list with step by step. Now I feel a lot better with trying to figure it out myself.... My approach is "get in and have a go" because I am so much more confident.

Most had continued learning new computer skills and programs and implementing these skills in new ways in their classrooms, attesting to the potential lifelong learning outcomes from the approach. In learning new skills, teachers were employing the types of exploratory learning approaches promoted in the course.

> I had the idea instilled into me that I am not going to break the computer. I drag the mouse over the tool bar till I get what it does. I drag down the menu, open things up and have a look around. If I change the setting I just remember what I did and go back. Before I had the misconception or fear that I could break things.

Virtually all of the interviewed participants had found themselves working with other staff within their school, assisting them in their own computer learning and use. Many also found themselves continuing to draw on support networks established through the program. Most interviewees were highly conscious of the types of strategies they were using to work with these other teachers, and were consciously building their own and others' confidence and utilising appropriate teaching and learning strategies.

Of particular significance, however, was the degree to which the course had influenced participants' teaching approaches within their own classrooms. Many had adopted aspects of the metacognitive approach with their own students, as indicated in the following comment:

> At first I was not so sure about metacognition... Learning how to learn. I did not have much time for it. I did not know about it and was shying away from it. But now I say to the kids "we have to learn about how to learn". I have taken this approach on board with the kids. We can't just do things, we need to think about different ways and approaches to problems. This has been a big improvement for me.

An important finding was the extent to which initially sceptical teachers had come to appreciate and benefit from the process of reflection and had begun to utilise reflective learning approaches with their own students:

> Reflection was something that was new. I had not used it before as a strategy. I think reflection is a good strategy. I use it a lot with my own learning and in the class. I have gone back to my journal as a resource, such as techniques that I learnt or what I was doing wrong. Reflection is a valuable tool, one we don't use enough.

Conclusions

These findings indicate that the metacognitive approach has broader outcomes and implications than as simply an approach to ICT professional development. Rather, ICT is used as a medium to engage teachers in confronting broader issues about their own, their students' and their fellow teachers' learning. The metacognitive approach also actively fostered the formation of support structures and networks which could support teachers' learning beyond their involvement in the professional development initiative. As such, it becomes a powerful vehicle to support change processes within the school environment.

Down & Hogan (2000) state that promoting more critical and reflective thinking in teacher education programs is fraught with contradictions, tensions and dilemmas. This is also consistent with comments made by Saylor (cited in Palmer, Burns & Bulman, 1994, p.5-6), who noted that reflection is hard because 'one must analyse what's transpired and to some degree, make a value judgement about it... It seems to be much safer and secure not to reflect, because I don't have to

change that which I don't see as wrong'. While involvement in the metacognitive approach was challenging for some teachers it was also liberating for others, and many participants came to realise the benefits of reflection for their own and their students' learning. The highly diverse ICT background knowledge, skills and experience of the teachers who participated in this professional development initiative attests to the flexibility of the approach in productively meeting a diversity of teachers' needs, and enabling everyone to learn at a level and point of readiness appropriate for them.

The formal framework of professional development, requiring reading and assessment but allowing postgraduate accreditation, is arguably of interest to a limited group of teachers. Future research is needed to investigate whether metacognitive theory, and the application of this theory to teachers' ICT learning, can inform other professional development approaches such as peer networking, mentoring and small group learning. The metacognitive and reflective learning approach would also appear to have outcomes beyond the ICT focus of this research and this research indicates that it may be a valuable approach to professional development in contexts other than ICT. Those involved in ICT professional development in contexts other then teacher education may also find benefit in investigating the applicability of the model within their own professional contexts.

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