

Influences on pre-service teachers' preparedness to use ICTs in the classroom

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The role of Information and Communication Technologies (ICTs) in the school classroom is becoming increasingly prominent, both because of the need for children to develop skills that will empower them in modern society and because of the potential value of such technologies as tools for learning. One of the challenges facing teacher educators is how to ensure that graduate teachers have the necessary combination of skills and pedagogical knowledge that will enable them to both effectively use today's technologies in the classroom as well as continue to develop and adapt to new technologies that emerge in the future. This study explores first year teacher education student preparedness to use ICTs in the classroom. The primary data source for the study is a set of intensive interviews with eight teacher education students. The results suggest that despite the prevailing view that this generation of University students are 'Digital Natives' (Prensky, 2001), there are a number of barriers to their preparedness to use ICTs in the classroom. In particular the study suggests that as well as looking at the teacher education curriculum and other aspects of the formal preparation of these pre-service teachers, the pre-service teachers' personal preparedness including attitude, motivation, and confidence, along with various social factors are important. The results are discussed in the context of various models of pre-service teacher ICT pedagogical development. As well as being important for teacher educators, the findings are also important in the context of academic staff development associated with the use of ICTs as a learning tool in tertiary education, as well as in the context of other disciplines where similar assumptions about the ICT literacy of first year university students are being made.

Keywords: ICT education; pre-service teacher attitudes; teacher education;

Introduction

Despite significant political will and spending by governments on technical equipment and training, levels of ICT integration in Schools for learning and teaching are often low. The drivers behind government and organisational policy relating to ICT integration are many and varied. Reasons cited for encouraging ICT integration include the need to equip students with the skills to participate and thrive in an information society, and the need to create highly skilled and flexible workforces (Baskin & Williams, 2006; Ottesen, 2006). The potential for enhancement of the "quality of the learning experience" and the transformation of pedagogy are other factors driving ICT integration in classrooms (McNair & Galanoulis, 2002, p. 182). In addition to this, and increasingly, the next generation of students often referred to as the 'Net Generation', are expecting the integration of Web 2.0 technologies into their learning and teaching programs (Thompson, 2007).

Providing some insight into the issue of teacher preparedness to use ICTs for learning and teaching, Granger, Morbey, Owston & Wideman (2002, p. 487), explain that the "relationship between teachers' ICT skills and successful implementation is complex." The results of their study of schools suggests that there are a range of contributing issues including teacher "attitudes, philosophies, communication, and access to skills training", in addition to having the necessary equipment, support, and education (p. 487). Baskin and Williams (2006, p. 10) posit that human factors are "... the most critical in nurturing the ICT culture and growing the critical mass of teachers able to sustain the use of ICTs effectively in their teaching".

Wang (2002, p.152) concurs and asserts that “pre-service teachers’ beliefs and perceptions play a crucial role in shaping their future teaching behaviours.” Brownlee, Purdie, and Boulton-Lewis (2001, pp. 247-248), with a view to increasing the preparedness of pre-service teachers to use ICTs, suggest that “teacher educators need to focus on teacher thinking and teacher beliefs to facilitate changes in the teaching-learning process.” From these findings it would seem clear that human factors such as attitudes and beliefs have a significant influence on teacher behaviours, and consequently their preparedness to use ICTs for learning and teaching.

Given the stated importance of human factors, and the apparent influence of teacher preparation, it follows that there is a need to understand each of these dimensions if pre-service teachers are to be well prepared to use ICTs for learning and teaching. The purpose of this study was to gain knowledge of Primary Education students’ perspectives on their preparedness to use ICTs in the classroom by investigating their attitude towards, experience and confidence with ICTs, as well as their intent to use ICTs. The paper will begin with a review of literature relating to influences on teachers’ preparedness to use ICTs in the classroom and approaches to preparing pre-service teachers for this use. The specific aim and methods employed in this study will then be described, followed by an analysis and discussion of the results.

Background

Preparedness

The notion of *preparedness* is significant to this study, and its meaning here includes the “state or condition of being prepared; readiness”, and emphasises the attitudinal aspect of being prepared to do something (OED Online, 2007).

What influences teachers’ preparedness to use ICTs in the classroom?

An oft cited BECTA commissioned review of the literature relating to barriers to ICT integration provides insight into what influences teacher preparedness to use ICTs. The review reports that in addition to a lack of time, resources, and training, that human factors including a lack of confidence in using ICTs, a resistance to change and negative attitudes to ICT, and a lack of perceived benefits were key and consistent barriers to teacher use of ICTs. (BECTA, 2004)

Numerous researchers have developed models that attempt to explain, if not predict acceptance and implementation of ICTs. The Technology Acceptance Model (TAM) developed by Davis (1986) (see Figure 1) is one of these. The TAM, which as its name suggests, examines user acceptance of computer technology, is based on the Theory of Reasoned Action (TRA), a model used for predicting and explaining behaviour in a range of contexts (Davis, Bagozzi & Warshaw, 1989).

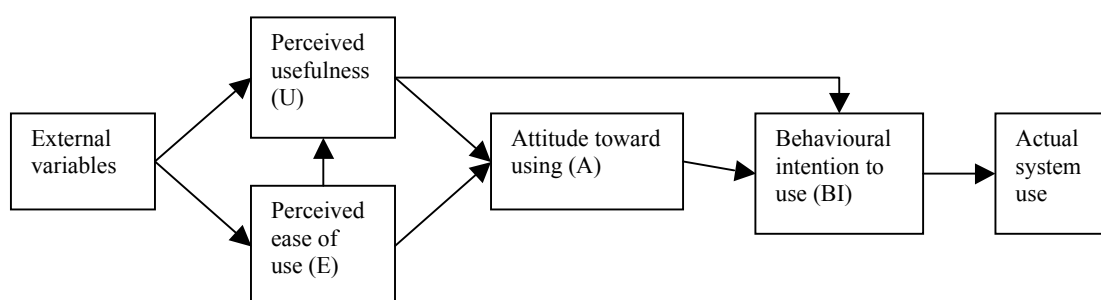


Figure 1: Technology acceptance model (TAM) (Davis, Bagozzi & Warshaw, 1989)

The TAM was assessed by Davis et al. (1989) in a study that examined 107 full-time MBA students at the University of Michigan. They found that beliefs of “perceived usefulness... [were] a major determinant of people's intentions to use computers [and that] perceived ease of use ...[was] a significant secondary determinant of people's intentions” to accept technology (Davis et al., 1989, p. 997).

More recent studies using this model, for example Smarkola (2007), confirm the validity of perceived usefulness and perceived ease of use as predictors of user acceptance of computer technology, and also provide support for the currency of the model. Extending upon this, Sime and Priestley’s (2001) study of student teacher views of ICTs in teaching found the perception that “even when resources were limited

and access to computer suites was problematic....that the individual teachers' attitude was the vital factor in determining ICT use" (p. 137). Galanouli and McNair (2001, p. 404) also found this to be the case, stating that "although lack of equipment was considered an important factor" ..., "it was clear that teachers' attitudes play the most crucial role."

Increasing preparedness of pre-service teachers to use ICTs in classrooms

Having established factors that contribute to use of ICTs, the questions that follow are: what influences the formation of pre-service teacher attitudes and beliefs that relate to preparedness to use ICTs in classrooms? And how can the likelihood of appropriate use be maximised? According to the literature, much of the answer to these questions lies within the pre-service teacher preparation experience, and as such, with teacher colleges and universities, as well as the schools in which pre-service teachers perform placements.

There are many views on what the pre-service experience should include to increase the likelihood that ICTs will be used in classrooms. Wozney, Venkatesh and Abrami (2006, p. 175) identify technology-related training as a key factor, suggesting that it "plays a crucial role in developing teachers' competency with computer applications as well as influencing teachers' attitudes towards computers." Ward (2003, p. 11) suggests that the "first step to ensuring teacher use of computers, as teaching and learning tools, must be to provide them with sound educational reasons for doing so." Similarly, Cuckle, Clarke and Jenkins (2000) referring to a study by Wild (1996), assert "that it is important that students are able to identify a purpose for IT use early in their courses and are able to reflect on IT use for learning and teaching" (p. 19). They also suggest that "for ICT training during initial teacher training to be really effective, schools and training institutions in partnership need to take a proactive role in promoting ICT", and add that the "difficulties encountered by students need to be tackled in partnerships between schools and training institutions" (pp. 17,19).

Steketee (2005) in a review of pre-service teacher experience and preparation to use ICTs in classrooms proposed a classification of preparatory approaches. These are not mutually exclusive, but do tend to identify the principal approach employed. Steketee (2005, p. 102) describes the approaches as follows:

- i. the ICT skills development approach
- ii. the ICT pedagogy approach;
- iii. the subject specific approach
- iv. the practice driven approach.

As its name suggests, the *ICT skills development approach* comprises the addition of one or more ICT subjects within the preparatory course. Zhiting and Hanbing (2002) reporting on initiatives in China consistent with this model advise that 'add on' approaches such as this have problems. They report that because of the technical focus of the subjects, and the fact that IT teachers taught the subjects, there was no reference or relation to pedagogical application. Also, as the teaching approach for these subjects was typically traditional, there was little innovative application of technology for teaching these subjects that could serve as exemplar models. Lastly, and as a result of these circumstances, the pre-service teachers "don't know how to use new technology in their classroom" (Zhiting & Hanbing, 2002, p. 69). Summing this up and referring to Wang (2002), Steketee (2005, p. 103) suggests that although there is evidently a need to develop ICT skills, that "skill alone is not enough to encourage students to confidently integrate ICT into their classroom programs."

The next model, the *ICT pedagogy approach* appears to meet this need, as it not only includes the addition of a skill component to a teaching program as per the model above, but also adds one or more ICT pedagogy subjects. Steketee (2005, p. 104) reports that although this model proved useful to develop ICT skills, to develop the ability to design "classroom based resources", and to increase student teacher "understandings associated with effective implementation strategies, as well as their self-efficacy as to their ICT competencies" ..., "this understanding has not been transferred in any notable way to the classroom context." Explanations offered for the minimal efforts to integrate ICT into the classroom as a result of this approach include an apparent perception by pre-service teachers that these ICT skill and pedagogical subjects are somewhat removed from the curriculum, an add-on (Steketee, 2005). It is also suggested that the degree of self efficacy attained with this approach may be a factor, as "teachers who have high levels of efficacy regarding teaching with technology are more likely to participate more eagerly, expend more effort, and persist longer on technology-related tasks than teachers who have low levels of efficacy" (Ertmer et al, 2003, p. 97).

The *subject specific approach* tackles the deficiency of the preceding model by both integrating and modelling “effective implementation skills in the context of genuine subject areas” (Steketee, 2005, p. 104). It also exposes pre-service teachers to “new and innovative ways of learning”, and provides them “with a practical understanding of what learning and teaching with ICT looks and feels like” (Steketee, 2005, p. 104). This approach is consistent with Mishra and Kohler’s (2006) model of the types of knowledge needed by educators to effectively use technology in their teaching. They emphasise the importance of *Technological Pedagogical Content Knowledge*, that is, knowledge of the learning technologies that offer affordances to particular content areas. Both affirming and building upon Steketee’s appraisal, Lock (2007, p. 586) found that pre-service teachers “can begin to design learning experiences for their students that appropriately integrate technology based on the modeling and experiences they have observed and experienced in their teacher education programs.” Although the approach employed in this project reportedly achieved deep and meaningful learning, the project did not include or require application in a classroom. Given this, it is not clear how prepared these pre-service teachers became to use ICTs in their classroom.

The *practice driven approach* incorporates attributes of the first three approaches, however, it has a significant focus on designing and developing ICT facilitated and/or supported classroom programs that will be implemented during the pre-service teachers’ practicum. One example of this approach cited by Steketee (2005) is the University of Wollongong Graduate Diploma course studied by Brown (2002). During this course students were required to research the ICT environment at the school where they were to perform their placement, and having done so to “design [and develop appropriate ICT] activities with their supervising teacher” and to then implement them in the classroom and evaluate what was learned (Brown 2002, p. 542). While it is evident that this approach was likely to have achieved a 100% result of ICT integration in classrooms during the practicum, it is not stated by Brown (2002) how this approach impacted the attitudes and beliefs of the pre-service teachers.

Shedding light on developing understandings and beliefs with this approach, a study by Taylor (2004) found that students believed that a range of experiences enabled their “understandings to grow”, and that “classroom experience seemed to be central” to increasing this understanding. Taylor (2004) identified three stages in this development of understandings. In the first most students appeared to have a “good understanding of the possibilities for the use of ICT in ... teaching, yet they received others’ assertions about the value of ICT without questioning them” (Taylor, 2004, p. 48). The second stage was characterised by increasing awareness and analysis of their own and others practice. Stage three was represented by “reasonably sophisticated reflection and theorisation for at least some strands in their thinking” (Taylor, 2004, p. 48).

If all of the points made in this section are considered together, it would seem clear that human factors are very important, and that the nature and composition of teacher preparation programs does impact significantly on pre-service teacher beliefs and attitudes and consequently their preparedness to use ICTs in classrooms. Also, while the success of the practice driven approaches mentioned here is acknowledged, there is a question on its potential “unless there is a strong relationship between faculty wide lecturers, tutor teachers and pre-service teachers, and a genuine commitment by all parties” (Steketee, 2005, p. 106). Given the situation outlined earlier in this paper that there are many countries where levels of ICT integration in classrooms vary and are typically below those desired, achieving this kind of relationship and commitment would seem a challenging proposition. However, while it is recognised that arrangements of this kind require significant levels of cooperation and commitment, it is suggested that the principles could be employed in many circumstances.

The study

The particular questions that this study set out to investigate were:

- What are the first year Primary Education student’s perspectives on their preparedness to use ICTs for learning and teaching?
- What influences pre-service teacher preparedness to use ICTs for learning and teaching?
- What can be done to maximise pre-service teacher preparedness to use ICTs in the classroom?

Method

This project employed a qualitative approach, and consistent with the phenomenological perspective intended to gain knowledge “by understanding the direct experience of others” (McMillan & Wergin, 2006, pp. 5-6). The study did this through “engagement with the participants” via interview, summarisation and analysis of the data (McMillan & Wergin, 2006, p. 6).

A series of semi-structured interviews were employed to gather data for this project. Given the attention to the human factors impacting upon preparedness to use ICTs for learning and teaching, this method was deemed most appropriate because the interview as a data gathering technique can be most effective, particularly “where human motivation is revealed through actions, feelings and attitudes” (Best & Kahn, 1998, p. 322).

Intending to maximise the content validity of the study, the interviews were “based on a carefully designed structure” with the intent of “ensuring that significant information is elicited” (Best & Khan, p. 322). Also, and referring to the criteria of Sapsford and Jupp (1996, p. 1) cited in Bell (2005, pp. 117 – 118), it is suggested that the validity of the findings is supported due to ability of the evidence offered to “bear the weight of the interpretation that is put on it.” The reliability of the data is likely to be enhanced through probing and restatement of questions in a slightly different form later in interviews as required (Best & Khan, 1998).

Procedures

The sample for this project comprised eight participants who were recruited from amongst the target population of 118 first year Bachelor of Education (BEd) Primary students. These students were studying the subject ‘Information and Communication Technologies in Educational Studies’ at Charles Sturt University at the time of the interviews. Volunteers were sought as unwilling or disenfranchised participants may not have been ideal subjects.

There were six females and two males interviewed, three of these were in the 18-21 age bracket, two aged 26-30, two in the 31-35 bracket, and one in the 36-40 age range. The gender balance was quite representative (20.3% males in population vs 25% in the sample). It is estimated that the sample had a greater representation of the over 30 age group (37.5%) when compared with the population (approx 24%). English was the first language of all of the participants.

The interviews took place during the 9th week of a 12 week teaching session. Consistent with May (2001, p. 123), the interview questions were pre-specified, however there was probing beyond the answers given to obtain clarification and/or to provide opportunity for elaboration. All interviews were digitally recorded and professionally transcribed.

Table 1: Interview questions

Research themes	Interview questions
Experience prior to CSU with ICT's?	Taking your mind back to before you commenced study at CSU, can you tell me what ICTs you may have used? For what purpose/s were these ICTs used? How familiar are you with Wiki's, Blogs, and Online Chat?
Experience as a student with ICT's?	Have you used any additional ICTs since coming to CSU? What are the new ICTs that you are now using? How are these ICTs being used? How have you found using these ICTs?
Attitude towards ICTs?	How do you feel about using ICTs? From your perspective what are some of the positives of using ICTs? What do you believe are some of the negative aspects of using ICTs?
How much and how do you expect to use ICT's in the classroom?	Have you considered using ICTs in your teaching? What are some of the ways that you might expect to use ICTs for learning and teaching in your classroom? How confident are you about your ability to use ICTs in the classroom? What problems do you think you'll face in the use of ICTs in your classroom?

Approach to analysis

The data was analysed in a manner consistent with approaches suggested and outlined by Merriam (1998), Dey (1993) and Bell (2005). Essentially in broad terms what they propose is the sorting of data into categories or groups with identifiable commonalities/recurring themes; these categories should “reflect the purpose of the research” (Merriam, 1998, p. 183). These are then examined with a view to identifying connections between them that may be in the form of regularities, variations and singularities (Dey, 1993, p. 47). Having clustered and condensed these chunks, the stage is set for drawing conclusions

(Miles & Huberman, 1994, p. 57). The analysis of the research was aided using a conceptual framework that served to render the data intelligible (Dey, 1993, p. 39).

There are a number of reasons why this approach was well suited to this project. As the core purpose of the project was to gain knowledge of the participants' experience with ICTs, their attitudes toward ICTs, and intent to use ICTs in their teaching, the interview, with its ability to "yield rich insights into peoples ... experiences, values, aspirations, attitudes and feelings" would seem a particularly appropriate method to employ (May, 2001, p. 120). Byrne (2004) cited in Silverman (2006, p. 114) concurs, positing that "qualitative interviewing is a particularly useful research method for accessing individuals attitudes and values."

Discussion of the results

Preparedness

To investigate the pre-service teachers' preparedness to use ICTs for learning and teaching, the attitude and beliefs of the participants was examined by questions relating to their experience with, and beliefs about ICTs, as well as their confidence to use them, followed by specific items checking how and how much they expected to use ICTs in the classroom.

Experience

The study found that all student teachers interviewed had experience with computers before commencing their studies, and all but one had used the internet for either email or web searches. The amount of experience varied as did the reason for using the technology, the mature age student usage being mostly needs based; with two of the participants having used ICTs for work purposes. At the point of interview, the participants had experience with a range of software. Some had used Word and Excel, while all had used PowerPoint, Movie Maker, and image manipulating software, as doing so was required for assignment work. All participants had heard of, and most had accessed a Wiki, namely Wikipedia; none of the participants had contributed to a Wiki. The majority of the sample had heard of blogs, and one had briefly used their own blog. Six out of eight had used online chat for keeping in touch with families and friends though most no longer used it regularly.

Attitudes and beliefs

On the whole the study participants were quite to very positive in their attitude toward ICTs, and their beliefs in regard to the importance of ICTs to themselves and their future pupils were often expressed. The following comments provide an indication of this: I "really enjoy technology and need it for everyday life" (Participant G), and "I think they're a really good thing to use...It's good for the kids...I think they're great." (Participant A)

Examples of beliefs often expressed as to why ICTs are important related to ready and rapid access to information and services. Other common responses included the ability to get things done easily, quickly, and conveniently, including communicating and sharing information, for example Participant E stated you "can share what you've made or found with lots of people quite easily".

A number of the responses of Participant C indicated a particularly high level of preparedness to use ICTs in the classroom. For example, he stated "I think with getting into teaching it's going to be a great tool to be able to use", specifically nominating perceived benefits such as time saving for information gathering and presentation, the ability to present visual material (also stated by Participants B and E), and time management through being able to do more preparation at home. These responses indicate a clear behavioural intent to use ICTs which according to the TAM is "jointly determined by the persons' attitude to using the system and perceived usefulness" (Davis, Bagozzi & Warshaw, 1989, p. 985).

A most interesting, and not uncommon social observation was that knowledge of ICTs made the student better able to participate with and relate to classmates and society in general, and that gaining this knowledge meant they were not being left behind. However, and conversely, the potential for ICTs to provide access to inappropriate information or images, and/or contact with undesirable others (Participants B, C, D, F, and H) was a strong and common negative belief relating to ICT use.

Confidence

When asked about their confidence in their own ability with ICTs, there was a range of responses, and although this depended on the application in question, many were not that confident at the time of the interview though their confidence was increasing. While Participant G, one of the younger participants was very confident, Participant H stated “I wouldn’t say over confident cause there’s always new stuff.” This issue was raised by a number of the participants including Participant F who saw the need to maintain skills due to constant changes with ICTs as a negative aspect, stating that it “Can be hard to learn new tech - don’t really want to when comfortable with old, but you have to”.

Continuing on this theme, the pre-service teachers spoke about ICTs sometimes being daunting at first, and getting overwhelmed when trying to learn how to use them, their rate of change a contributor to this feeling. However, it seemed in most cases as it was for Participant F that “once I got over that initial fear then I was fine ..., new things can take a little time to get used to.”

Comparisons of skill level with ICTs were common, for example the mature age students often mentioned that their school leaver age peers knew more about ICTs than they did. Throughout the interviews a very common concern mentioned was that their pupils may know more about an ICT being used in the classroom than they would (Participants A, C, D, E, F, and H). An example of this came from Participant A who had already worked as a teacher’s aid, she stated “they know heaps more than I do.”

Despite an apparently steep learning curve for some students, all expressed at the least a degree of confidence that by the end of the course they would be reasonably proficient and in some cases quite expert with ICTs. However, the resources and equipment available at schools, or the potential lack thereof was a concern for the participants.

Expected usage

Although the interviews took place quite early in their course, all participants were able to provide examples of how they expected that ICTs would be used in the classroom. The most common response was the employment of educational software (eg. Leap Frog, maths program, spelling, reading, letter recognition, and educational games). Accessing the internet was also mentioned as were use of an electronic whiteboard, some innovative online testing ideas, some creative writing ideas (eg. story, poem, and spelling nouns), making for the children (eg. posters and charts), and using it as a reward.

These ideas seemed to have come from personal experience with their own children (Participants A and D), from what they had heard about or done themselves (Participants D and G), their own ideas or suppositions (Participants B, E, F, and H), or how they had seen ICT used for teaching and learning (Participants B, C, and H). These latter ideas were thought to be particularly interesting as they highlighted the influence and importance of modelling to teacher preparation. For example, when asked about how ICTs might be used in their classrooms, Participant C responded “in seeing the way the lecturers teach us,... using the PowerPoint displays ... going to be a great tool”, and similarly Participant H stating “like using, for example, how in our lectures they use PowerPoint presentations.” This is somewhat problematic given that few experienced educators would suggest that Primary School teachers use PowerPoint in their classroom in the way that University lecturers use it to deliver lectures.

This finding really stood out and gave rise to deeper consideration of the concept of preparedness and how it related to the preparation of the pre-service teacher, and the need to carefully consider pedagogical decisions pertaining to ICT use during the course, which is discussed in the next section.

Influences on and maximising preparedness to use ICTs for learning and teaching

On the basis of the above findings it would seem that while this study confirms the literature discussed in this paper, it highlights some pertinent issues such as teacher modelling of ICTs as a potentially key aspect of teacher preparation to use ICTs, and it also reveals a social influence of ICTs on the group. In addition to beliefs and attitudes, the results of this study indicate that aspects of preparation are related and can influence preparedness to use ICTs for learning and teaching.

There appears to be evidence supporting the relationship suggested in the TAM (Davis et al, 1989) between the perceived usefulness of ICTs, the perceived ease of use of ICTs, attitudes towards using ICTs, and that these factors relate to expressed intent and preparedness to use ICTs for learning and teaching. Having said this, the data also suggest that for these pre-service teachers at this point in their

studies, that experience with given ICTs alone does not necessarily translate into preparedness to use these for learning and teaching. For example, despite all students being required to record and work with video footage for an educational purpose, only one suggested that they might use this technology in their classrooms.

The participants' descriptions of expected use of ICTs for learning and teaching are consistent with Stage 1 of a model describing developing understandings created by Taylor (2004, p. 49), where ICT use is largely uncritical and accepting and is characterised by "good knowledge of possible uses of ICTs in teaching", and "straight transfer and/or acceptance of others ideas". This positioning may explain in part the proposed use of PowerPoint in classrooms described in the preceding section, however, it is suggested that these final points could also be indicative of the potential influence of teacher modelling of ICT use for learning and teaching on the preparation and perhaps preparedness of these pre-service teachers to use ICTs in the classroom.

At this stage in their course these students had experienced preparation to use ICTs for learning and teaching in a way that most closely resembles the "ICT pedagogy approach" described by Steketee (2005, p. 104), though here, being a first year and first semester subject, the majority of time was allocated to learning about and how to use ICTs, with little time being assigned to lesson design using ICTs. Within this environment the pre-service teachers developed new technical skills with ICTs, and towards the end of the session were expressing a predominantly positive attitude towards ICTs, and intent to use them in the classroom.

An interesting theme from the data in relation to this environment related to the class dynamic, and the personal and social impact of learning about and how to use ICTs. For example, Participant C described a relationship between the attainment of knowledge of ICTs and fitting in with the class cohort and perhaps beyond. "...it's given me a lot more self esteem in class and I feel a lot more comfortable in class, ... even outside of it". Extending on this social concept beyond the class, Participant D evidently new to some of these technologies, suggested that ICTs will become "something I'll use forever. Not only in my studies...work career... it will be an everyday thing... even contacting family and friends." Highlighting a perceived divide in the class, Participant E mentioned that for those with less of an interest in ICTs and/or lack of natural ability with them, that this "can set them a bit behind or apart from the rest of the people that are enjoying it." Referring to ICTs and gaining knowledge of such as a part of the course, Participant F stated that "they're becoming such a part of society...there's a positive that I won't be left behind... and I'll be able to use that technology like everybody else." These statements would seem to suggest that the social dimension of ICT knowledge both within and beyond the class could be an aspect of pre-service teacher preparation that warrants further thought and investigation.

The model shown in Figure 2 below summarises the themes arising from this study, and depicts how they relate to pre-service teacher preparation and preparedness to use ICTs for learning and teaching. The model indicates and suggests linkage between Preparedness, Preparation and Curriculum, with the development of attitudes, beliefs, skills, and knowledge that relate to the use of ICTs for learning and teaching. The model also suggests varying levels of teacher influence on the process, and highlights social factors as an aspect to be considered in relation to preparation for, and preparedness to use ICTs both within and outside the classroom. It is suggested that the framework could serve a number of roles for which theories are intended, namely to link themes, to define, explain, and arrange concepts, as well as in particular with this case, explore ideas relating to pre-service teacher preparation and preparedness to use ICTs in their teaching (May, 2001; Silverman, 2005; Coffey & Atkinson, 1996).

As a final word in this section, and also of note, were comments made after the interviews were conducted. All participants stated that they had enjoyed the experience, and around half indicated that the interview process had caused them to think about more deeply, and reflect on how they might use ICTs for learning and teaching, and that this was a valuable exercise. Given this, and considering the previously discussed findings of this study, it is suggested that potential exists to maximise teacher preparedness to use ICTs through teacher modelling of ICT use in tandem with technical and pedagogical skill and knowledge development, and by providing opportunities for pre-service teachers to think about and reflect on how they might use ICTs for learning and teaching.

Conclusion

It is clear from the literature reviewed, and suggested by this study, that teacher beliefs and attitudes impact on whether and perhaps how pre-service teachers use ICTs in classrooms. Aspects such as perceived usefulness, benefit or advantage, ease of use, and the ability and confidence to use ICTs, appear

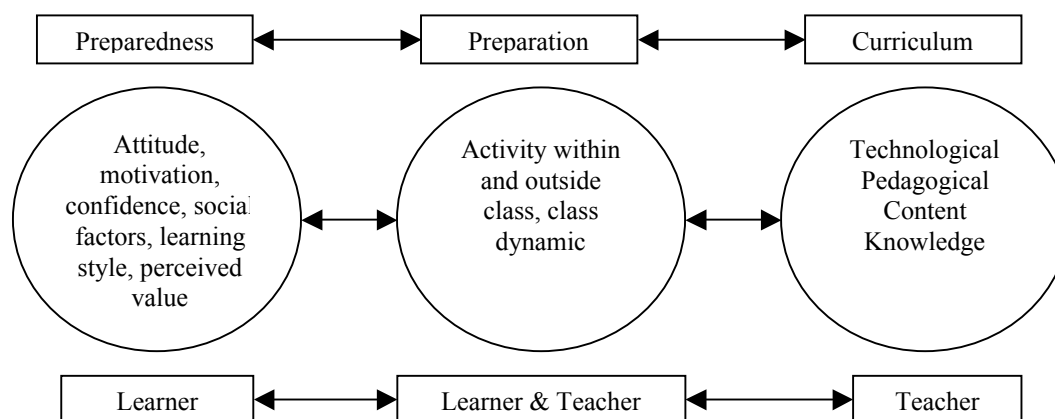


Figure 2: Pre-service teacher preparation and preparedness to use ICTs

to be critical elements. When all of the points made in this paper are considered together, it would seem clear that human factors are very important, and that the nature and composition of teacher preparation and training programs does impact significantly on pre-service teacher beliefs and attitudes, and consequently their preparedness to use ICTs in classrooms. As well as contributing to an understanding of the issue of pre-service teacher preparedness to use ICTs for teaching in their classrooms, it is suggested that this study could also inform on the nature of University lecturer preparedness to use ICT's in their teaching. For example, it would be reasonable to expect that many of the attitudinal issues affecting pre-service teachers as they consider the possible use of ICTs in the classroom will also apply to lecturers as they consider adopting online teaching technologies. The importance of models of practice experienced as a student as a limiting factor in the range of possible approaches to be considered for use as a teacher, may well apply equally to university lecturers, many of whom have no experience with online learning technologies as a student.

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