Developing fluency with information technology in a self-regulated learning environment: an interpretive case study of pre-service teachers at an Australian university

Victoria Maree Neville

University of Wollongong

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Developing fluency with information technology in a self-regulated learning environment: An interpretive case study of pre-service teachers at an Australian university

A thesis submitted in fulfilment of the requirements for the award of the degree

Doctor of Philosophy

from

University of Wollongong

by

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Faculty of Education

2011
Declaration

I, Victoria M. Neville, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Faculty of Education, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Victoria M. Neville

February 2011
I am sincerely grateful for the guidance and support of my supervisors, Associate Professor Sue Bennett and Professor Lori Lockyer. This journey would not have been possible without their practical advice, patience and good humour. They gave me direction when I needed it, and the support to find my own way through this challenging journey.

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Finally, I thank the participants of this study who gave me their time so generously.
Abstract

This study investigates how pre-service teachers can use self-regulated learning strategies to develop fluency with information technology. There has been a wealth of research on issues associated with pre-service teachers’ and teachers’ development of computer literacy. Similarly, extensive research has been undertaken of learners’ development of self-regulated learning (SRL) strategies within higher education and technological learning environments. There is little research, however, on the ways in which pre-service teachers may use self-regulated learning to develop fluency with information technology (FITness). This study addresses this gap by investigating learners’ experience of using self-regulated learning strategies to become “fluent” with information technology.

This study used a qualitative, case-study research design to investigate pre-service teachers’ development of FITness within a self-regulated learning environment. This environment was situated in a teacher education bachelor degree subject concerned with learning about the use of information technology in teaching. Pintrich’s (2000) framework of self-regulated learning was used to guide the design of the educational intervention.

The study was guided by three research questions:

1. What aspects of FITness can learners develop in a self-regulated learning environment?
2. What self-regulated learning strategies can learners use when learning to become fluent with information technology?
3. What other factors may influence learners’ becoming fluent with information technology through self-regulated learning?

The educational intervention included learning tasks and resources that were designed to provide opportunities for students to develop self-regulated learning strategies to assist their planning, cognition and monitoring of their learning. It was anticipated that these strategies may enable learners to develop the skills with
contemporary software, the ability to solve problems commonly encountered in the use of IT, and a future-orientation to professional development with IT. These are aspects of FITness required of teachers in a technologically dependent world.

Interviews with study participants, together with their assignments, provided rich sources of data for this investigative study. A priori data analysis codes were developed from the research questions and relevant literature. However, the iterative data analysis process enabled other relevant themes or issues emerging from the data to be identified and integrated within the coding framework. This framework enabled meaningful interpretation of participants’ experience.

This study’s findings suggest that learners were able to develop the aspect of FITness concerned with being able to use contemporary software. However, learners tended to set lower order learning goals and consequently used lower order cognitive self-regulated learning strategies. These types of goals and strategies compromised participants’ ability to conceptualise how technology worked, and their ability to solve common technological problems. Learners’ confidence in using IT increased. However, they expressed a limited commitment to ongoing professional development with IT through a reliance on familiar people and resources. The study revealed some of the limitations of using self-regulated learning to enhance learners’ higher order thinking and independence in learning. These findings have implications for the design of programs that seek to develop learners’ FITness through self-regulated learning.

This study contributes to the knowledge base about the experience of Australian first year pre-service teachers’ use of self-regulated learning as an instructional method to develop the FITness. Investigating the application of this study’s findings to other student populations could enhance our understanding of instructional processes to enhance the development of independent, lifelong learners and users of IT.
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Chapter 1: Introduction

1.1 Introduction

Today’s society is characterised by an increasing dependence on information technology (IT) in personal, business and educational fields. Parents and educational authorities expect that teachers will prepare pupils to become citizens in a technologically dependent world (Anderson, 2008; Ramsey, 2000). Teacher preparation education enables pre-service teachers to develop the knowledge and skills for using IT in their teaching practice. The technology with which teachers become familiar during their pre-service preparation may become unfamiliar as developments create new technologies that teachers will be expected to use. Teachers need to be able to develop the skills for using IT effectively in their teaching, but they also need to be able to adapt to technological changes throughout their professional lives. Therefore, teachers need to be able to modify their knowledge and skills of technologies with which they are already familiar to new technologies that they may encounter. Learning to use new technologies also requires a commitment to professional development with IT. Consequently, an approach is required for preparing pre-service teachers to use IT in a technologically changing workplace.

Fluency with information technology (FITness) is a useful concept for pre-service teacher IT skill development. FITness is fundamentally different from previous concepts of IT literacy or IT competency. IT literacy is mostly concerned with a competency approach to users’ ability to use software application programs and other technologies available at the time the IT literacy course or testing was undertaken (Pyrczak, 1990; Valde, Bower, & Thomas, 1996).

FITness, however, requires the development of such personal characteristics as creativity and adaptability in approaching new technologies and their uses, the ability to conceptualise IT principles and processes, the ability to monitor one's own thinking when dealing with technological problems, self-reliance and commitment to ongoing learning about IT, and motivation to sustain learning (National Research Council Committee on Information Technology Literacy (NRC CITL), 1999). The
emphasis in FITness is on the thinking required to use the technology, not just of being able to use that technology.

These characteristics of self-reliance, self-monitoring and motivation in learning required for FITness, are inherent, too, in self-regulated learning (SRL). Indeed, Zimmerman (1986) claims that self-regulated learners actively engage in managing the metacognitive, motivational, and behavioural processes necessary for their own learning. Therefore, SRL may be an appropriate learning strategy for developing FITness.

The aim of this study was to gain a better understanding of the ways in which pre-service teachers can use SRL to develop FITness. This study examined the experiences of pre-service teachers learning about the use of IT for teaching within a self-regulated learning environment.

This chapter provides an overview of the aims of the study and the environment in which it was conducted. Sections address the background to the study, research questions that guided the study, the significance and limitations of the study, the research strategy and context of the study. The final section describes the structure of the thesis to guide the reader.

1.2 Background to the study

The IT knowledge and skills needed by school students in order to participate in society changes as technology changes; and technology changes rapidly (Lonsdale & McCurry, 2004). Learning becomes a cyclical process as previously achieved IT skills become outdated by advancements in knowledge and technology. Therefore, national (Australian Council for Computers in Education (ACCE), 2000-2003; Ramsey, 2000) and international (21st Century Literacy Summit, 2002; North Central Regional Educational Laboratory (NCREL), 2003) sources advise that teachers must utilize IT within their teaching practice as they prepare children for a technologically dependent world. This recommendation is still as relevant at the end of the first decade on this century, as it was at the beginning (Anderson, 2008).

Preparing children for the technological society in which they currently live and will work in future requires “a vibrant, dynamic system of teacher education
attuned to the realities and possibilities of a society shaped by information technology”, according to Ramsey (2000, p. 72). Preparing pre-service teachers to be fluent with IT will enable them to become adaptive to technological change, which is necessary to integrate IT into their pedagogy (Becker, 1999; Ramsey, 2000; Riel & Becker, 2008).

For pre-service teachers to meet this IT challenge, their training must allow them to develop the abilities to integrate IT appropriately in their pedagogy (ACCE, 2000-2003; Markauskaite, 2007; Ramsey, 2000). Further, their continuing professional development must build on their IT knowledge and skills in the context of technological change (21st Century Literacy Summit, 2002; NCREL, 2003). Teachers’ reliance on a set of IT literacy skills developed with technology available during their pre-service preparation may be inadequate to cope with technological changes that will occur throughout their professional lives.

Teachers, therefore, need the ability to adapt to changes in familiar technologies and to the development of new technologies. Teachers also need to keep informed about how technological changes may contribute to their pedagogical use of IT (Firek, 2002; Riel & Becker, 2008). This requires their commitment to their ongoing professional development with IT. The adaptability and future-oriented focus of teachers’ use of IT may assist their self-reliance in using IT effectively (NRC CITL, 1999). This requires that teachers become fluent with IT, not merely literate with IT.

Fluency with IT emphasises self-reliance in using IT. Therefore, pre-service teachers need a learning strategy that will assist their ability to develop their self-reliance in learning. Self-regulated learning encourages learners’ active management of their own learning in order to “actively and autonomously guide their own learning and update their knowledge whenever necessary” (Puustinen & Pulkkinen, 2001). It was anticipated, therefore, that self-regulated learning may be an appropriate strategy to help pre-service teachers to develop their fluency with IT.

The dearth of research specifically linking the development of FITness through self-regulated learning suggests the need for the focus of this study. The purpose of this study, therefore, was to understand how pre-service teachers can use
self-regulated learning strategies to become fluent with information technology (FIT).

1.3 Significance of the study

Our technologically complex and changing world requires teachers who are both knowledgeable and skilled in using IT in their pedagogical practices. The changing nature of IT means that teachers need to be flexible in how they use IT in their teaching, adaptable to the changes in technological developments, problem-solvers in unfamiliar circumstances, and continue learning throughout their professional lives. Teachers need to embody the capabilities of being fluent with IT as they embed IT into their teaching practice.

The concept of “FITness” (NRC CITL, 1999; Snyder, 2003) includes traditional notions of computer competence as well as adaptable, problem-solving, future-oriented learning capabilities. These attributes also reflect the characteristics necessary for lifelong learning. While there has been much rhetoric on the need for pre-service teachers to develop IT skills and utilize IT in their pedagogical practice, there has been little research on the nature of their developing FITness. This type of research is especially sparse in the context of pre-service teacher preparation in Australia.

Many studies of pre-service teachers’ and teachers’ development of IT skills and use of IT in their teaching have been concerned with their attitudes towards IT, specifically computer anxiety (Albion, 2001) and their computer self-efficacy (Ertmer, Evenbeck, Cennamo, & Lehman, 1994; Gist, Schwoerer, & Rosen, 1989; Kurbanoglu, 2003; Milbrath & Kinzie, 2000; Russon, Josefowitz, & Edmonds, 1994; Torkzadeh & Koufteros, 1994; Torkzadeh & Van Dyke, 2002), and its effect on their adopting new technology (Fenech, 1998; Francis-Pelton & Pelton, 1996; Mowrer-Popiel, Pollard, & Pollard, 1994; Yi & Venkatesh, 1996). Other studies have examined pre-service teachers’ and teachers’ use of IT in their classrooms (Cox, Rhodes, & Hall, 1988; Davidson & Ritchie, 1994; Gabriel & MacDonald, 1996; Liu, Reed, & Phillips, 1992; McInerney, McInerney, & Sinclair, 1994; Reed & Overbaugh, 1993). These studies have been directed primarily towards examining users’ proficiency or confidence with specific IT tools or software, such
as email, the Internet and office productivity software. A recent quantitative study (Burns-Sardone, 2008) that investigated FITness of university students measured only students’ knowledge of computer concepts, which is a small part of being fluent with information technology. Few studies have attempted to address the fundamental skills that users should be developing in order to be able to continue to adapt to new technologies.

There is abundant research on the influence of self-regulated learning on academic performance (Busch, 1995; Elias & Loomis, 2000; Pajares, 1996). Winne and Stockley (1998) suggest that computer technologies may assist learners’ development of self-regulated learning. Recent studies have investigated the development of self-regulated learning within technological learning environments (Azevedo, Moos, Greene, Winters, & Cromley, 2008; Burner, 2007; Sitzmann, Bell, Kraiger, & Kanar, 2009). There is, however, little research on the use of self-regulated learning in IT fluency development. This may be because traditional notions of computer literacy have focussed on the finite, competency approach rather than on the concept of fluency with its inherent future-oriented, lifelong learning needs.

This qualitative study, therefore, makes a significant contribution to our knowledge because it investigates how pre-service teachers can use self-regulated learning to assist their development of the desired outcome of FITness. Teachers who are FIT may be more likely to adapt appropriately to technologically changing educational contexts.

1.4 Research questions

This study was guided by the primary research question:

How can pre-service teachers use self-regulated learning strategies to develop fluency with information technology?

This question integrates two important claims in the literature:

1) that learners who develop fluency with information technology are more likely to be able to use IT independently, effectively and adapt to unfamiliar technology and technological developments; and
2) that learners who adopt self-regulated learning strategies are more likely to become independent, effective and successful learners.

Three questions were developed from the primary research question. These questions, listed below, addressed key components of the primary research question and helped to direct the focus of the investigative aspects of the study.

**Question 1: What aspects of FITness can learners develop in a self-regulated learning environment?**

This study was interested in identifying the particular aspects of FITness that learners developed, such as their skills with contemporary IT tools, their independence in solving commonly encountered technological problems, and their orientation to their future development with IT.

**Question 2: What self-regulated learning strategies do learners use when learning to become fluent with information technology?**

This question was concerned with investigating the strategies, and their related methods and resources, for self-regulated learning that learners used when learning to use IT. The rationale underpinning learners’ choice of strategies, and the ways in which learners used these strategies when learning to use IT was also examined.

**Question 3: What other factors may influence learners’ becoming fluent with information technology through self-regulated learning?**

This question was concerned with investigating other factors that may contribute to, or influence, learners’ ability to develop their FITness within a self-regulated learning environment. The types of factors that influenced learning, and the ways in which those factors influenced learners’ ability to develop FITness through their use of self-regulated learning was examined.

**1.5 Limitations of the study**

The ability to generalise qualitative research findings to other contexts and population samples is an issue of less concern to qualitative research than to
quantitative research (Guba & Lincoln, 1994; Merriam, 1998; Patton, 2002). Indeed, the results from a context, such as the one used in this exploratory study, with its inherent multiplicity of variables and non-representative sample, prohibits generalization (Berg, 1989). Instead, this researcher endeavoured to compare the findings of this study with recent literature in the field. This approach recommended by Berg (1989), Marshall and Rossman (2006) and Yin (1994) as a way to address the generalizability issue in qualitative research.

The other limitation in undertaking qualitative research is the opportunity for the researcher’s subjectivity to introduce bias into the collection and analysis of data. This researcher makes explicit all the methodological processes from design and data collection to analysis (Berg, 1989) and provides thick description of the data (Merriam, 1998) within the Methodology and Findings chapters, respectively. These inclusions within the chapters provide ways to minimise the opportunities for, and effect of, this subjectivity on the research process and outcome, and enables readers to evaluate the veracity of the research findings.

Another limitation of the study was the participants’ self-reporting of their experiences in response to the researcher’s questions (Marsick, 2003). Participants’ understanding of their experiences may have changed between the two interviews, and may have been different from the researcher’s interpretation of those their understanding. The researcher, therefore, sought confirmation of her understanding of participants’ experience by asking them directly if her understanding reflected their own understanding.

The change to the reflection assessment task by one of the academic team members limited the opportunity to examine participants’ future-orientation to learning IT from that data source. The researcher sought to address this problem by asking participants, during the interviews, about their future-orientation to learning IT.

1.6  Research strategy and context

This study used a qualitative, case-study research design within the context of a subject concerned with the use of IT in teaching within the first year of a pre-service teacher bachelor degree program at an Australian university. This study
sought to understand, from the student’s experience, how pre-service teachers can use self-regulated learning strategies to develop fluency with information technology. Key features of this study were the bounded context and the exploration of relevant issues from the learners’ perspectives. These are also the types of features for which a qualitative research design is appropriate (Creswell, 2007).

Key features of FITness and SRL provided the conceptual framework for the design of the learning environment within the IT subject. A range of learning tasks and resources were designed to assist students to develop their planning, cognitive and metacognitive learning strategies appropriate for learning to become FIT in their use of IT for teaching. It was anticipated that this learning intervention would provide an opportunity to investigate how pre-service teachers can use SRL strategies to learn skills with contemporary technology, and the intellectual capability of solving common IT problems and developing a future orientation to professional IT development.

Students enrolled in the IT subject, in which this study was conducted, were from the Physical Education (PE), Early Childhood (EC) and Primary course specialisations. Students, within the IT subject, completed resource development activities utilizing their skills with computer software, analysed and evaluated educational software, and undertook a project related to their teaching specialisation in which they planned the learning activities and developed the associated resources for using IT in their teaching specialisation. This project included a component in which students created concept maps that reflected their knowledge of how IT may be used in teaching, and wrote reflections on their learning throughout the subject and their future professional development with IT.

Twelve students, enrolled in the IT subject in the Spring Session of 2004, participated in the study. Interviews with participants, and their assignments, provided the primary data sources for this study. The initial participant interviews were conducted within the first four weeks of semester while participants were engaged with the computer resource development activities. The second interviews were undertaken within the last two weeks of semester by which time participants had completed most of the learning experiences within the IT subject. Participants’
assignments provided other sources of data. The assignments were collected by the investigator after they had been assessed. These assignments included the concept maps and written reflections, which were one part of the final project task.

Data analysis commenced when the data collection was complete. The purpose of the data analysis was to identify and code categories and themes within the collected assignments and interview transcripts. Codes arose from the themes emerging from the data, and were informed by the research questions and relevant literature. The findings from the data analysis were presented and ultimately used to answer the research questions.

1.7 Structure of the thesis

This chapter has provided an overview of this study by explaining the focus, significance and investigative strategy. The remaining chapters address those issues in more detail. Chapter Two provides a review of literature within the research context of pre-service teachers’ development of IT skills and identifies the contribution that the current study makes to the field. The second part of the chapter presents the conceptual framework that informed this study, that is, it explains the two primary concepts of fluency with information technology and self-regulated learning. Chapter Three presents the context in which the study was undertaken, and detailed explanations of the investigative processes. Chapter Four provides a detailed description of the findings that arose from analysis of the data sources. Chapter Five presents a discussion of the key findings of the study in relation to the research questions, the implications of these findings for educators, and suggestions for possible future research. The appendices include supporting documents mentioned within the text and to which readers may refer.
Chapter 2: Literature Review

2.1 Introduction

This chapter presents a review of the literature relevant to the current study. The first section of this chapter presents the research related to the current study, and explains the contribution that the current study will make to this field. The second section of the chapter is divided into two parts that address the two key concepts that informed this study: fluency with information technology (FITness) and self-regulated learning (SRL). The first part of this section introduces the concept of FITness and explains its origin and key features. The second part of this section explains the processes of self-regulated learning that are relevant to the development of FITness.

2.2 Research related to the current study

A review of literature was undertaken to identify research relevant to teachers’ and pre-service teachers’ development of IT skills, specifically FITness, and issues related to their use of IT in teaching. Several authors (Aiken, Kock, & Mandviwalla, 2000; Brown & Campbell, 2002; Dougherty, Kock, Sandas, & Aiken, 2002; Higgins, Sprague, & Stewart, 2000; Lin, 2000; Snyder, 2003; Umbach, 1997; Urban-Lurain, 2003) advocate for university students’ development of FITness. However, there are few research studies that address either the methods or outcomes of efforts to develop teachers’ or pre-service teachers’ FITness. Nevertheless, studies by educational researchers that investigated issues that are related to pre-service teachers’ development of IT skills for teaching were examined.

The scarcity of research studies that address key elements of teaching and learning of FITness for teachers’ and pre-service teachers’ indicates a need for more research in this area. This study will help to address that need.

2.2.2 IT Skills

Australian educational advisors recommend that pre-service teacher courses include opportunities to develop skills for appropriately utilizing IT in their
teaching (Freeman, 2000; Ministerial Advisory Council on the Quality of Teaching, 1997; Ramsey, 2000). Pre-service teachers need skills in using IT before they can consider its use in their teaching.

Assertions have been made that technology-proficient “digital natives” are entering university (Prensky, 2001) and may not need IT skills development. However, studies by McEuen (2001) and Kvavik, Caruso and Morgan (2004) have shown that many university students have only basic IT skills and are not able to adapt to technological change or use IT effectively for their learning. This empirical evidence suggests that pre-service teachers, as university students, indeed need appropriate IT skills training.

Teachers’ and pre-service teachers’ development of IT skills and use of IT in their teaching practice has been the focus of considerable investigation. Despite teacher preparation programs introducing computer skills training for pre-service teachers, international (DeCorte, 1990; Earle, 2002; O’Dwyer, Russell, & Bebell, 2004; Wang, 2002) and Australian (Meredyth, Russell, Blackwood, Thomas, & Wise, 1999; Sherwood, 1993) studies have found that pre-service teachers’ and teachers’ quantity and quality of their use of IT for teaching has been disappointing.

Acquiring the technical skills with using IT is alone insufficient to enable beginning teachers to use that technology effectively in their teaching practice (Oliver, 1993). This is particularly important when the technology available to teachers in their employing schools may be different from that technology with which they initially learnt their IT skills. This signifies a need for pre-service teachers and teachers to develop the ability to adapt to technological change as their basic IT skills become outdated.

As suggested previously, developing IT skills does not guarantee teachers’ use of IT in their teaching. Therefore, researchers considered other factors that may influence teachers use of information technology in their teaching. Teachers’ attitudes towards information technology and their consequent use of IT in teaching have been studied extensively, and are examined in the next section.
2.2.3 Attitudes to IT

Research into pre-service teachers’ and teachers’ characteristics, other than their IT skills, that may influence their pedagogical use of IT has examined a range of attitudinal attributes. Pajares’ (1992) research demonstrated that teachers’ behaviours are influenced by their attitudes. If pre-service teachers’ experience feelings, such as computer anxiety, then they may be less likely to use IT in their teaching regardless of what IT skills they have (Bohlin, 2002). Therefore, pre-service teachers’ attitudes and beliefs may affect their willingness to use IT in their teaching.

Many studies have reported that anxiety with using computers created a significant barrier to teachers’ adopting new technology (Fenech, 1998; Francis-Pelton & Pelton, 1996; Jacobsen, 2000; Mowrer-Popiel et al., 1994; Pritchard, 2004; Walters, Burhans, Kershner, & Alphonce, 2000; Wilson & Stacey, 2003; Yi & Venkatesh, 1996) and using IT in their classrooms (Cox et al., 1988; Davidson & Ritchie, 1994; Gabriel & MacDonald, 1996; Liu et al., 1992; McInerney et al., 1994; Reed & Overbaugh, 1993; Williams, Coles, Wilson, Richardson, & Tuson, 2000). Chu and Spires (1991) found that instruction helped to ease computer anxiety, but other studies (Hakkinen, 1994; Reed & Overbaugh, 1993) found that instruction reduced computer anxiety for only the most anxious students. However, Albion’s (2001) study of Australian pre-service teachers linked their computer anxiety with their infrequent use of computers.

The gradual increase in common usage of computers for personal tasks prompted Albion (2003) to hypothesise that pre-service teachers’ anxiety with computers may play a less significant role for those enrolled in more recent teacher preparation courses. This was confirmed by his study (2003) that compared data collected from his previous studies in 1991, 1997, 2000 and 2002 of Australian pre-service teacher groups.

Data were collected for Albion’s (2003) studies using the Attitudes Towards Computer Technologies (ACT) and the Self-efficacy for Computer Technologies (SCT) instruments, validated by Kinzie, Delcourt, and Powers (1994). Comparison of data from Albion’s prior studies between 1991 and 2002 showed that pre-service
teachers’ positive feelings towards computers had improved and their nervousness or anxiety with computers decreased from the first study in 1991 to the last study in 2002. Similarly, between 1997 and 2002, pre-service teachers were spending more time per week using computers. Albion (2003) concluded that pre-service teachers’ comfort with IT, and specifically with computers, was associated with their persistent use of that technology.

However, as previously indicated, pre-service teachers were still not adopting the use of IT in their pedagogical practice (Firek, 2002), despite computer anxiety being a less inhibiting factor for this group in years just prior to the current study. This suggests that other attitudes may also contribute to teachers’ use of IT in their teaching.

A key area of investigation has focussed on pre-service teachers’ belief and confidence in their ability to use IT for their pedagogical practice, that is, their computer self-efficacy. The concept of computer self efficacy (CSE) was derived from Bandura’s (1986) broader concept of self-efficacy. CSE is defined as “an individual's perception of efficacy in performing specific computer-related tasks within the domain of general computing” (Marakas, Yi, & Johnson, 1998, p. 127).

Several studies (Ertmer et al., 1994; Gist et al., 1989; Milbrath & Kinzie, 2000; Russon et al., 1994; Torkzadeh & Koufteros, 1994) have shown that receiving instruction assists with the development of computer self-efficacy. Research into computer-self-efficacy tends to focus on teachers’ confidence with the competence/skill development aspect of using computers. This is evident in computer self-efficacy instruments, such as that developed by Delcourt and Kinzie (1993), used in this type of research. However, computer self-efficacy does not address the intellectual capabilities of solving common IT problems or professional development that are an essential part of being FIT.

Teachers’ perception of the usefulness of IT to their teaching practice may influence their motivation to use IT in their teaching (Marcinkiewicz, 1994). Other studies (Angeli, 2004; Collier, Weinburgh, & Rivera, 2004; Francis-Pelton & Pelton, 1996; Yildirim, 2000) have confirmed that instruction helps to enhance perceived usefulness of IT by teachers as being an important factor in their use of
IT within their own teaching. Providing opportunities within a FITness development curriculum to consider the application of IT to teaching may enhance pre-service teachers’ motivation to learn to become fluent with information technology. Motivation for learning and using IT is a factor examined in this current study.

2.2.4 Processes of teaching and learning IT

The types of instruction that teachers and pre-service teachers receive may play a key role in their development of IT skills, levels of computer anxiety, computer self-efficacy, and perceived usefulness of those skills for teaching purposes. However, teachers’ use of IT remains less than ideal, despite educators’ efforts to improve, and researchers’ efforts to understand, these issues (Firek, 2002).

Studies of pre-service teachers’ development of computer skills have been concerned with investigating issues that may affect their ability to use IT effectively in their teaching practice. There has been limited focus, however, on investigating the methods used to assist that development (Phelps, Ellis, & Hase, 2001; Taylor, 2003). Therefore, the current study’s focus on pre-service teachers’ development of FITness within a self-regulated learning environment will contribute to our knowledge of how pre-service teachers may use self-regulated learning strategies to assist their development of FITness.

Learning methods that may assist teachers’ and pre-service teachers’ IT development are suggested by the literature. Developing skills with relevant technologies helps pre-service teachers build familiarity with the IT that they may encounter in their teaching workplace, and may enhance their willingness to utilize IT (Beyerbach, Walsh, & Vannatta, 2001; Collier et al., 2004). Clarifying the relevance and planning the application and integration of technology into classroom teaching may assist pre-service teachers’ motivation to learn to use IT (Angeli, 2004; Beyerbach et al., 2001; Clift, Mullen, Levin, & Larson, 2001; Collier et al., 2004; Ely, 1999; Gunter, 2001; Yildirim, 2000). Similarly, modelling the use of IT in teaching by academic teachers (Collier et al., 2004; Gunter, 2001) may help pre-
service teachers to recognise that the use of IT in teaching is part of normal teaching practice.

These suggestions may assist educators to create learning environments for pre-service teachers and teachers to learn to use IT. However, these methods do not directly address the development of the self-reliance in learning necessary for FITness.

An Australian study of pre-service teachers learning IT skills through metacognitive processes is rare in that its explicit focus is on investigating a method to assist pre-service teachers to develop as “life-long capable computer users” (Phelps et al., 2001, p.482). This suggests that they develop their capability, which is an essential component of FITness, even though Phelps et al. (2001) did not use the term “fluency with information technology”.

Pre-service teachers’ who used reflection to guide their metacognition were found by Phelps’ et al. (2001) to be more likely to adopt learning approaches towards their development of computer skills which are applicable for life-long learning. However, Phelps’ et al. (2001) reported that it was the pre-service teachers’ motivation and ability to undertake reflection that determined the effectiveness of this learning method.

The effectiveness of metacognitive reflection on practicing teachers’ use of IT in their teaching was also examined by Phelps, Graham, & Kerr (2004). They reported that teachers who engaged in the metacognitive reflective processes developed an awareness of the value of reflection for their own and their pupils’ learning. Teachers’ confidence in using IT improved, and they integrated IT into their teaching more readily than they had before their IT skills training course. Many of the teachers also began utilizing the processes of metacognitive reflection in their classroom teaching, not necessarily related to using IT.

Both of these studies (Phelps et al., 2001; Phelps et al., 2004) link a key concept within FITness, that is, capability with IT as a lifelong user, to a key feature of self-regulated learning, that is, metacognition. This illustrates that the focus of the current study on developing aspects of FITness within a self-regulated learning environment may be appropriate.
Similarly, university students’ use of self-regulated learning strategies have been investigated by many educational researchers (Chen, 2002; Cole & Denzine, 2004; Garavalia & Gredler, 2002; McMahon & Luca, 2001; Peverly, Brobst, Graham, & Shaw, 2003; Polleys, 2002; Van Blerkom & Van Blerkom, 2004; Vanderstoep, Pintrich, & Fagerlin, 1996; Wolters, 1998). However, few studies were found that address the instructional processes for self-regulated learning that learners may have experienced. This corroborates Hadwin and Winne’s (2001) claim that such studies are uncommon.

A study by Hadwin, Winne, Stockley, Nesbit, and Woszczyna (2001) investigated university students’ self-reported use of study tactics, goals and resource use with different contexts or tasks. The authors adapted items from the Learning and Study Strategies Inventory (LASSI), Motivated Strategies for Learning Questionnaire (MSLQ) and the Study Process Questionnaire (SPQ; Biggs, 1996, cited in Hadwin et al., 2001) to create the Strategic Learning Questionnaire (SLQ), which consisted of scales for tactics, goals and resource use. Respondents from a first year course in educational psychology at Simon Fraser University completed the questionnaire soon after undertaking the assessment tasks (contexts) in which the researchers were interested. Hadwin et al. (2001) found that students may develop a particular study style in the methods and resources they used. However, students often modified that study style in response to the particular requirements of the learning or assessment tasks or contexts with which they were concerned. This suggests that providing students with a diverse range of assessment tasks may encourage them to broaden their preferred study style to adopt a wide range of appropriate tactics and resources. This, in turn, may assist students to become more adaptable to a variety of learning contexts or tasks.

The study by Travers and Sheckley (2000) specifically identified five SRL instructional processes that were integrated within a community college’s mathematics curriculum in the USA. The SRL instruction included guided goal-setting, promoting reflection on learning, providing remedial feedback, encouraging the connecting of concepts, and the linking of new experience to familiar concepts. Travers and Sheckley (2000) found that learning through the curriculum embedded SRL instruction produced learners who were more able to regulate their learning than others who relied on their lecturers to give them information. This suggests
that integrating SRL strategies into a curriculum may be an appropriate method for assisting learners to develop their ability to self-regulate their learning.

Review of literature relevant to teachers’ and pre-services teachers’ development of IT skills and related issues reveals that there is a dearth of research that specifically addresses their development of FITness. Similarly, recent research concerned with instructional processes for learning to use IT, especially SRL processes, is sparse. Therefore, the current study will contribute to knowledge in this field because it will examine how pre-service teachers may use curriculum-embedded SRL strategies to develop key areas of FITness, and examine other issues that may influence that FITness development and use of SRL.

The time-limited usefulness of basic IT skills are insufficient for teachers in a technologically changing workplace. They need to be able to use IT effectively, independently, and adapt to new and unfamiliar technology. Therefore, they need to develop FITness.

2.3 Fluency with information technology

Information technology has become increasingly pervasive throughout most aspects of life in the modern world. The need for workforce participants, especially teachers, to be able to utilize IT effectively in their employment roles is recognized nationally (Department of Education Science and Training (DEST), 2000; Ramsey, 2000) and internationally (Buettner et al., 2000; Dougherty, Clear et al., 2002; NRC CITL, 1999; Snyder, 2003).

IT tools enable information to be created, stored, made accessible, and manipulated to meet a variety of personal and work-based tasks. Proficiency with using IT has been of concern to educators since the introduction of the personal computer in the 1980s.

Traditional IT literacy training primarily focused on computers as IT tools. Computer literacy training tended to address learning about computers (declarative knowledge) rather than learning how to use computers (procedural knowledge) efficiently for their work tasks (Gattiker, 1990). Other approaches to computer literacy generally referred to an understanding of the use of application programs,
computer use in its social context, computer operations, history of computers, and proficiency in a programming language (Martin & Heller, 1982; Pyrczak, 1990).

The need for IT users to be able to utilize computers effectively shifted the emphasis within computer literacy from knowing about computers to a focus on developing computer competence. Computer competence for teachers and pre-service teachers required them to develop skills with specific software, computer programming and consideration of their application for teaching purposes (Martin & Heller, 1982; Valde et al., 1996).

Various attempts have been made to identify the range of IT competencies required by teachers in Australia. The Ministerial Advisory Council on the Quality of Teaching (1997) in New South Wales produced a list of computer proficiencies for teachers. Similarly, the Australian Council for Computers in Education (ACCE) (2000-2003) produced a “Teacher Learning Technology Competencies” framework to guide programs that sought to enhance teachers’ knowledge and skills for using IT in teaching. The ACCE claimed that “good teachers in the 21st century can reasonably be expected to be, amongst other things, good users of learning technology” (Freeman, 2000, p. 16). ACCE also claimed that minimal standards of competence should be revised as technology changes, but did not specify how frequently this revision should occur.

Significantly, these sources identify not only the basic knowledge and skills for teacher productivity purposes (e.g., administration and preparation of teaching materials), but they recognize the necessity of integrating IT into pedagogical practices. IT in teaching and learning, therefore, becomes content to learn about, tools to learn from, and tools to learn with. Pedagogically embedded IT enables both teachers and learners to “create, access and share knowledge” (Ramsey, 2000, p. 68).

IT competencies may be a useful starting point for teachers’ IT skill development, but the complex educational and technological environment in which teachers work may need them to develop additional capabilities. Eraut (1998, p. 129) defines competence as “the ability to perform the tasks and roles required to the expected standard”. Setting computer competencies or proficiencies can be
advantageous to the novice computer learner when the standards to achieve are clear. However, there is a risk that designated computer competencies may reflect the “discrete behaviours associated with the completion of atomised tasks” that Gonczi (1994, p. 28) associates with the most widely held, but lowest order, concept of competence. Competencies of this type “tend to be prescriptive and are designed for a more stable environment with familiar problems” (Wildman, 1996, p. 86). Most learning and workplace IT environments remain neither stable nor familiar.

Competencies, however, can make up part of an individual’s professional capability. Capability includes the “capacity to become competent” (Eraut, 1994, p. 208) or “to become more able” (Doncaster & Lester, 2002, p. 92), or to “transform one’s practice over time, to create new knowledge through one’s practice as well as learning from others” (Eraut, 1998, p. 136).

Capabilities are not just another set of competencies added to prior competencies. They are inherently dependent on the individual’s autonomy in recognising the need for, and ability to engage with, learning for oneself rather than relying on outcomes set by others. Capable people are those who know how to learn and are creative in their approaches to dealing with problems. They have a strong self-belief in their ability to apply their knowledge and skills to both familiar and unfamiliar circumstances, and they work well with others in a climate of mutual learning and problem-solving (Cairns, 1996; Hase & Kenyon, 2000; Stephenson, 1996). These are the attributes needed by teachers in IT teaching and learning environments that are characterised by constant change.

The concept of “fluency with information technology” (FITness) may meet this need to integrate computer competencies with IT capabilities for autonomous professional practice in a changing environment. FITness, according to the National Research Council Committee on Information Technology Literacy (NRC CITL, 1999) includes three features:

1. Contemporary skills for using current computer software
2. Fundamental concepts for understanding the basic principles of how computers work, and
3. Intellectual capabilities for being able to apply IT appropriately in multifaceted contexts, and for dealing with unforeseen technological problems as they occur.

The first two categories of FITness knowledge clearly reflect the traditional approach to computer literacy in terms of learning to use specific IT and computer tools, and learning about how information technology works. However, the inclusion of intellectual capabilities distinguishes FITness from previous approaches to computer literacy or computer competence.

The requisite intellectual capability components of IT fluency include the ability to:

1. engage in sustained reasoning
2. manage complexity
3. test a solution
4. manage problems in faulty solutions
5. organize and navigate structures and evaluate information
6. collaborate
7. communicate to other audiences
8. expect the unexpected
9. anticipate changing technologies
10. think about information technology abstractly (NRC CITL, 1999, Box ES.1).

Intellectual capabilities enable IT users to be actively and constructively engaged with the changing and unpredictable nature of IT. Fluent IT users are capable, not merely literate. Indeed, Dougherty, Clear, Cooper, Dececchi, Richards, and Wilusz (2002, p.154) claim that “intellectual capabilities encourage abstract reasoning about IT to empower a person to exploit IT when possible and recover from the problems using IT”. This is what teachers will be expected to do as they utilize IT in their classrooms.
The NRC CITL’s (1999) report was praised for its efforts in identifying the need for higher order thinking skills required for IT users to move beyond mere computer literacy/competency to become lifelong learners in their use of IT (Denning, 2000). However, Denning (2000) criticised, as a significant weakness, the FITness report’s (NRC CITL, 1999) exposition of concepts instead of including definitive, measurable standards of knowledge and practice competence. Yet it was the limitations of prior definitions of IT competence that the inclusion of intellectual capability concepts within FITness sought to address.

The NRC CITL recommended learning about fundamental IT concepts and intellectual capabilities through learning computer programming. Learning programming, according to the NRC CITL (1999), helps IT users to think logically and learn to solve programming problems. Snyder (2003, p.vi) claims that this problem-solving of programming through “algorithmic thinking, reasoning, (and) debugging” will assist users to solve other types of problems that they may encounter in their everyday use of IT.

The NRC CITL chair, Lawrence Snyder, most committee members, and those they consulted, were primarily computer scientists (Denning, 2000; NRC CITL, 1999). Therefore, it may be expected that they recommend solving programming problems as the key to developing problem-solving-type capabilities in using IT.

The literature, however, is divided about the transferability of problem-solving skills from one domain to another. Computer scientists, such as Snyder (2003), tend to support the domain transfer application of problem-solving once users have learnt to solve programming problems. In contrast, Sternberg (1995) contends that problem-solving should be taught in the domain in which problem-solving skills will be used, whilst Anderson, Reder and Simon (1996) argue that learners should be exposed to multiple, cognitively similar problems in order to learn how to solve those types of problems effectively.

Similarly, the emphasis, within the NRC CITL report, on learning to solve common problems encountered in using IT through solving programming problems, reflected the professional computer scientists’ interests of the Committee’s members, according to Denning (2000). He claimed that the
intellectual capabilities vital for becoming FIT need to draw on thinking skills broader than solving programming problems. This argument against the learning of programming skills in order to learn how to solve common technological problems was made by Romiszowski (1988) in relation to the early computer literacy training programs, and is also held by other authors in the field, such as Jonassen (2000).

A logical conclusion from this debate is that learning to deal with common problems in using IT is an important part of being fluent with IT (FIT). The methods employed for learning how to solve these common problems may differ from those espoused by the NRC CITL’s (1999) FITness report.

The success of a FITness computer-science program for non-computer scientists was studied by Urban-Lurain (2003). He claimed that this program was able to teach FITness without teaching programming. He argued that students’ learning of fundamental computing concepts was critical for the development of FITness. The learning of fundamental computing concepts might be appropriate in a program devoted only to learning about technology. However, pre-service teachers also need to learn how to apply the use of technology to their teaching context. This content may have a higher priority in a teacher preparation curriculum than a focus on learning of computer concepts. Pre-service teachers may be able to develop a functional understanding of how technology works as they utilize IT for teaching tasks.

The range of types of knowledge and their sub-components associated with fluency with IT, as well as the lack of definitive performance standards of FITness, suggest that IT fluency is an attribute that an individual develops over time. The key to becoming fluent with IT is being “capable of evaluating, distinguishing, learning and using new IT” (Dougherty, Kock et al., 2002, p.140). FITness, therefore, implies a continuum of expertise and the need for lifelong learning as technology changes and familiar technology becomes obsolete (Dougherty, Clear et al., 2002).

Pre-service teachers who are just beginning to develop their knowledge and skill in the use of IT for teaching practice may be located at the novice end of the FITness continuum. However, the opportunities that an IT curriculum can provide
for pre-service teachers to develop their FITness may assist their ongoing learning throughout their professional lives.

The key aspects of FITness that may assist pre-service teachers to begin the lifelong journey of their FITness growth are:

- the development of skills with current IT used in schools
- the knowledge of how IT may be integrated in their pedagogy
- the ability to adapt to new or unfamiliar technologies
- the ability to deal with common IT problems, and
- the commitment to ongoing professional development with IT.

A learning intervention within an IT curriculum that assists pre-service teachers to develop the self-reliance inherent in FITness requires a learning strategy that encourages self-reliance in learning, such as self-regulated learning.

### 2.4 Overview of self-regulated learning theoretical perspectives

Self-regulated learning is concerned with the processes that learners use to manage the cognitive, motivational and self-monitoring aspects of their learning in order to achieve their academic goals (Zimmerman, 1986). The emphasis within self-regulated learning is on the learner and the actions that the learner takes in directing their own learning. Learners who manage these aspects of their learning become more self-reliant in learning and are able to overcome many of the barriers to learning that arise within their external and internal/psychological environments (Zimmerman & Schunk, 2001). These characteristics are important for teachers because changes in technology over time require ongoing learning as teachers adapt to those changes as they utilize IT in their teaching practice.

The study of self-regulated learning has been addressed from a number of different theoretical perspectives: operant, phenomenological, information processing, constructivist, volitional, Vygotskian, and social cognitive (Zimmerman, 2001). The particular educational philosophy that underpins each of these perspectives is reflected in their explanations of the nature of self-regulated learning. However, these theoretical perspectives commonly recognize that students
actively participate in their learning through their cognition (and metacognition), motivation and self-monitoring actions directed towards achieving their learning goals (Schunk, 2001).

The operant perspective is concerned with the external or environmental actions and motivation sources that influence learners’ behaviours in their academic goal attainment (Mace, Before, & Hutchinson, 2001). This view assumes that even mental or affective processes manifest in some external behaviour. This reflects the stimulus-response foundation of the behaviourist learning theory that underpins this self-regulated learning perspective. The operant perspective of self-regulated learning is concerned with learners’ overt actions or behaviours. It does not, however, give the opportunity to explore the inner world of the learner. Pre-service teachers who are learning to become FIT require a learning strategy that addresses their cognitive approach to IT, as well as their actions in using IT.

The phenomenological perspective of self-regulated learning views the individual’s self-concept and striving towards self-actualisation as the primary motivators in self-regulated learning (McCombs, 2001). Learners’ self-concepts for learning may be global to their learning generally, to a specific learning domain, or vary across domains. For example, pre-service teachers may view themselves with a positive self-concept in their specific content domains of childhood or physical education, but have a lower self-concept in the domain of being an IT user. Self-concept can play an important role in learning motivation. However, the phenomenological perspective of self-regulated learning assumes that people are naturally self-aware. Not all learners are aware of their self-concept or of its role in their learning endeavours. Therefore, another approach to self-regulated learning will be necessary for pre-service teachers to learn beyond the limitations of their self-concepts.

Conceptual schemas are central to both the information processing view (Winne, 2001) and the constructivists’ view of self-regulated learning (Paris, Byrnes, & Paris, 2001). The information processing view of SRL is concerned with mechanisms for processing information in the short-term memory for transfer and storage in long-term memory for later retrieval. The motivational stimulus for learning, according to this perspective (Winne, 2001), is learners’ recognition of the
gap between the state of their current knowledge schema and the desired outcome. Learners’ efforts to close this gap initiates a recursive feedback loop.

The purpose of conceptual schemas in the constructivist view of SRL is in resolving or making sense of cognitive conflicts (Paris et al., 2001). Humans are inherently motivated to make sense of their experience, according to this view, by creating “interconnected knowledge structures and belief systems” (Paris et al., 2001, p. 257) about the content and themselves. Learners’ reflection on their knowledge and experiences prompts construction and re-construction of their knowledge and beliefs. This is mediated through their own self-schemas.

Ultimately, both the information processing perspective and the constructivist perspective of SRL rely on learners’ awareness of their own mental or conceptual schemas and their self monitoring of the effectiveness of their actions to close the gaps in their knowledge or to re-construct their knowledge. However, neither of these perspectives of SRL account for other factors that may influence learner knowledge re-construction, such as environmental or other personal motivational considerations.

The volitional perspective of self-regulated learning is concerned with the learner’s intentions and abilities to control those factors that may have an impact on carrying out learning strategies (Corno, 2001). Both covert and overt processes influence learners’ control of these factors. Covert processes, and learners’ awareness of these processes may influence the formation of learning intentions. The choices of learning strategies that learners make and their choices in implementing those strategies, reflect the overt processes of volitional control of learning. Therefore, effective learning, according to this perspective (Corno, 2001), requires learners’ awareness of the barriers to learning intentions that the covert processes may present, and an awareness of the appropriate learning strategies that learners choose overtly to overcome those learning barriers. This strategy relies on learners’ awareness of their own barriers to learning and learning processes. This may be unrealistic to expect of first year pre-service students.

The Vygotskian perspective has at its core the view that self-direction, and ultimately self-regulation, is possible when children are able to transform the
external speech of adults (words) into their own internal speech (thoughts) (McCaslin & Hickey, 2001). Children’s regulatory behaviour is initially directed by the external speech of adults in their social environment. Children develop self-regulation when they become aware of their own thoughts, can organise their thoughts and are able to generate their own inner self-talk to direct their thoughts and actions.

The principles of this perspective can be extended to the learning of adults through such concepts as mentoring and peer learning (Bonk & Kim, 1998). However, Fitness emphasises independence in using IT. Therefore, another approach to self-regulated learning that encourages personal self-reliance may be more appropriate for developing Fitness.

This study’s focus on the need for teachers to become self-motivated and independent users of IT in their teaching requires consideration of a self-regulated learning perspective that addresses personal, behavioural and environmental issues that may have an impact on the self-regulated learning of young adults. The reciprocal relationships between personal, behavioural and environmental factors in learning form the basis for the social cognitive perspective of self-regulated learning (Schunk, 2001). These factors are derived from Bandura’s (1986) work on social learning, and form a triadic interaction framework. This framework suggests that learners’ thoughts (cognition), actions (behaviours) and motivations influence each other in a reciprocal way throughout the learning cycle (Pintrich & Schunk, 1996; Schunk, 1990; Zimmerman, 2002).

The range of views about self-regulated learning constructs illustrates how ideas evolve over time, and reflects how self-regulated learning may be viewed through the “lens” of particular educational philosophy perspectives about how learning occurs. Pintrich (2000b) claims that the many different approaches to self-regulated are underpinned by four basic assumptions. These include (Pintrich, 2000b):

- the active, constructive assumption where learners are viewed to be active participants in learning who “construct their own meanings, goals and strategies from the information available in the external environment as
well as information in their own minds (the internal environment)” (Pintrich, 2000b, p. 252)

- the potential for control assumption where learners are assumed to have the latent ability to manage their behaviour, motivation and cognition, although not necessarily in all contexts or all the time

- the goal, criterion, or standard assumption where learners are assumed to direct their learning efforts towards achieving a particular objective (goal), the characteristics of which they can compare their achievement (self-monitor) in order to modify their learning activities (self-regulate) towards that goal achievement

- the mediation role played by self-regulated learning activities between the personal and contextual characteristics and learners’ ultimate performance or achievement.

Therefore, all self-regulated learning perspectives, despite their difference in origin and emphasis, seek to explain the cognitive (or metacognitive), motivational and behavioural (learning strategies and self-monitoring) aspects of becoming a self-regulated learner (Zimmerman, 2001).

This study takes a social cognitive perspective as being relevant for the context focus because the interaction of the personal, behavioural and environmental factors may provide the opportunity for insight into how first year pre-service teachers can use self-regulated learning to become fluent with information technology. Theoretical perspectives of self-regulated learning provide a guide to understanding the features of self-regulated learning. Learning processes and strategies provide the opportunity to understand how learning occurs through particular learning activities. The next section presents the learning processes and strategies of self-regulated learning from the social cognitive perspective.

### 2.5 Self-regulated learning processes and strategies

A conceptual framework, within the social cognitive perspective of self-regulated learning, was developed by Pintrich (2000b). His view of self-regulated
learning has been refined over time and supported by numerous empirical studies (Pintrich, 1999, 2000a; Pintrich & Schrauben, 1992; Pintrich & Schunk, 1996; Pintrich, Smith, Garcia, & McKeachie, 1993; Ryan & Pintrich, 1997; Vanderstoep et al., 1996). Pintrich’s (2000b) framework, therefore, may be used confidently to explore the learning processes and strategies of self-regulated learning.

Four phases that learners experience when undertaking learning tasks are presented in Pintrich’s (2000b) framework as: Forethought, Planning and Activation; Monitoring; Control; and Reaction and Reflection. The Forethought, Planning and Activation Phase addresses ways in which learners’ prepare and plan for learning. The Monitoring Phase and Control Phase reflect the actions that learners take to think, learn and monitor their progress during the learning period. The Reaction and Reflection Phase includes learners’ evaluating their goal achievement and attributing their performance to personal characteristics or learning strategies.

The self-regulated learning processes within each phase are divided into four areas for regulation: Cognition, Motivation, Behaviour, and Context. The resulting framework identifies the types of processes that occur across each of these areas for regulation within each phase of the learning sequence. The processes within the phases may be undertaken sequentially or simultaneously in iterative learning cycles (Pintrich, 2000b). Table 2-1 illustrates Pintrich’s (2000b) framework of phases and areas for self-regulated learning.
Table 2-1: Pintrich’s (2000) framework of phases and areas for self-regulated learning

<table>
<thead>
<tr>
<th>Phases</th>
<th>Areas for regulation</th>
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<tbody>
<tr>
<td></td>
<td>Cognition</td>
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<tr>
<td>Forethought, planning and activation</td>
<td>Target goal setting</td>
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<td></td>
<td>Prior content knowledge activation</td>
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<tr>
<td></td>
<td>Metacognitive knowledge activation</td>
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<tr>
<td>Monitoring</td>
<td>Metacognitive awareness and monitoring of cognition</td>
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<tr>
<td>Control</td>
<td>Selections and adaptation of cognitive strategies for learning, thinking</td>
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<tr>
<td>Reaction and reflection</td>
<td>Cognitive judgments</td>
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<td></td>
<td>Attributions</td>
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Pintrich (2000b, p. 454)

For this study, Pintrich's (2000b) framework of phases and separate areas for regulation provides a useful structure for examining the different types of processes that occur within the phases of self-regulated learning. Therefore, the following consideration of self-regulated learning processes and strategies will utilize Pintrich's (2000b) framework.
2.5.1 Forethought, Planning and Activation Phase

The key processes within the Forethought, Planning and Activation Phase address the cognitive areas of goal setting and knowledge activation. Motivational processes linked to cognition include goal orientation, self-efficacy, and interest in and value of the learning tasks.

**Goal setting and goal orientation**

Planning for learning is important for pre-service teachers in their first year of study with a content area with which they may not be very familiar, such as learning about IT for teaching. During the Forethought, Planning and Activation Phase learners need to determine what learning needs to be achieved. Learners need to identify the formal learning goals required and establish their own learning goals and sub-goals that build toward those ultimate target goals (Garavalia & Gredler, 2002; Pintrich, 2000b). This goal setting process helps learners to clarify their learning direction and then to choose which strategies or methods may assist them to meet each sub-goal. Goal setting, then, becomes an important planning strategy.

The motivational process of adopting a suitable goal orientation may influence the types of goals learners set during their planning (Pintrich, 2000a). Intrinsic goal orientation refers to a learner’s focus on seeking to understand (mastering) the content for learning. Learners with the prime goal of passing the subject or getting the qualification, demonstrate an extrinsic goal orientation. The types of goals that learners set, based on their goal orientation, may, in turn, influence their choice of cognitive strategies during the Control Phase of learning. Learners who are aware of their goal orientation may be more likely to adapt their learning strategies to accommodate their goal orientation.

Many pre-service teachers undertaking their course probably commenced their university studies with an extrinsic goal orientation. Their desire to graduate and work as a professional in their field requires that they achieve adequate grades throughout their course of studies. While this goal may provide a stimulus for learning at the commencement of the course, students may need to develop intrinsic learning goals to help sustain their motivation throughout the duration of the course, especially when learning about IT for teaching. Indeed, students’ adoption
of a intrinsic/mastery goal orientation and relevant learning strategies tends to have a positive effect on their motivation and cognitive outcomes, and consequent academic performance (Hofer, Yu, & Pintrich, 1998).

**Prior content knowledge activation**

Activating their prior content knowledge is another important process that learners may use before engaging with the material to be studied. This may occur unconsciously, but it becomes a self-regulatory process when learners actively adopt strategies to assist their recognition and activation of their prior knowledge (Pintrich, 2000b). Knowledge activation strategies for pre-service teachers learning about IT for teaching may include skimming the lecture topics and assessment requirements before class and identifying questions to be answered from undertaking the learning activities. These strategies enhance comprehension and cognitive organisation by stimulating learners’ prior knowledge. Learners who utilize these types of strategies often perform better academically than those who do not use them (Hofer et al., 1998).

**Metacognitive knowledge activation**

Another cognitive component of the Forethought, Planning and Activation Phase involves activating one’s metacognitive knowledge. Metacognition is often referred to as “thinking about thinking”; specifically, thinking about one’s own thinking. Flavell (1976, p. 232), an early proponent of metacognition, claims that “metacognition refers to one’s knowledge concerning one’s own cognitive processes or anything related to them”.

Pre-service teachers eventually will be responsible for facilitating the learning of their pupils. Therefore, developing their own metacognitive knowledge will play an important part of their being able to teach those pupils effectively. Activating their metacognitive knowledge about using IT provides a good starting point for their metacognitive development.

Metacognitive knowledge activation requires pre-service teachers to think about, or become aware of, how they are thinking, think about the strategies that assist their thinking, and think about their knowledge of how to use these strategies
effectively. This metacognitive knowledge, therefore, necessitates that learners draw on their declarative knowledge (knowing about), procedural knowledge (knowing how) and conditional knowledge (knowing when and why) (Biggs, 2003; Eraut, 1994) of cognitive learning strategies that they may adopt during the Control Phase of self-regulated learning. Metacognitive awareness reflects the active role that learners adopt in becoming self-regulated.

**Self-efficacy judgements**

Learners’ self-motivation is vital to enable them to sustain their learning effort. An important aspect of this is self-efficacy, belief in one’s ability to learn generally, and learn particular content specifically (Schunk, 1991). This is particularly significant for pre-service teachers when learning about content that may lie beyond their course speciality, such as Early Childhood or PE teachers learning about the use of IT for teaching.

Learners’ self-efficacy influences their perception of the learning task’s importance to them and its achievability. Setting incremental goals on the path to achieving the final learning goal assists learners to master each step and create positive self-efficacy for achieving the next goal. Similarly, learners’ self-efficacy can be enhanced through their use of actions during the Monitoring Phase to increase their self-awareness as they identify the effectiveness of their learning actions on their learning achievements.

An example of this would be in pre-service teachers’ learning the professional use of computers and information technology. If pre-service teachers believe that they are innately incapable of understanding IT then it is likely that they will perform poorly in an IT subject. If, however, educators emphasise the variable nature of self-efficacy across different domains and situations (Bandura, 1986) then learners may accept that they can change their self-efficacy for learning IT, just as they can change their learning strategies (Schunk, 1994).

Environmental factors that contribute to learners’ self-regulation include mastery experiences and observing successful modelling of learning (Zimmerman, 2001). These types of experiences may be provided through tutorials in which pre-service teachers practice the skills of using IT, and observe their academic teachers
model the use of IT in class. Similarly, during the Reaction and Reflection phase, when learners observe their peers’ successful achievement through the use of appropriate learning strategies, they are more likely to develop their own self-efficacy for similar learning goals.

**Task value activation**

The value that learners place on the learning is another aspect associated with motivation. Pre-service teachers may not be interested in learning about the use of IT in teaching. However, they may recognize that this content makes an important contribution to their being able to manage different types of teaching tasks that they will have to deal with in their future teaching practice. Low intrinsic interest, therefore, may be counter-balanced by high value for the learning task.

Similarly, Zimmerman (2002) claims that outcome expectations are linked to student motivations because learners anticipate that their efforts to learn will be of some benefit to achieving their goals. When learners can identify the outcome of their learning and how it will assist them achieve their goals, then they are more likely to sustain their motivation. Pre-service teachers’ motivation for learning to use IT in their teaching may decline if it is not readily apparent what the beneficial learning outcome will be for them for their own teaching.

**Interest activation**

Learners’ intrinsic interest in the content is very helpful in sustaining motivation for learning. Interested learners are more likely to invest more learning effort in a content area that interests them, than with other areas that do not. Learners with low interest in the learning task need to recognize the impact of their low interest on their learning efforts and may need to purposefully adopt motivational strategies, such as rewards, to help maintain their learning persistence (Pintrich & Schrauben, 1992). This is particularly important for pre-service teachers who may have low interest in IT.

The Forethought, Planning and Activation Phase identifies the issues that self-regulated learners undertake prior to commencing their learning. However,
learners also need to plan how they will monitor the effectiveness of their learning efforts.

2.5.2 Monitoring Phase

The Monitoring Phase of self-regulated learning requires learners to recognize the events in their learning by monitoring or observing their thinking, actions and emotions. Recording their learning activities (self-observation) may prompt learners to evaluate the outcomes of those actions against the learning goals (self-evaluation and self-judgement). Learners’ self-reactions to those judgements may include feelings of satisfaction or dissatisfaction with the outcome. These evaluative motivators then play a role in enhancing or inhibiting learners’ self-efficacy and in encouraging or discouraging their learning efforts. Tangible motivators are self-administered rewards that are contingent on successful self-judgement of learning achievement. These motivators also assist in enhancing learners’ self-efficacy for learning and the adoption of effective learning strategies.

Learners’ self-observation (also known by other authors as self-monitoring (Butler & Winne, 1995; Thiede, Anderson, & Therriault, 2003) or self-recording (Zimmerman, 2002)) is a method where learners write down what learning methods they used and how frequently they used them. For example, pre-service teachers might keep a log of what methods they used and how much time they spent using those methods to learn new technology. This self-monitoring would enable pre-service teachers to identify which of their actions are effective or ineffective for learning, and, therefore, where they need to initiate regulatory behaviours. If pre-service teachers do not monitor their learning behaviours then they will not recognize the reasons why their learning activities are unproductive, inefficient or ineffective.

Linked with this is, what Zimmerman (2002) calls, the “self-experiment” where students may suspect that their learning performance, as measured by their assessment results, may reflect the amount of study time or methods they used to learn new technology. In order to test this suspicion (hypothesis) pre-service teachers may then compare the amount of study time or the particular methods they used, with their relevant assessment result. They may then find that they attained
better results when they spent more time on their study and used higher order
cognitive learning strategies. Learners using self-observation processes monitor
their learning activities and evaluate the success of those activities. This helps
learners to recognize what learning strategies work best for their learning success
and where they may need to seek assistance.

Pre-service teachers need a realistic perception of their competence with
which to compare their self-efficacy. If their self-efficacy for learning IT is high
then they may not recognize the need to change their learning behaviours unless
their initial competence with some aspect of their using IT is demonstrated to be
low. Conversely, if their self-efficacy is low then their learning may be impeded,
unless they are encouraged by knowing that their competence is better than they
expected (Pintrich & Schunk, 1996). In either case, learners may be encouraged to
improve their competence by adopting effective learning strategies when they
acknowledge that self-efficacy is not a static characteristic and know their realistic
level of competence. This may also improve their self-efficacy for learning IT.

2.5.3 Control Phase

The Control Phase of self-regulated learning is concerned with learners’
choice and use of learning strategies.

Cognitive learning strategies

Four cognitive learning strategies play an important role in academic
performance (Pintrich, Smith, Garcia, & McKeachie, 1991). These are rehearsal,
elaboration, organisation and metacognition.

Rehearsal strategies are used to focus the learner’s attention onto important
points or to keep information in active memory. Examples of rehearsal strategies
for learning to use IT may include underlining of text in a user guide, or saying out
loud the procedural steps for completing an IT task. Text underlining is a passive
activity since it does not assist learners to generate any knowledge. It can be useful,
however, in highlighting important points for learners to make notes about on their
second reading of the text. Speaking words aloud is similarly effective as a pointer
for more in-depth learning. These methods for remembering lists of items are useful
as learning tools only if they enable learners to return to each item for further exploration. Pre-service teachers need more than the superficial approach provided by rehearsal strategies.

Garcia and Pintrich (1994) list a number of elaboration strategies. These include: paraphrasing and summarising ideas, creating analogies, generative note taking, explaining ideas to other people, asking and answering questions about the information/text. Elaboration strategies get learners actively engaged with the material they are learning. These strategies enable learners to initiate some action on those ideas identified from their rehearsal strategies.

These types of strategies are utilized when pre-service teachers exchange ideas with each other about how to use IT, or when they link parts of unfamiliar technology with technologies with which they are already familiar. Similarly, when pre-service teachers ask themselves questions about particular aspects of IT functions then they are engaging elaboration strategies for learning to use IT.

The products of elaboration strategies, such as notes, explanations or questions, are external to the learners, but are created by them. This provides opportunities for learners to compare their understanding evident in their products with others or with the original text. Learners construct their own knowledge by using elaboration strategies to create their own products. Testing their knowledge by comparing their products with others, or the original text, helps learners to validate that knowledge and thus “own” it or identify errors and the need for revision.

Organisational strategies are important for pre-service teachers learning the unfamiliar content of how to IT for teaching. Organisational strategies lead to deeper understanding by identifying the relationships between concepts or conditions in which principles apply. Examples of organisational strategies include creating concept maps or concept outlines. These products are more distant from the original text and thus more accurately reflect learners’ understanding. These products, too, may be used to test and confirm the accuracy of learner understanding, or to identify areas for revision.
Metacognitive strategies enable learners to become aware of their thinking and the methods they use for their learning. Metacognitive awareness of their thinking and learning is essential for learners to be able to judge the effectiveness of their learning methods and make adjustments to them when they enter the Reflection and Reaction Phase of learning.

Cognitive learning strategies provide the means through which pre-service teachers can become active participants in their own learning. Yet these strategies also provide products of learner cognition that may be used to monitor learning effectiveness. Cognitive learning strategies, therefore, are an essential component of a pre-service teachers’ learning repertoire.

**Motivational strategies**

Learners adopt motivational strategies during the Control Phase that contribute to their learning persistence and effort. Encouraging self-talk (Wolters, 1998) and generating interest or value in the learning task may help maintain pre-service teachers’ persistence in learning. Similarly, pre-service teachers may enhance their motivation by promising themselves a reward contingent on the successful completion of particular goals or tasks (Graham, Harris, & Troia, 1998; Zimmerman & Martinez-Pons, 1986). This may be especially important for those pre-service teachers who have low interest in the IT content being learnt.

**2.5.4 Reaction and Reflection Phase**

The Reflection and Reaction Phase of self-regulated learning includes processes by which learners make cognitive judgements about their learning performance and then react to that judgement. These judgements need to be based on information about learning performance. Zimmerman (2002) recommends, therefore, that learners need to undertake some form of self-evaluation.

**Self-evaluation behaviours**

Self-evaluation occurs when students measure their learning performance against some standard. That standard may be the one set by a formal examiner, or it may be the learner’s own prior assessment performance, or it may be against the performance of other students. Whichever standard is used, learners’ self-
evaluation helps them to identify how successful their learning performance is compared with that standard.

**Affective reactions**

Self-evaluation raises learners’ awareness of the extent of their learning success. This also has implications for their motivation and choice of future learning strategies. If pre-service teachers’ performances of FITness learning tasks, such as learning skills with current software, compare well with the standard set in the assessment criteria then they know that their learning strategies are effective. Conversely, if their performance is not satisfactory then they know that they may need to change some of the learning methods or introduce some aspect of self-observation into their learning performance.

However, self-evaluation becomes problematic when the standards are not clearly defined, such as the solving of common IT problems required within FITness. In this case, pre-service teachers may rely on their own standards of acceptable performance, which may not be congruent with the characteristics of FITness.

Consequences of learners’ self-judgement include processes associated with their self-reaction to that judgement. One of these consequences is learners’ self-satisfaction with their self-judgement. Schunk (2001) reports that learners’ motivation is enhanced with an increase in their self-satisfaction, whereas future learning may be inhibited by a decrease in their self-satisfaction.

Pre-service teachers who successfully solve an IT problem they encounter may react with satisfaction to their achievement and feel encouraged to attempt to solve other problems in future. However, if their problem-solving is not successful, then they may react with dissatisfaction and retreat from further problem-solving efforts in future.

**Attributions**

Learner thoughts and feelings about what they attribute to cause their performance are linked with these self-judgements and self-reactions. Causal
attribution refers to learners’ beliefs about what caused their success or made them less successful than they anticipated (Zimmerman & Kitsantas, 1997).

If pre-service teachers attribute their errors to their choice of learning strategy then they may maintain their motivation to continue learning to use IT because the cause of the error is controllable; that is, they only need change their learning strategy. If, however, pre-service teachers attribute their errors to something over which they have no control, such as their own ability with IT or other people, such as their academic teachers, then their motivation may be threatened (Zimmerman & Kitsantas, 1997).

Actions taken by pre-service teachers as a self-reaction to their self-judgments will also determine the success of their future learning. Pre-service teachers may retreat from expending much effort in their learning to use IT or simply “drop-out”. This defensive reaction helps to keep their self-image as an athlete, or as a person who works well with children, intact but inhibits further learning. Alternatively, an adaptive reaction enables pre-service teachers to take appropriate action to try to improve their learning by changing their learning strategies to more effective ones when they re-engage with learning in the next learning cycle.

Learning is an ongoing activity throughout a pre-service teacher’s course of study and professional career. Being FIT requires teachers to continue their learning to adapt to technological change throughout their careers. Therefore, Pintrich’s (2000b) framework of self-regulated learning is an appropriate learning strategy to assist pre-service teacher’s FITness development because it identifies the processes that pre-service teachers may use to regulate their learning to use IT and how each of those processes may influence the next phase and cycle of learning.

However, the contextual constraints of this study (explained in Chapter 3) restrict the implementation of Pintrich’s (2000b) entire comprehensive SRL framework. Consequently, this study utilized an SRL learning process from each Phase of Pintrich’s (2000b) framework in order to introduce pre-service teachers to a limited number of SRL strategies. Goal setting from the Forethought, Planning and Activation Phase provided the opportunity for cognitive planning. Learning
resources, such as assessment rubrics and checklists, provided the opportunity for participants to use these to undertake the Monitoring Phase of learning. A cognitive organisational strategy appropriate to the Control Phase of learning included a concept map assessment task. A metacognitive reflection learning task provided the opportunity for participants to make judgments about their learning strategies and their reactions to those judgments, as part of the Reflection and Reaction Phase of Pintrich’s (2000b) framework.

2.6 Summary

This chapter provided an overview of the research context to which the current study will contribute, development of the concept of FITness, and processes of SRL relevant to pre-service teachers’ development of FITness. Theoretical and research literature examined in this chapter provided support for the potential of SRL to aid the development of FITness for pre-service teachers.

Despite the range of approaches to SRL, Pintrich’s (2000b) SRL framework, from the socio-cognitive perspective, provides an appropriate guide for the design of the learning intervention within this study. FITness and SRL have been investigated by both qualitative and quantitative investigative methods. However, the choice of investigative method is dependent on the type of research questions being investigated. The research questions of the current study are concerned with understanding learners’ experience of using SRL to develop FITness. Therefore, a qualitative research methodology that explores participants’ experience through such data collection tools as interviews and assignment tasks may be appropriate. The rationale for the researcher’s choice and implementation of methodology for this study is explained in Chapter 3, Methodology.

Research that informed the study design suggested that:

• many students, on entering university, are ill-equipped with the knowledge and skills necessary to utilize IT effectively in their learning or to adapt to changes in technologies (Kvavik et al., 2004; McEuen, 2001)
• pre-service teachers’ confidence in teaching may be enhanced through their goal setting (Travers & Sheckley, 2000) and metacognitive reflection (Phelps et al., 2001)

• a variety of types of assessment tasks, as contexts for learning, may assist learners to vary their study style and use of learning tactics and resources, and adapt to the demands of different learning situations (Hadwin et al., 2001)

• developing skills with relevant technologies (Beyerbach et al., 2001; Collier et al., 2004) may enhance pre-service teachers’ motivation to use IT in their teaching practice

• pre-service teachers’ attitudes to their use of technology in their own future teaching practice may be enhanced by clarifying the relevance of the application and integration of technology into classroom teaching (Angeli, 2004; Beyerbach et al., 2001; Clift et al., 2001; Collier et al., 2004; Ely, 1999; Gunter, 2001; Yildirim, 2000).

The review of the literature of FITness and SRL underpinned this investigation’s design and implementation. The operational design of this study, which was informed by the literature, is addressed in the next chapter.
Chapter 3: Methodology

3.1 Introduction

The purpose of this chapter is to present the process of investigation used in this research study. The first part draws on educational research literature to provide a rationale for the choice of a qualitative, case study approach to this research investigation. The second part describes the design of the educational intervention, research context, data collection tools and procedures, and data analysis processes. This chapter, therefore, provides the means for the reader to understand how and why the research was undertaken.

3.2 Qualitative research paradigm

There has been considerable debate throughout the history of educational research about the merits of quantitative versus qualitative methods of research (Cohen, Manion, & Morrison, 2007; Scott & Usher, 2000). Different forms of knowledge arise from different investigative paradigms which look at phenomena differently. The mode of inquiry chosen to investigate a particular phenomenon must be appropriate to the research purpose (Yin, 1994) and the form of knowledge that purpose seeks to identify.

The term “knowledge” includes both knowledge of the field and knowledge of individuals. Knowledge of the field is that which has been tested in the public domain and been found to meet the epistemological assumptions of that particular field of scholarly inquiry (Scott & Usher, 2000). Individual knowledge arises from the cognitive awareness of a specific individual and is based on the individual’s own epistemological assumption, beliefs and experience. Scott and Usher (2000) claim that the socially interactive and culturally laden nature of human experience means that researchers and participants come to the research process with their own ontological and epistemological foundations.

All forms of knowledge continue to grow and change through testing and experience. This is true of knowledge generated by either quantitative or qualitative methods.
Knowledge may be generated by a variety of approaches and occurs within methodological frameworks called “research paradigms”. A paradigm is a “fundamental model or scheme that organises our view of something” (Babbie, 1992, p. 56). It includes shared assumptions about beliefs, values, theories and techniques underlying the approach to research (Kuhn, 1970).

The scientific/positivist/empiricist paradigm arose from its use in the natural sciences. It is based on “logical empiricism” or the positivist world view. This paradigm assumes that phenomena being investigated are inherently logical and operate according to laws (Erlandson, Harris, Skipper, & Allen, 1993). The epistemological foundation of this paradigm assumes that facts about the world are objective, whose truth is distinct from the knower and can be measured in order to predict future events, that is, to generate propositions (Scott & Usher, 2000).

This research paradigm is appropriate for the investigation of educational phenomena that can be measured. Propositional knowledge generated from this paradigm contributes to our understanding of some educational phenomena. It does not constitute, however, our entire understanding of all educational phenomena because the process of teaching and learning also includes constructivist and affective dimensions. Indeed, criticism of this paradigm stems from its “mechanistic and reductionist view of nature which, by definition, excludes notions of choice, freedom, individuality, and moral responsibility” (Cohen et al., 2007, p. 17). These factors are common and important features of teaching and learning contexts, especially when we seek to understand an educational phenomenon from the student’s perspective.

An individual’s knowledge, from the constructivist perspective, deals with the individual’s creation of personal meaning from experience (Candy, 1991). The constructivist view of knowledge about the world is concerned not with knowledge representing an accurate picture of the world, but rather with knowledge consisting of representations that enable the individual to make sense of the world in order to participate and interact with others. Nystedt and Magnusson (1982, p. 34) claim that forms of knowledge are “constructed by the one who experiences it … people do not merely respond to the environment, they construe it”. According to this view, an individual’s knowledge is constructed from his or her interpretation of
experience, and in seeking to understand, an individual’s knowledge is tested, changed and reconstructed within the context of an individual’s knowledge and experience in relation to others. Therefore, there is a significant personal or subjective aspect to the development of an individual’s knowledge.

While constructivism views understanding of reality as a personal creation, it also recognises the influence of culture and society on the individual’s interpretation of experience and construction of meaning (Candy, 1991). Therefore, the individuals’ learning of cultural and societal values and traditions contributes to some extent to their understanding of their world. Yet it is the individual who must create meaning from his or her experiences.

Teacher and learners bring to the learning context their knowledge constructed from their prior experience. Consequently, the personal and interactive nature of teaching and learning requires a humanistic approach to understanding people’s meaning and experience. In order to provide this broader understanding we need to turn to the interpretive paradigm.

The interpretive paradigm aims to explore, describe and clarify human experience and to consider the effect of context on understanding that experience. Denzin and Lincoln (2005, p. 3) claim that “qualitative researchers (within the interpretive paradigm) study things in their natural settings, attempting to make sense of or interpret phenomena in terms of the meanings people bring to them”. The interpretive paradigm is relevant to this particular study because it seeks to understand, from the student’s experience, how self-regulated learning strategies can assist learners to develop fluency with information technology.

An important part of our understanding of learners is in relating their learning experience to the learning context. Therefore, the principles and strategies involved in the interpretive paradigm are important mechanisms for helping us, as educational researchers, to expand our knowledge base of the nature of students’ learning experiences in order to provide more effective instruction.

Researchers’ interpretation and meaning construction of learners’ experiences require appropriate methodological processes. Quantitative instruments and
statistical analyses will not provide the best opportunities to explore this inner world of participants’ experience.

The concept and attributes of FITness, compared with the more competence-oriented notions of computer literacy, have not been explored adequately in the research literature, especially in relation to developing FITness through self-regulated learning. Consequently, this study provided opportunities to identify issues from pre-service teachers’ learning experience that may influence their abilities to utilize self-regulated learning in developing FITness. Once the issues are identified and their relationships clarified, then they may be transformed into variables to guide future quantitative research. In this way, this study contributes to knowledge about how self-regulated learning may be used to enhance learners’ becoming fluent with information technology and provides a basis for future research.

This study used an interpretive, qualitative methodological approach to investigate how pre-service teachers can use self-regulated learning to contribute to their development of fluency with information technology. In essence, this study seeks to understand the learners’ experience from their own perspectives. This provides opportunities for a better understanding of the use of self-regulated learning within the context of pre-service teachers’ learning of FITness, and assists our understanding of the connections between instruction (SRL) and outcomes (FITness) (Butler, 2002).

Case study was the method used to guide the research process within the qualitative research paradigm. The rationale for the choice of case study method is explained in the next section.

3.3 Case study research method

Case study was the primary research method used within this study. Definitions of a “case study” vary within the research literature (Hammersley & Gomm, 2000) according to the purpose, types and data collection tools used. Many authors do agree, however, that a case study is bounded by time and place (Stake, 1978/2000); may be focussed on an individual event or program (Creswell, 2007);
and utilize multiple, rich sources of data (Yin, 1994) in a descriptive, interpretive or evaluative way (Merriam, 1998) to understand human experience.

Case studies are especially useful for understanding issues in educational practice and their effect on student learning experience (Merriam, 1998; Stake, 1978/2000). The investigation of a specific, bounded case enables researchers to examine numerous contextual factors that may influence the phenomenon being researched. Understanding contextual influences may lead to a better understanding of the relevant issues, which is the goal of educational research generally, and this study specifically.

The pursuit of understanding from a case study requires collection of different types of data from a range of sources, for example, interviews and documents (Creswell, 2007; Hammersley & Gomm, 2000). Multiple data sources and types help to provide rich information about many aspects of the case that may contribute to a better understanding of the phenomenon under investigation.

The purpose of the research study influences the type of case study undertaken. Merriam (1998) identifies three types of case studies: descriptive, evaluative, and interpretive. Descriptive case studies aim to provide “a detailed account of the phenomenon under study” (Merriam, 1998, p. 38) but are not directed by theory or hypotheses. Historical case studies or descriptions of innovative programs depict the phenomenon in its context without seeking to explain or understand any theoretical implications of the case (Yin, 1994), although the descriptive case study could provide the impetus for further investigation.

Evaluative case studies add judgment to the case study description for the purpose of, for example, determining the value or worth of an educational intervention or program (Stenhouse, 1988). Evaluative case studies provide rich data for educational decision-making (Merriam, 1998; Yin, 1994), but are not as useful for aiding educational researchers’ understanding of phenomena as are interpretive case studies.

Interpretive case studies take the case study description a step further by analysing the rich data in the case in order to “develop conceptual categories or to illustrate, support, or challenge theoretical assumptions held prior to the data
gathering” (Merriam, 1998, p. 38). The interpretive aspect of this type of case study draws on existing theory and contributes to theory building by seeking to explain the influence of contextual factors on the phenomenon being studied. This type of case study is especially relevant for educational research that seeks, within a theoretical milieu, to develop our understanding of learners’ experience and the implications of that experience for future educational practice. Yin (1994) calls this type of study an “explanatory case study”, while Stenhouse (1988) labels it an “educational case study”.

The case study context of this research is an educational intervention within a single subject offered in a single semester in a teacher preparation bachelor degree program at a particular university in Australia. The temporal and geographic boundaries of this context make it suitable for investigation as a case study. Similarly, the nature of the educational intervention within the IT subject provides the only opportunity within the degree program for students to develop their FITness through self-regulated learning. This makes the educational intervention within the IT subject a single setting which is appropriate for an interpretive case study investigation.

The research questions in this study provide the investigative purpose, that is, to understand how students in a specific context may use a particular learning strategy (self-regulated learning) when learning to become fluent with information technology. Specifically, the research questions are:

Question 1: What aspects of FITness can learners develop in a self-regulated learning environment?

Question 2: What self-regulated learning strategies do learners use when learning to become fluent with information technology?

Question 3: What other factors may influence learners’ becoming fluent with information technology through self-regulated learning?

This research purpose supports the use of an interpretive case study as an appropriate investigative method.
3.4 Research context

This section introduces the reader to the context in which the research study occurred. This setting in which the educational intervention was implemented, the participants and the learning design are presented.

3.4.1 Researcher’s background

The researcher has been employed, for the past 20 years, as an academic educator in undergraduate and post graduate professional preparation courses at an Australian university. During that time, she facilitated students’ development of knowledge and skills with IT for professional practice and academic scholarship. This experience led the researcher to identify the educational problem of students’ difficulty with developing their independence in learning to use IT in a changing technological context. Consequently, the researcher was drawn to investigate how self-regulated learning may assist students to develop the higher order knowledge and skills with IT necessary for lifelong learning within professional environments characterized by technological change.

3.4.2 Curriculum subject

The curriculum subject that provided the context for this study was “Information Technology for Learning” (EDIT102) offered in semester 2 of 2004. This introductory subject is undertaken by students in their first or second year of the teaching preparation bachelor degrees at the University of Wollongong. These degrees include:

- Bachelor of Teaching in Early Childhood Education
- Bachelor of Education in Physical and Health Education
- Bachelor of Teaching (Primary).

Scheduling the semester of offering this subject is determined by the numbers of students enrolled in the different courses. Normally students undertaking the Early Childhood Education and Physical and Health Education courses enrol in EDIT102 in semester 2, and students in the Bachelor of Teaching (Primary) enrol in
this subject in semester 1. A few students with atypical enrolment patterns were enrolled in EDIT102 in during semester 2, 2004.

The aim of “Information Technology for Learning” (EDIT102) is to:
provide students with the opportunity to learn and critically reflect on
• The role of information and communication technologies (ICT) in improving learning for all students
• The support provided by information technology to the teacher in her/his professional activity and career.

(University of Wollongong, 2004)

This subject had been offered previously using lectures and laboratory tutorial practice, with standard computer hardware and software found in local schools. Lectures provided opportunities for students to learn about the principles and practice of the use of IT in schools, and then consolidate this learning with their skill practice in the computer laboratory tutorials. In 2004, changes to the design of the subject and teaching approach were made to integrate self-regulated learning strategies and fluency with information technology concepts.

EDIT102 provides the only compulsory opportunity in the curriculum for students to learn knowledge and skills in the use of IT for teaching practice. It was important, therefore, that students be encouraged to develop the ability to continue to learn and adapt to new technologies in their future roles as student teachers and, ultimately, as practicing teachers. The primary goal in the learning design of this IT subject was to assist students in their learning to become fluent with IT, rather than being merely computer literate. Self-regulated learning was judged to be the most appropriate strategy for enabling students to develop their self-reliance for ongoing learning. The subject outline for EDIT102 is available in Appendix 4.

3.4.3 Learning intervention design

The initial phase of this research required the identification of the specific knowledge and skills that are required for a pre-service teacher to be considered fluent with IT. Self-regulated learning strategies to assist learner development of FITness were also identified. The curriculum for EDIT102 was revised to address these FITness components and self-regulated learning strategies.
Content clarification

A number of processes were undertaken to ensure that the EDIT102 curriculum provided learning opportunities for the development of FITness and self-regulated learning strategies. These included revising the content, assessment, the teaching strategies and learning strategies.

Essential knowledge and skills necessary for pre-service teachers learning to use IT for teaching were identified from the literature, especially recommendations from NRC CITL (1999), Ministerial Advisory Council on the Quality of Teaching (MAQT, 1997), the Ramsey (2000) report on teaching quality, and the Australian Council for Computers in Education (ACCE, 2000-2003) technology competencies project. It was imperative that the content not compromise the Department of Education’s requirements for pre-service teacher preparation courses to meet the expected computer proficiencies of graduate teachers. Other aspects of FITness, such as intellectual capabilities and adaptability, enhanced the minimum requirements of the Department of Education. Appendix 5 lists the features of these source documents and identifies their similarities and differences.

Comparing the computer competencies and capabilities in the source documents helped the researcher to clarify the focus of the learning design of EDIT102. The primary purpose of the learning design within EDIT102, therefore, was to integrate FITness with the Department of Education requirements to assist students to:

- articulate a rationale for using IT in teaching practice
- develop skills with a range of software through which they may learn to use basic computer operations
- use IT to support their teacher roles
- integrate IT into curriculum through
  - choosing appropriate technologies for learning activities by locating, evaluating, selecting and using educational software
  - creating electronic teaching resources
  - designing technology-supported activities
• develop an awareness of emerging developments in IT and the need for professional development of IT skills in the future
• solve common IT problems individually and in collaborative teams
• communicate effectively with others about using IT
• think about IT abstractly for solving real world problems.

Implications of FITness on learning design

The NRC CITL’s FITness framework was set out in their report “Being fluent with information technology” (1999). This report expressed their view that (NRC CITL, 1999, section 2.3):

FITness integrates skills, concepts, and capabilities into an effective understanding of information technology, enabling citizens to use information technology to solve personally relevant problems and apply their knowledge of information technology to new situations. This integration is an essential element for individuals to learn over a lifetime.

Student teachers need skills in the use of IT for teaching and learning. This enables them to develop the contemporary IT skills of FITness. The learning design included opportunities to learn how to use a range of current technologies for teaching and learning purposes.

The focus of the learning design within EDIT102 was on how to use computers for teaching and learning. This contrasted with that of the NRC CITL’s focus on the learning of fundamental concepts of IT. The learning design emphasised the learning through using IT (Jonassen, 2000). The NRC CITL, on the other hand, emphasised learning about IT. The purpose of EDIT102 was to prepare students to become teachers who utilize IT. Therefore, it was appropriate that educational intervention’s design approach reflected learning about the concepts, principles and processes of the application of IT to classroom teaching and learning.

The learning design provided opportunities for students to develop intellectual capabilities necessary to become lifelong learners and users of IT. These capabilities were adapted from those suggested by NRC CITL.
The NRC CITL recommended learning about fundamental IT concepts and the intellectual capabilities of problem-solving through learning computer programming. However, the types of problems to which students in this study were exposed were not concerned with solving or debugging programming problems. Instead, the learning design utilized two types of problems that would occur in real schools with real teaching issues.

The first type of problem was concerned with providing a stimulus for student inquiry and learning. Students were given basic instruction in some aspects of each software program that they utilized throughout the resource development activities. Each of the resource development activities were assessed using a resource development criteria rubric for each software program. “Get started” notes for each software program were available for download from the subject’s WebCT site. The resource development criteria rubrics, however, included extra features that had not been addressed in the computer laboratory tutorials or in the notes. This provided an inquiry stimulus for students to explore the software and support materials in order to learn for themselves how to utilize those software functions, if they wanted to achieve the marks awarded for those features.

Similarly, some tasks required students to use technology that they had not been specifically taught, for example, students were advised to save their work-in-progress files to a thumb/flash/usb drive and submit their assignments on CDROM. While there were “get started” notes for how to do this, available on the WebCT site, students really had to learn how to solve this technological problem independently.

Another type of problem with which students engaged, within the third assessment task Project, was creating an appropriate teaching plan with accompanying IT resources to address a real classroom problem scenario. The details of the problem scenario was loosely structured to enable students to create their own solutions. This enabled students to integrate their understanding of ways in which IT could be used in the classroom with their technical abilities to create IT products relevant to the problem solution. This activity reflects what students will be required to do when they eventually work as practicing teachers. This type of real world, inquiry-based, problem-solving activity reflects the use of authentic

These types of problems reflect the reality of schools, that is, technology will become obsolete and be replaced. These replacements will be unfamiliar because they are new. Exposing students to multiple problems similar to those they are likely to encounter in their real teaching situations reflects the view of the problem-solving literature (Anderson et al., 1996). Dealing with real problems encourages students to adapt the methods that they use to learn how to meet unfamiliar aspects of the technology they encounter.

The problem-focussed learning design of EDIT102 provided opportunities for students to develop their skills with contemporary technology and develop intellectual capabilities of adaptability and solving real problems in using that technology. The design of the learning intervention also considered ways to embed SRL to assist students’ learning of FITness.

Self-regulated Learning Intervention

The advantage of embedding or integrating self-regulated learning strategies into a curriculum is that learners may readily apply those strategies to the domain content they are learning. Consequently, their transfer of learning these strategies is immediate and relevant to the domain content. A disadvantage is that the range of self-regulated learning strategies to which students may be exposed is limited, compared with the possibilities in an adjunct self-regulated learning program. The curriculum limitations in the Bachelor of Teaching mean that there was no opportunity for an adjunct self-regulated learning subject. Therefore, decisions about the choice of self-regulated learning strategies to embed in the learning design of the EDIT102 subject were based on consideration of the four planning issues identified by Hofer et al. (1998), including scope, content, timeframe and learner characteristics.

Planning the scope of the learning intervention required the researcher to consider how many different types of SRL strategies to include. Limiting the scope to the use of a single strategy may assist measurement of the effectiveness of that
strategy in a learning program. However, that is not the purpose of this research. Conversely, introducing learners to too many SRL strategies may confuse or overwhelm them as they grapple with learning to use the strategies in addition to learning course content. Determining the use and effectiveness of particular SRL strategies may become problematic when too many strategies are used (Hofer et al., 1998).

Hattie, Biggs and Purdie (1996) found that whilst the use of a single strategy had the strongest effect on learner achievement, using a few strategies was also quite effective for achieving the desired learning. Consequently, the learning design in this study includes four types of SRL strategies from Pintrich’s (2000b) framework. These include the opportunity for cognitive planning through goal setting appropriate to the Forethought, Planning and Activation Phase; and the opportunity to utilize cognitive organisational strategies appropriate to the Control Phase of Pintrich’s (2000b) framework. It was anticipated that the resources provided to assist learner goal setting would also enable learners to utilize those resources for self-monitoring of their learning achievement; which is an important component of Pintrich’s (2000b) Monitoring Phase of his framework. The reflection learning task provided an opportunity for learners to identify what learning they had achieved and consider the processes they used to achieve that learning. This reflected the cognitive judgements and attributions inherent in the Reflection and Reaction Phase of Pintrich’s (2000b) framework.

The choice of the type of SRL strategies to include in the scope of the intervention enabled the researcher to select particular strategies which would be most relevant to learning the course content. These particular strategies then became the content of the design of the educational intervention.

Students were given three types of checklists to assist their strategic planning of how to approach their learning of each IT topic area and their self-monitoring of their achievement: 1) the general planning checklist, 2) the resource development criteria rubrics, and 3) the software evaluation checklist. Students were also advised to identify the learning goals and sub-goals required for each assignment (see Appendix 8). Goal setting helps student planning and provides opportunities to check their progress (self-monitoring). It was anticipated that this goal setting
would also assist student motivation when they could recognise their progressive achievement of the goals (Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002).

The general planning checklist included planning questions for students to consider for the entire IT subject and for each assignment. It included questions to assist students to identify the learning outcomes they were expected to achieve, resources they would need to achieve those outcomes, and how they would be able to determine to what extent they had achieved the expected learning outcomes.

Another goal setting tool was a rubric of assessment criteria for each particular resource development activity within Task 1 and grade of achievement level from a Pass to High Distinction. For example, the Task 1 resource development assignments concerned with learning skills for using particular software, such as, creating a PowerPoint presentation, creating a web site, and creating a database or spreadsheet using Excel, were graded according to the achievement of specific criteria. The resource development criteria rubrics were provided to students in advance. This enabled students to readily identify the knowledge and skills of the software they needed to demonstrate in order to achieve their desired goal of a particular grade for that assignment.

There were three software evaluation checklists provided that listed issues for students to consider when evaluating pre-existing educational software, but they did not provide assessment rubrics. The two software evaluation checklists for the EC student group were excerpts from books on software evaluation for young children. These checklists included questions about features concerned with child learning, teaching and technical issues. The software evaluation checklist for the PE student group included a list of questions concerned with the educational software’s quality, credibility, links to other resources, relevance to teaching syllabus, and technical issues of stability and functionality.

The general planning checklist, the resource development assignment-specific criteria rubrics and software evaluation checklists provided opportunities for students to utilize strategic planning to guide their learning. These resources also enabled learners to monitor their learning by checking their progress against the
checklists and rubrics. These tasks instructions and resources are provided in Appendices 8-13.

Particular cognitive organisational strategies were included either as part of, or as a resource for, resource development tasks. For example a web design matrix table for web site creation was a resource provided as a cognitive organisational strategy to assist student learning. A concept mapping assignment activity was included to introduce students to another cognitive organisational strategy to enhance their learning skill repertoire.

The scope and content of SRL strategies used within the educational intervention was influenced by the timeframe of the learning program. The IT subject in which the educational intervention was embedded was offered in one semester of thirteen weeks. Student learning of the IT content during this time ranged from the more simple learning to use specific software to the more complex planning of the pedagogical integration of IT.

The limitations of time and the curriculum-embedded nature of the intervention, required limitations in the scope and content of the SRL strategies. Introducing students to a more comprehensive set of SRL strategies was simply not feasible within the timeframe available to the IT subject.

The characteristics of students in the particular teacher preparation degrees also needed to be considered. These degrees prepare students to become teachers in particular contexts, such as for children of certain ages (early childhood or primary school) or for a particular purpose (health and physical education). The perceptions of students in these degrees of the relevance of the content of the IT subject to their ultimate teaching context may influence their approaches to learning the IT content. This has been demonstrated in previous research (Angeli, 2004; Beyerbach et al., 2001; Clift et al., 2001; Collier et al., 2004; Ely, 1999; Francis-Pelton & Pelton, 1996; Gunter, 2001; Yildirim, 2000).

Two learning design decisions helped to prevent attitudinal obstacles to learning by addressing this relevance issue. A number of lectures were included that illustrated how IT could be integrated into the pedagogical practice for each course stream of early childhood and physical education. The final assignment
(Task 3) required lesson planning and resource development for the integration of IT into a teaching scenario. A concept mapping assignment within Task 3, as a cognitive organisational strategy, was chosen to assist students to make explicit conceptual connections between the IT content they were learning and its application to their future pedagogical contexts. It was anticipated that making this link explicit, through the concept map, would clarify the relevance of student learning to their future teaching practice and enhance their motivation for their learning to use IT in their future teaching practice. In addition, the concept map component of the Task 3 assignment provided the opportunity for the researcher to explore how participants could use this cognitive learning strategy to represent their knowledge. This study was not concerned with the accuracy of participants’ knowledge of the use of IT in teaching contained within the concept map.

Students in EDIT102 are usually within their second semester of their first year in the teacher preparation degree. This means that they are still coming to terms with the standards of the knowledge and skills required of them as university students. The learning methods that may have sufficed for these students during their school years may not be adequate for the complexity of studies at university. Therefore, the SRL intervention needed to introduce students to a limited number of strategies that would be useful for first year students to manage as they adapt to the university learning environment. The choice of strategies to assist strategic planning, self-monitoring and cognitive organisation, provided students with basic tools with which to engage in learning.

The design of the educational intervention provided ways in which FITness and SRL could be embedded into the EDIT102 curriculum. The learning tasks and resources provided opportunities for students to develop components of IT fluency and/or cognitive, motivational and self-monitoring aspects of self-regulated learning. The list of learning intervention tasks and resources and their relationship to FITness and SRL constructs is available in Table 3-1.
Table 3-1: Learning intervention tasks and resources and their relationship to FITness and SRL components

<table>
<thead>
<tr>
<th>Learning Task</th>
<th>Learning Resource</th>
<th>FITness component</th>
<th>SRL component</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Learn new computer platform - Mac</td>
<td>• “Mac OS Basics” help sheet</td>
<td>• knowledge &amp; skill of current technology</td>
<td>• strategic planning &amp; goal setting</td>
</tr>
<tr>
<td>• plan how to meet expected outcomes of EDIT102</td>
<td>• general planning checklist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• attend lectures</td>
<td>• lectures</td>
<td>• knowledge of IT in teaching</td>
<td></td>
</tr>
<tr>
<td>• <strong>Task 1 Resource Development Activity 1:</strong> Multimedia presentation using PowerPoint</td>
<td>• general planning checklist</td>
<td>• knowledge &amp; skill of current software</td>
<td>• strategic planning &amp; goal setting</td>
</tr>
<tr>
<td>• task description guide in subject outline</td>
<td>• “PowerPoint Basics” help sheet</td>
<td></td>
<td>• stimulus to learn more than in classroom instruction</td>
</tr>
<tr>
<td>• “Working with Images” help sheet</td>
<td>• Marking criteria rubric “Assessment guide”</td>
<td></td>
<td>• self-evaluation/self-monitoring</td>
</tr>
<tr>
<td>• Task 1 Resource Development Activity 2: Multimedia presentation by creating a Web site</td>
<td>• general planning checklist</td>
<td>• knowledge &amp; skill of current software</td>
<td>• strategic planning &amp; goal setting</td>
</tr>
<tr>
<td>• task description guide in subject outline</td>
<td>• “Web page Basics” help sheet</td>
<td></td>
<td>• stimulus to learn more than in classroom instruction</td>
</tr>
<tr>
<td>• Marking criteria rubric “Assessment guide”</td>
<td>• Web design matrix planning tool</td>
<td></td>
<td>• self-evaluation/self-monitoring</td>
</tr>
<tr>
<td>• Web design matrix planning tool</td>
<td>• knowledge &amp; skill of current software</td>
<td></td>
<td>• cognitive organisational strategy</td>
</tr>
<tr>
<td>• adapt multimedia design to new software</td>
<td>• strategic planning &amp; goal setting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning Task</td>
<td>Learning Resource</td>
<td>FiTness component</td>
<td>SRL component</td>
</tr>
<tr>
<td>---------------</td>
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<td>---------------</td>
</tr>
</tbody>
</table>
| • Task 1 Resource Development EC Activity 3: Database using Excel | • general planning checklist  
• task description guide in subject outline  
• “Database Basics” help sheet  
• “Excel Basics” help sheet  
• Marking criteria rubric “Assessment guide” | • knowledge & skill of current software | • strategic planning & goal setting  
• stimulus to learn more than in classroom instruction  
• self-evaluation/self-monitoring |
| • Task 1 Resource Development PE Activity 3: Spreadsheet using Excel | | | |
| | | | |
| • Task 2 Educational Software Analysis Activity 1:  
o Individual evaluation | • general planning checklist  
• task description guide  
• (EC) Selecting And Assessing Children’s Software guide  
• (EC) Checklist for Evaluating Software for Young Children  
• (PE) Evaluation Checklist  
• (PE) Individual Analysis Marking Criteria rubric | • organise, navigate & evaluate information systems  
• think abstractly about IT to solve real tasks | • strategic planning & goal setting  
• self-evaluation/self-monitoring |
| • Task 2 Educational Software Analysis Activity 2:  
o Group presentation of teaching plan | • general planning checklist  
• task description guide | • organise, navigate & evaluate information systems  
• think abstractly about IT to solve real tasks | • strategic planning & goal setting |
| • Task 3 Project Activity 1: Teaching Resource Project (group)  
o create teaching plans & associated IT resources for integrating IT into lessons on 2 topics | • general planning checklist  
• task description guide | • think abstractly about IT to solve real tasks  
• adapt software skills to new tasks | • strategic planning & goal setting |
Table 3-3: Learning intervention tasks and resources and their relationship to FITness and SRL components (continued)

<table>
<thead>
<tr>
<th>Learning Task</th>
<th>Learning Resource</th>
<th>FITness component</th>
<th>SRL component</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 3 Project Activity 2:</strong> Reflection on learning</td>
<td>• general planning checklist</td>
<td>• consider future professional development with IT</td>
<td>• strategic planning &amp; goal setting</td>
</tr>
<tr>
<td></td>
<td>• task description guide</td>
<td></td>
<td>• metacognitive awareness of learning</td>
</tr>
<tr>
<td></td>
<td>• consider future professional development with IT</td>
<td></td>
<td>• IT self-efficacy</td>
</tr>
<tr>
<td><strong>Task 3 Project Activity 3:</strong> Concept map of IT for teacher roles using SmartIdeas or Inspiration software</td>
<td>• general planning checklist</td>
<td>• knowledge &amp; skill of current software</td>
<td>• strategic planning &amp; goal setting</td>
</tr>
<tr>
<td></td>
<td>• task description guide</td>
<td>• think abstractly about IT to solve real tasks</td>
<td>• cognitive organisational strategy</td>
</tr>
<tr>
<td></td>
<td>• “SmartIdeas Basics” help sheet</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• “Inspiration Basics” help sheet</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>store files on CD &amp;/or USB thumb drive</strong></td>
<td>• “Burning CD” help sheet</td>
<td>• adapt to new technology</td>
<td>• stimulus to learn skill for which there was no classroom instruction</td>
</tr>
<tr>
<td><strong>print presentation handouts etc.</strong></td>
<td></td>
<td>• solve common IT problems</td>
<td></td>
</tr>
</tbody>
</table>

A learning design is only as effective as the educators’ abilities to implement that design. Therefore, the researcher sought the support of the academic teaching team in implementing the learning design.

**3.4.4 Academic teaching team meetings**

The researcher met regularly with the subject coordinator and the academic teaching team of EDIT102 throughout the months preceding the implementation of the educational intervention within the EDIT102 curriculum. During these meetings the staff discussed the successful and problematic aspects of the previous curriculum content and structure. The researcher introduced the concepts of self-regulated learning and FITness to the staff. This prompted discussion between the researcher, subject coordinator and teaching team of how the EDIT102 curriculum could be re-designed to incorporate these concepts and what tasks needed to be completed by particular staff members, for example, learning resource development.
Ultimately, the researcher worked most closely with the subject coordinator, but it was essential to include other teaching team members in discussion to ensure their commitment to and cooperation with the implementation of the educational intervention within the EDIT102 curriculum. The successful implementation of the educational intervention within the EDIT102 curriculum could have been compromised if members of the teaching team had felt that they had not been involved in the revision process or that their contributions were superfluous or ignored.

3.4.5 Change of teaching style

The revised curriculum required a change of teaching style in order for the curriculum’s focus on self-reliance to be congruent between the content and instructional processes. The researcher ran a workshop for the academic teaching team on how self-regulated learning and the intellectual capabilities of FITness could be enhanced by specific educator actions in the classroom, particularly during the skill laboratory tutorials.

Instead of simply providing answers to students’ questions about using the technology, academic staff were advised to provide support in ways that helped students to learn for themselves. Rather than give the solution to a student question, staff were advised to re-phrase the question to help clarify the key components of the student’s difficulty, and then ask questions of the student in order for the student to ultimately identify the problem solution. This process reinforced the self-regulated aspect of focused questioning for learning. The purpose of this approach was to assist students to learn to refine their questions and seek their own answers; thereby encouraging an inquiry approach to learning. Student-generated solutions are more likely to result in meaningful learning and build confidence, than having the solution provided for them. This approach is also consistent with Barnett’s argument that university students should be encouraged to develop the skills necessary to “live purposively with uncertainty” (Barnett, 1994, p.177).
3.4.6 Subject timetable

The room booking procedures are centralised at the University of Wollongong. The only control the subject coordinator has is to request that lecture and tutorials be scheduled for the same day. Any other decision about the EDIT102 timetable is determined by the room booking software that considers the name of academic staff member, student numbers and type of classroom required, for example, lecture theatre or computer laboratory for tutorial. Consequently, the five necessary EDIT102 tutorial groups (2 for Early Childhood and 3 for Physical and Health Education) were timetabled at 9.30, 10.30 and 11.30 am on a Thursday. The two lectures were timetabled at 2.30 and 3.30 on Thursday. This met the requirement of having all EDIT102 classes on the same day of the week. The gap of time, however, between the end of the tutorials and the afternoon lectures may have discouraged lecture attendance, especially for students with employment commitments.

The content areas were organised into the existing curriculum timetable framework for EDIT102. The EDIT102 class schedule included two weekly lectures of 1 hour duration, and a 1 hour computer laboratory tutorial.

The weekly lectures were separated according to their purpose. The first hour of the weekly lecture included content relevant to all of the students enrolled in the EDIT102 subject. The first 6 weeks of lectures introduced students to:

• the need for teachers to utilize IT in their teaching
• technologies and techniques for using IT in teaching: past, present and future possibilities
• the ways in which a range of technologies may be used to assist teacher roles
• evaluating existing educational software programs
• pedagogical strategies for integrating IT into teaching.

The students separated into their specific course groups of EC or PE for the second lecture for the first 6 weeks of semester. This second lecture was focused on
introducing students to particular use of IT in their specialty teaching areas, including demonstrations by current practicing teachers of the ways in which they used IT in their teaching.

The structure and content of the lecture component of EDIT102 enabled students to be introduced to the rationale for, and methods of using, IT, generally, and in their teaching specialty areas, specifically. This helped to clarify the relevance of what students were learning to their future practice as teachers, which, in turn, may enhance students’ value of the learning tasks. Similarly, Bandura’s (1986) social modelling theory and research by Collier et al. (2004) and Gunter (2001) suggest that modelling the use of IT by academic teachers, and by school teachers as guest lecturers, may help to reinforce the concept that IT is an important tool for the teacher of the twenty first century.

Students did not attend lectures from weeks 7-13 of semester. Instead, the time scheduled for lectures was allocated to the group work required for the educational software evaluation planning and presentation for Assignment 2, and for the resource development for the last assignment.

The weekly 1 hour computer laboratory tutorials, for the first six weeks of semester, gave students the opportunity to practice skills with specific software and complete the associated assessments of their skills. Two weeks were allocated to each software skill assignment. Students were introduced to and practiced their skills during the first week, and completed the assessment of that software skill during the following week’s tutorial time.

3.4.7 Participant recruitment

The researcher addressed the EDIT102 student group at the end of the first lecture for the semester. She described briefly the nature and purpose of the research study and invited students to volunteer as participants. The researcher emphasised the voluntary nature of participation and that participant interview data would remain confidential and not be used by the assessors to influence student assessment results in the subject. The subject co-coordinator clarified that the researcher was undertaking the research in the subject with her consent and reiterated the confidential nature of the data storage.
Participant information sheets (see Appendix 2) and consent forms (see Appendix 3) were distributed to all students who attend the initial lecture. Fourteen students volunteered to be participants in the study by signing the consent form.

3.4.8 Participants

An initial group of 14 voluntary participants were drawn from approximately 115 first year undergraduate teacher education students, who were enrolled in EDIT102 in semester 2, 2004. One volunteer failed to respond to contact by the researcher to organise an interview time and was eliminated from the participant list. Another participant completed the first interview but failed to respond to the researcher’s multiple attempts to contact her for the second interview. The researcher deemed this participant to have withdrawn from the study and removed data collected from this participant from the data set. This left a final group of 12 participants. Their details regarding age, course specialization and year they commenced the course is presented in the Findings chapter.

This section presented the context in which this research study was undertaken. The next section describes the methods used to collect data for analysis in this study.

3.5 Data collection

This section introduces the sources of data used in this research study, the design of data collection methods and their implementation.

3.5.1 Data sources

Two types of data were analysed: interviews with participants, and participants’ assignments. The participant assignments included two sources of data from assignment components from Task 3 Project Part 2: concept map and reflection assignment documents. These different data types and sources enabled different types of information to be collected. The variety of information provided opportunities to explore the phenomenon under investigation more comprehensively than was possible from a single data source. This approach to data collection is called “triangulation” (Patton, 2002) and helps to ensure that themes emerging from analysis of each source are confirmed, disputed and/or elaborated by
other sources. For example, one emerging theme may assist our understanding by exploring factors that contribute to its occurrence in all data sources. Similarly, it is just as important for our understanding to explore the factors that contribute to where and why some themes or events are not present in other data sources. Triangulation, therefore, helps to ensure that data analysis reflects the reality of the phenomenon as much as possible. Table 3-2 lists the research questions and relevant data sources to address them.

Table 3-4: Summary of research questions and related data types and sources

<table>
<thead>
<tr>
<th>Research question</th>
<th>Data types and source</th>
</tr>
</thead>
</table>
| What aspects of FITness can learners develop in a self-regulated learning environment? | • participant interviews 1 & 2  
|                                                                    | • Task 3 Project Part 2 - reflection assignment                                      |
| What self-regulated learning strategies can learners use when learning to become fluent with information technology? | • participant interviews 1 & 2  
|                                                                    | • participants’ planning notes for Task 1 Resource Development Activity              |
|                                                                    | • Task 3 Project Part 2 - reflection component                                       |
|                                                                    | • Task 3 Project Part 2 - concept map component                                      |
| What other factors may influence learners’ becoming fluent with information technology through self-regulated learning? | • participant interviews 1 & 2  
|                                                                    | • Task 3 Project Part 2 - reflection component                                      |

The first research question of “What aspects of FITness can learners develop in a self-regulated learning environment?” required analysis of data from the first and second interviews with participants, and their reflection assignments. The second research question was concerned with “What self-regulated learning strategies can learners use when learning to become fluent with information technology?” This required analysis of data from participant interviews 1 and 2, the participants’ planning notes for software skill assignments, their reflection assignments, and their concept map assignments. The final research question considered “What other factors may influence learners’ becoming fluent with information technology through self-regulated learning?”. Participant interviews 1 and 2, and their reflection assignments provided the data from which this question could be addressed.
Participant interviews

The first interviews with participants were conducted during Weeks 1-4 of semester while participants were undertaking the computer resource development activities. The second interviews were carried out during Weeks 12-13 of semester by which time participants had completed most of the learning experiences within the IT subject.

Participants were interviewed twice by the researcher in order to explore their experience of learning to develop FITness within a self-regulated learning environment. The interviews were conducted in a quiet office in the Faculty of Education building. The researcher contacted participants by phone, SMS and email to arrange a time convenient for each participant. The duration of interviews ranged between approximately 30 to 60 minutes.

Each interview was audio-recorded using digital and analogue recorders to ensure that data would not be lost if one device malfunctioned. During the interviews, the researcher took brief notes of important non-verbal cues (such as gestures or facial expressions) that may assist the data analysis. She added to these if necessary after each interview. The recordings were transcribed into a digital form that could be imported into the data analysis software (NVivo) for analysis.

Interview questions

The researcher designed questions that were used to guide the semi-structured interview process. These questions were directed towards eliciting responses from participants relevant to answering the research questions.

The construction of a list of interview questions is to ensure that each participant is asked similar questions and helps to ensure that the researcher is not distracted from the interview purpose. The timing of asking these questions in the interview varied according to the flow and content of the interview process with each participant. The semi-structured nature of the interviews enabled the process to be focused on the research task but flexible enough to accommodate variations in participants’ experiences and responses to the questions.
A framework for guiding interview question construction is presented by Patton (2002). This framework was used to ensure that the interview questions prompted description of actions taken by participants, expressions of their values and opinions, emotional responses and sensations about the relevant issues from participants’ experience. In addition, some of the questions were designed to collect relevant demographic information from students, such as, age, gender, experience with computers, computer access, computer type, and enrolment mode.

Interview questions were informed by constructs in Pintrich’s (2000b) SRL framework, but were adapted to the types of questions recommended by Patton (2002). Other questions were directed towards gathering information about particular aspects of FITness, such as participants’ adaptability to new technology and their future orientation to learning IT, and other factors that may influence their learning. The list of interview questions, their associated investigative focus, and the type of question, according to Patton’s (2002) question typology, each question reflects is provided in Appendix 14.

Participants’ assignments

Participants’ assignments submitted for assessment in the EDIT102 subject were examined in order to determine ways in which they demonstrated aspects of FITness and self-regulated learning. Different assignments contained different types of data required for analysis.

Participants’ resource development activities were assessed in class and were not saved. Instead, the researcher relied on the participants’ self-report during the interviews and the Subject Coordinator’s report of their success in those assignments. These reports were sufficient to confirm whether participants had achieved the required standard for the first level of FITness of being able to use current software. Participants’ notes related to their planning of the resource development activities were required to explore how participants approached the planning and goal setting for those assignments.

The concept map component of the Project assignment was examined specifically to identify how participants used this type of organisational strategy to illustrate their knowledge of the use of IT for their teaching roles. The researcher
was particularly interested in the level of thinking that participants demonstrated when using this strategy, and not the accuracy of their knowledge illustrated in the concept maps.

The reflection component of the Project assignment gave students the opportunity to consider how their knowledge, skills and attitudes relevant to their use of IT for teaching purposes had changed throughout the semester as a result of their learning experiences. This type of assignment also served to assist students to recognise their learning as a stimulus for considering their future professional development with IT. Analysing these assignments would provide some insights into participants’ learning experiences and their attitudes towards their professional development.

This study was concerned with the self-regulated learning strategies that participants used to develop their FITness. It was less concerned with the accuracy of participants’ knowledge about the use of IT for teaching. Therefore, assignments such as the development of teaching resources as part of the Task 3 Project or the software evaluation report, were not analysed specifically. Instead, these different types of assignments provided opportunities to explore within the interviews participants’ approaches to planning and self-monitoring of their learning.

The participants’ assignments were collected after they had been assessed. This helped to ensure that the research analysis did not interfere with the assessment process.

3.6 Data analysis

The purpose of data analysis, for the qualitative researcher, is to understand what the range of data reveal about the issues being investigated (Creswell, 2007; Denzin & Lincoln, 2005; Patton, 2002; Silverman, 2005). Making sense of the information within the data necessitates a systematic approach to the analysis process. This researcher needed to develop ways to organise the data from different sources, examine the data for patterns and themes, and interpret the data to generate meaning. This data analysis process is made explicit so that the reader is able to judge the trustworthiness of the research findings.
While the stages of data analysis may appear to be sequential, the reality of qualitative data analysis reflects an iterative process. Preliminary analysis often occurs during the data collection phase as the researcher notes ideas of interest that arise that may influence some aspects of the categorization and coding, or interpretation and meaning making. Similarly, ideas identified in the researcher’s notes or emerging themes may prompt the researcher to seek more information about that idea in the next round of data collection or analysis. The iterative nature of data collection and analysis helps to ensure that the approach to data collection and analysis is comprehensive (Creswell, 2007).

Qualitative research findings are presented, generally, in three phases: exposition/description, interpretation, and explanation (Creswell, 2007; Merriam, 1998). The findings of this study, from the data analysis, are presented in two chapters. The first expository level of analysis is presented in the next chapter, Findings. The interpretive and explanatory levels of data analysis are presented in the last chapter, Discussion and Conclusion.

Visual tools to display research findings are recommended by Miles and Huberman (1994) as a way to make those findings accessible for the reader. These tools may include tables that summarise or provide an overview of the findings, where appropriate, before the findings are described in more detail. This researcher, therefore, will utilize tables as visual tools to enhance reader comprehension of the findings.

### 3.6.1 Data preparation

The data collected from a range of sources were organised and prepared for analysis. The digital audio recordings of the interviews were transcribed. The audio and text transcription files were stored electronically on CDROM. Photocopies of student reflection assignments were collected and scanned using optical character reading (OCR) software. Field notes were transcribed and stored with the other documents in electronic format. All electronically formatted documents were saved as rich text files (.rtf) so that they could be imported into the data analysis software.

Non-text documents, such as the student concept maps, could not be imported directly into the data analysis software. These were stored in a paper folder for later
analysis. The researcher’s analysis notes about these documents were then saved in rich text file format for importing into the data analysis software.

**NVivo software**

Textually based data were analysed using NVivo software. NVivo is a qualitative data analysis tool that enables text, such as interview transcripts, researcher notes, or document text, to be imported and explored for coding. Both a priori codes and emerging thematic codes may be added throughout the analysis process. Researcher notes about particular segments of text data may be added as memos and linked to those text segments to which they refer (Bazeley & Richards, 2000; Gibbs, 2002).

Non-text documents, such as student concept maps, cannot be imported directly into NVivo. Researcher notes about the concept maps, however, were imported for analysis.

NVivo includes the ability to attach attributes, such as gender, age or course, to the text documents; to search text documents for words or phrases; as well as enabling the researcher to explore the intersection of codes and document attributes. Documents may be coded individually and as batches. These functions enable the researcher to explore emerging themes and to search for confirming and dissenting instances that may assist the researcher develop a better understanding of the issues. The modelling function of NVivo assists the researcher to develop a conceptual model of the relationships between the codes that can then be tested using interrogative functions of the software (Bazeley & Richards, 2000; Gibbs, 2002).

### 3.6.2 Coding

This section describes the processes used to code the interview data and the student assignments.

**Interview data analysis**

Analysis of interviews with participants was undertaken in three phases: reading and memoing; issue identification and categorisation (coding); and interpretation. The researcher began the analysis process by reading through several
of the interview transcripts and making notes about them in order to develop a “feel” for the data. These notes then assisted the researcher to identify relevant issues and develop coding categories.

The research questions provided the primary coding categories into which interview segments could be grouped for further analysis. The three primary code categories included Fluency with information technology, Self-regulated learning, and Other factors. A set of a priori codes (Marshall & Rossman, 2006) were developed from the research questions, and the literature on FITness and self-regulated learning. These a priori codes helped to provide the framework for initial data analysis. Additional emerging thematic codes were added as they became apparent from data analysis (Creswell, 2007). Consequently, the hierarchically subsumptive coding structure for the interviews included one to four sub-categories for each primary coding category.

Interview data analysis codes relevant to the first research question included:
Fluency with information technology

- skills with technology
- adaptability to new technology
- technical problem-solving
  - problem clarification
    - ask another
  - problem solution identification and implementation
    - solve by self
      - active engagement
      - passively deal with problem
    - solve with/ask help from others
    - avoid
    - influencing factors and attitudes
      - figure it out by myself
• fear of crashing/breaking computer
• self-image of non-computer whiz
• time-consuming

  o solution testing
    ▪ “does it work”

• orientation to future IT development
  o recognised their need for future development
  o participant-identified resources for future development
    ▪ school
    ▪ own willingness to learn
    ▪ other people
  o obstacles
    ▪ teacher colleague as role model
    ▪ IT available in the school.

Data codes used to analyse interviews in order to address the second research question included:
Self-regulated learning

• planning and monitoring
  o used planning resources provided
    ▪ general planning checklist
    ▪ resource development criteria rubric
    ▪ educational software evaluation checklist
  o did not use planning resources provided
    ▪ web design matrix table
  o reasons for using planning resources
    ▪ give assessors “what they want”
- clarify outcomes & set learning goals
- work towards grade achievement
- check progress
- identify relevant issues
- save time

- cognition
  - rehearsal strategies
    - methods of exploring the software for understanding the technology
    - non-specific ‘play around’
    - prefer to be shown
    - keep notes on procedure steps
    - repetition
  - elaboration strategies
    - experimentation with specific functions or tasks
    - discus with others
    - relate to prior experience
    - use help file
    - pose questions
  - organisational strategy
    - mental map.

Interview data analysis codes relevant to the third research question included:

Other factors

- prior IT experience
  - office / productivity software
  - internet
- other
- formal prior learning
  - used at school, university or work
  - years of experience
- computer platform familiarity
- attitudes to information technology
  - anxiety
  - interest
- computer self-efficacy
- motivation
  - extrinsic
    - assessment deadlines
    - needing to use IT for teaching
  - intrinsic
    - needing to use IT for teaching
    - desire to “learn something new”
    - satisfaction with achievement
    - personal interest
- self-image
  - as learner
  - as IT user
- intellectual challenge
- extracurricular activities
  - paid employment
  - sporting activities
  - social activities.
Each interview was read and significant sections coded to the relevant category. Patterns in the data were determined by comparing recurring similarities as well as differences or negative cases (Merriam, 1998; Miles & Huberman, 1994). Reading and coding continued until mutually exclusive codes were achieved.

The iterative analysis process enabled emerging thematic codes to be organised and integrated into the framework appropriately. Finally, the researcher interpreted the patterns that the data revealed. These interpretations enabled the researcher to create meaningful explanations of the findings in relation to the research questions.

Two types of participant assignments were analysed. These included the reflection assignments and concept map assignments.

**Reflection assignment data analysis**

The initial curriculum design revision intended that all students in the IT subject, regardless of their primary course of Early Childhood or Physical Education, would complete identical assignments. However, the researcher found that the academic team member who was responsible for the teaching of IT for the Early Childhood stream, had changed the assignment focus of the reflection assignment. Consequently, the Early Childhood and Physical Education student groups completed different types of reflection and concept map assignments. The reflection assignment instructions are included in Appendix 8.

The Physical Education student group were asked to write a 600 hundred word reflection about their changing confidence and skill level in using IT in the classroom as a result of undertaking the IT subject, and to identify the learning resources and strategies they used that contributed to their learning. Students were also asked to consider approaches they might use in future to continue their development in this field.

The researcher anticipated that this reflection assignment would assist students to recognise their own improvement in their confidence, knowledge and skills in using IT for teaching and learning. This part of their reflection might reveal
information relevant to understanding the role of student computer self-efficacy and skill development in their learning.

Students’ articulation of their learning might also help them to identify learning resources and strategies that may have contributed to their learning. This aspect of the reflection was relevant to understanding students’ use of self-regulated learning strategies.

The third part of the reflection was concerned with ways in which students considered they might approach their future development of their skills in using IT for teaching. This part of the reflection assignment was relevant to understanding a key component of FITness, that is, of a future-oriented focus on their professional development.

The reflection assignment for the Early Childhood group of students differed from the above assignment in a few ways. The word limit of the reflection assignment was reduced from 600 words to 500 words. This might have reduced the opportunity for students to convey their learning adequately. There were only two parts, instead of three, to the reflection assignment for the EC students. EC students, therefore, did not have the opportunity to clarify their future-oriented FITness attributes within this assignment. The researcher sought to address this problem by asking participants, during the interviews, about their future-orientation to learning IT.

The first part of the reflection assignment was focused on the students’ experience of the group work within the subject, in terms of group member responsibilities and contributions. This part of the reflection, therefore, was not appropriate to exploring issues about student computer self-efficacy and skill development. It did, however, provide an opportunity to examine issues related to participants’ learning with peers.

The second part of the reflection for the EC group was concerned with how the project work (Task 3) had contributed to students’ learning about the ways in which IT could be utilized in classroom teaching and learning. This part of the reflection may have provided opportunities for the researcher to develop an understanding of issues associated with the relevance of content and learning
methods to real-world practice. The method of analysing the reflections and the concept maps are described below.

The researcher’s analysis of the reflection assignments explored the responses participants gave to each of the reflection questions, as well as the types of reflective responses they demonstrated. The researcher applied the categories of reflective types identified by Hatton and Smith (1995) to the analysis of the reflection assignments. These categories illustrate increasing complexity of reflective thought as learners attempt to explicate their learning. The categories included (Hatton & Smith, 1995, p. 48-49):

- descriptive writing which merely describes events without any rationale
- descriptive reflection which may provide some limited reasoning for events described
- dialogic reflection which is more analytical as learners engage in self-talk about possible reasons for events and employ their judgement in identifying alternatives
- critical reflection in which learners recognise the context of the action and consider any influence of contextual factors on the events.

**Concept map data analysis**

The concept map part of the final assignment provided an opportunity for students to utilize a conceptual organisational resource to illustrate their understanding of what they had learnt about using IT for their teaching. Concept maps are recognised (Deshler, 1990; Novak, 1998; Novak & Gowin, 1984; Shavelson, Lang, & Lewin, 1993; Tergan, 2005) as a tool to assist learners to demonstrate their cognitive framework that reflects the integration of their prior knowledge with their new understanding. This section describes the concept mapping tasks in the learning intervention and the methods used to analyse them.

The PE and EC student groups completed different types of concept map assignments. The concept map assignment task required students to:

- “integrate and interconnect the multiple ways that you can use ICT in your study and work” (Early Childhood students).
• “highlight the points made in each of the teaching roles described in Week 2”
  (Physical Education students)

  [source: Task 3 assignment sheets for EC & PE from WebCT site, see Appendix 8]

  In tutorial classes, lecturers and tutors introduced students to the features of concept maps and concept mapping software. This introduction was brief and lasted about 10-15 minutes. Resource materials for using concept mapping software were provided on the subject’s WebCT site. This assignment task suggested that students use “Smart Ideas”, “Inspiration” or other software to create the concept map. This software was available on the computers in the computer laboratories.

  The participants’ concept maps were analysed using two different methods. One approach examined each concept map’s ability to demonstrate understanding through the structural features of the map. The second method explored how participants’ language in their maps conveyed their “approach to learning”.

  A concept map is a cognitive organisational tool to help learners clarify their understanding and make that understanding explicit through the arrangement of concepts and their relationships. This tool is a symbolic one that represents concepts as nodes with labelled connecting lines between the nodes to signify the relationship between those concepts. Concept maps reflect the basic tenet of cognitive psychology that “the essence of knowledge is structure” (Anderson, 1984, p.5).

  Novak and Gowin (1984, p.15) claim that “concept maps are intended to represent meaningful relationships between concepts in the form of propositions. Propositions are two or more concept labels linked by words in a semantic unit”. Essentially, this means that concepts are labelled and their interrelationships identified by connecting lines containing meaningful key words or short phrases. The concept map, therefore, consists of linear propositions of concept-link-concept. Complex understanding may be conveyed by the ways in which multiple propositions are organised and interrelated (Ruiz-Primo, 2004).

  This study adopted the Novak and Gowin (1984) method of concept map scoring because Shavelson, Lang and Lewin (1993, p10) report that this method
“provided the most comprehensive scoring system”. Each of the participants’ maps were scored in the following way (Novak & Gowin, 1984):

- 1 point was awarded for every meaningful proposition
- 5 points were awarded for every hierarchical link where the sub-concept was less inclusive than the parent concept
- 10 points were awarded to each cross-link that was both significant and valid
- 2 points were awarded for each cross-link that was valid but did not demonstrate synthesis
- 1 point was awarded for every example that was listed in a separate node.

The content of the participant concept maps were also analysed to investigate the participants’ “approach to learning” that the maps signified. Learners adopt strategies, methods and tools to enable them to develop their understanding. Learners’ choice of cognitive learning strategies is influenced by their “approach to learning”. Entwistle (1998) posited two approaches to learning: a surface approach to learning and a deep approach to learning. Surface learning is characterised by the learner’s intention to gain the minimal set of knowledge or competencies required to pass assessment (Chin & Brown, 2000). In contrast, learners who adopt a deep approach to learning have a primary intention to understand. Deep learners are more likely to look for connections between new knowledge and their previous understanding and experience. They seek to integrate the new knowledge into their existing conceptual structure. In this way, deep learners try to link the unfamiliar to the familiar.

A learner’s approach to learning, however, is not immutable (Prosser & Trigwell, 1999). It is influenced by such personal factors as an individual’s motivation for learning, interest in the content and perception of the learning task (Prosser & Trigwell, 1999). Students who are learning knowledge and skills for using IT in their teaching may be expected to utilize a range of cognitive learning strategies that reflect their approach to learning this content. Therefore, this investigator expected that deep and surface approaches to learning would be reflected in the use of words in the content of participants’ concept maps as they sought to provide evidence of their understanding.
The content of participants’ concept maps that reflected a surface approach to learning were likely to demonstrate the following characteristics:

- reproducing or paraphrasing of lecture notes terms
- negligible use of additional and/or original concepts
- listing few concepts.

On the other hand, the content of participants’ concept maps that reflected a deep approach to learning were likely to show an attempt to understand through:

- including more concepts
- using novel concepts and words
- elaborating on terms
- explaining ideas
- providing examples.

The concept maps were analysed through two different methods. This helped to provide a comprehensive approach to the researcher’s seeking to understand what the participants’ concept map assignments revealed about how they used a cognitive organisational learning strategy.

3.7 Methodological issues

The methodological dependability of qualitative educational research relies on three important issues: trustworthiness, generalizability and ethical considerations. This section, therefore, will explain how these issues have been addressed in this study.

3.7.1 Trustworthiness

Lincoln and Guba (1985) use the terms “trustworthiness” or “truth value” to refer to issues of validity and reliability in qualitative research. This is to avoid misunderstanding of the qualitative research process and findings by applying quantitative standards of validity and reliability inappropriately.
“Intellectual rigor” and “methodological competence” provide the foundation for the credibility of a qualitative research study, according to Patton (2002, p.570). Similarly, Merriam (1998) and Miles and Huberman (1994) claim that thick description (Geertz, 1973) of the data and analysis methods aid in the transparency of linking the study findings to the original data.

The trustworthiness of the data in this qualitative study was ensured by making explicit the data collection and analysis methods and processes, and providing thick description of the data. This provides opportunities for readers to judge how well the researcher’s interpretations are founded on the data.

Data collected from different sources, such as interviews and different types of student assignments, enhanced the trustworthiness of the study because it helped to identify what participants actually did as well as what they say they did. Comparison of data from multiple sources also assists to add depth to our understanding of the issues under investigation by seeking evidence that corroborates or contradicts initial insights. This triangulation of analysis of data sources helps to ensure that the analysis is comprehensive and identifies all features relevant to understanding the issue (Patton, 2002).

Qualitative research does not seek to generalise its findings to a broader population, which is an important factor of reliability in quantitative research. Instead, qualitative research endeavours to analyse appropriately the data collected from its particular set of participants. All methodological processes of qualitative research must be made explicit and their relationships explained. This research study clarifies explicitly each methodological phase, from design and data collection to analysis, in order to ensure its methodological trustworthiness.

3.7.2 Generalizability

Generalizability of research findings to other contexts is an issue that is fundamental to quantitative research, and of increasing importance in qualitative research. The empirical or quantitative research paradigm, through a range of sampling and methodological processes, emphasises the finding of propositions or laws about a phenomenon that are applicable across contexts and time. This paradigm, therefore, seeks to make nomothetic generalisations. However,
discussion of the nature of the research paradigms earlier in this chapter explained that making nomothetic generalisations, or predictive laws, is not the goal of, nor useful for, qualitative research (Schofield, 2000).

The issue of generalizability in qualitative research has often been ignored or rejected, according to Schofield (2000). Yet generalizability is becoming more important in qualitative research, in general, and in educational research, in particular, as educational researchers and educators seek to apply research findings to their own contexts.

Instead of using the term “generalizability”, with its quantitative research associations, other terms are used. Stake (1978/2000) discussed how the tacit knowledge that individuals develop from their experience enables them to make comparisons between contexts when assessing how suitable educational research findings may be to their own context. He called this “naturalistic generalizations” (Stake, 1978/2000). Similarly, Lincoln and Guba (2000) discussed “transferability”, where educators examine the congruence between the research context and their own contexts; thus creating their own contextual “working hypothesis”. Goetz and LeCompte (1984) stress the “translatability” of research to other contexts by researchers clarifying their theoretical position and making explicit their research techniques.

The responsibility for making naturalistic generalisations or assessing transferability rests with the user of qualitative research, according to Lincoln and Guba (2000) and Stake (1978/2000). Conversely, translatability places the responsibility on the researcher to provide sufficient information for the users of qualitative educational research to be able to understand and make contextual comparisons before applying research findings to their own contexts.

This researcher’s use of a qualitative case study is not attempting to create nomothetic generalisation. Instead, this researcher provides thick description of the research processes and outcomes so that potential users of this research will be able to use this information, as well as their own educational experiential knowledge, when considering the transferability and translatability of this research to their own
contexts. This researcher aims to provide general relevance of the study to other similar contexts through theoretical inference.

### 3.7.3 Ethical considerations

The data collection plan was submitted to the Research Ethics Committee of the University of Wollongong. Written approval from the Research Ethics Committee was obtained before data collection commenced (Appendix 1).

The opportunity to participate in this research was offered to all students enrolled in EDIT102. Students who volunteered to participate were asked to complete a consent form indicating their willingness to participate in the research. Their participation in the research was voluntary, but they had the opportunity to withdraw their participation at any time. Students’ participation or assessment results in EDIT102 were unaffected by their withdrawal or refusal to participate in the research project.

The researcher ensured confidentiality of collected data by not sharing the data with anyone beyond the research team (that is, the researcher and her supervisors). In addition, each participant was allocated a pseudonym, so that participants’ real names were not used during the data analysis. The curriculum teaching team did not have access to the data collected from the qualitative processes. In this way, grading of students’ formal assessment was unaffected by information in the interviews or other data analysis.

The findings of the analysis of the data gathered from those who agreed to participate in this study is presented in the next chapter.
Chapter 4: Findings

This chapter presents the findings of the study from analysis of multiple data sources, including interviews with participants at the beginning and end of the semester, and the concept map and reflection components of the Task 3 Project. The chapter is divided into several sections relevant to the research questions. The first section presents findings associated with participants’ development of fluency with information technology, particularly related to participants’ development of their skills with contemporary IT, their approach to dealing with common IT problems, and consideration of their future IT development. The second section presents findings regarding participants’ use of self-regulated learning strategies, particularly focused on planning and cognitive strategies, that they used in their learning to become fluent with IT. The final section presents findings related to other factors that may influence the interpretation of the findings of the first two sections such as participants’ prior IT experience, attitudes to information technology, computer self-efficacy, extrinsic and intrinsic motivational factors, self-image, intellectual challenge of learning to use IT, computer platform familiarity, and extracurricular activities. A summary of findings is provided at the end of each section.

4.1 Study participants

Ten of the participants were in their first year of study. One was in his second year, and another in his third year of study. Eight participants were undertaking the Bachelor of Physical and Health Education. Two participants were enrolled in the Early Childhood course, and two in the Primary course. Participants’ ages ranged from 19 to 31 years. Table 4-1 lists the participants, their age, commencement year and course. Pseudonyms are used instead of real names.
Table 4-1: Research participants

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Course</th>
<th>Year started</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ann</td>
<td>20</td>
<td>Early Childhood</td>
<td>2004</td>
</tr>
<tr>
<td>Brian</td>
<td>21</td>
<td>Primary</td>
<td>2002</td>
</tr>
<tr>
<td>Carol</td>
<td>20</td>
<td>Early Childhood</td>
<td>2004</td>
</tr>
<tr>
<td>Debbie</td>
<td>19</td>
<td>Physical and Health Education</td>
<td>2004</td>
</tr>
<tr>
<td>Eric</td>
<td>21</td>
<td>Physical and Health Education</td>
<td>2004</td>
</tr>
<tr>
<td>Fran</td>
<td>18</td>
<td>Physical and Health Education</td>
<td>2004</td>
</tr>
<tr>
<td>Gemma</td>
<td>20</td>
<td>Physical and Health Education</td>
<td>2004</td>
</tr>
<tr>
<td>Hilda</td>
<td>24</td>
<td>Physical and Health Education</td>
<td>2004</td>
</tr>
<tr>
<td>Isabel</td>
<td>23</td>
<td>Physical and Health Education</td>
<td>2004</td>
</tr>
<tr>
<td>Jenny</td>
<td>24</td>
<td>Physical and Health Education</td>
<td>2004</td>
</tr>
<tr>
<td>Kevin</td>
<td>24</td>
<td>Physical and Health Education</td>
<td>2004</td>
</tr>
<tr>
<td>Luke</td>
<td>31</td>
<td>Primary</td>
<td>2003</td>
</tr>
</tbody>
</table>

The next section presents the findings concerned with issues related to participants’ development of fluency with information technology (FITness).

### 4.2 Fluency with information technology

This section examines issues associated with participants’ development of characteristics of fluency with information technology (FITness). FITness within this context consists of skills with contemporary software and hardware, and the intellectual capabilities of problem solving, and future-oriented learning for ongoing professional development. Data from participant interviews and their reflection assignments were examined to identify issues relevant to understanding participants’ development of FITness.
4.2.1 Skills with contemporary IT

A fundamental component of FITness is proficiency with current IT that is being used in the real world contexts, in this case, schools. Students in the IT subject were introduced to a range of software with which to develop their own teaching/learning resources and to evaluate commercially available educational software and websites. They also used computer platforms and additional technologies that are currently used in NSW schools. Students needed to develop satisfactory skills with both the software and hardware to be considered to have developed this skills with contemporary IT part of FITness.

All participants reported, during their interviews, at least one of their marks for the resource development activities or their educational software evaluation class presentation assignment. The marks participants reported were mostly high, either 8 or 9 out of a possible 10 marks. Eric reported getting a mark of 7 for his spreadsheet assignment, and Ann reported achieving a 7 for her website assignment. Brian, Carol, Debbie, Kevin and Luke did not list their result for each assignment. Instead, they conveyed their satisfaction with their results. For example, Luke said “I got I think nine for all of them as well or something close to that anyway”, while Debbie said “I was happy with mine… I didn’t expect to do so well I guess”. The subject coordinator confirmed that all study participants achieved at least a Pass grade on their software skill assignments and the assignment concerned with evaluating educational software.

The software that participants learnt to use were common programs used in schools, such as PowerPoint presentation software, Excel spreadsheet, AppleWorks database, and Mozilla composer for web page design. The subject co-ordinator of EDIT102 reported that all participants successfully learnt to use these programs by achieving at least a Pass grade on the software skill assignments. Consequently, participants demonstrated that they were able to develop the contemporary skills component of FITness.
4.2.2 Problem solving

In order to explore how students dealt with the problems that they were likely to encounter in using IT, the researcher asked participants the following question: “What do you do when you encounter a technical problem with the technology you use?” Some participants answered the question in relation to a particular problem that they had encountered during the semester, either with developing a technical skill or with dealing with a technical fault. Other participants were unsure of the meaning of the question and asked for an example to illustrate. A common problem that IT users encounter is a problem with printing, so the researcher generally gave this example to which participants could relate their problem-solving methods.

Participants did not address how they identified the nature of the problem they encountered. Nor did they address, specifically, how they determined that their solution attended to the original problem. Participants focussed their discussion on the types of solutions they implemented to deal with the problems they encountered. The solutions that participants identified when they tried to solve problems by themselves may be categorised as those of active engagement with the solution-finding, and those that addressed the problem passively.

Ten participants reported that they would “fiddle” about, “press buttons”, “play” around with the computer or search the menus for a possible solution to their problem. Seven of the participants claimed that they would use available resources to help them find a problem solution. Three participants took a systematic approach to the problem-solving by considering the most simple solutions first and working towards more complex solutions.

Seven participants used a passive approach to their problem-solving by turning off the device, such a computer, and returning to it later (5 participants) or seeking alternative technology to use (2 participants).

Seeking assistance from other people was identified by all the participants as an appropriate solution strategy. However, such help-seeking usually occurred after participants had exhausted their own solutions. Only two participants sought to
avoid dealing with IT problems that they felt were beyond their interest or capability.

The need to “figure it out” by themselves was the most influential factor that participants reported that influenced their solution seeking (6 participants). Other factors that impeded participants’ solution seeking was their fear of damaging the computer (4 participants), their self-image as not being a “computer whiz” (1 participant), or the view that problem-solving was time consuming (2 participants). Table 4.2 identifies the methods and issues reported by participants in how they dealt with problems they encountered, or may encounter, as they work with information technology.
Table 4-2: Participants’ methods and issues in dealing with computer problems

<table>
<thead>
<tr>
<th>Name</th>
<th>Ann</th>
<th>Brian</th>
<th>Carol</th>
<th>Debbie</th>
<th>Fran</th>
<th>Eric</th>
<th>Gemma</th>
<th>Helen</th>
<th>Isabel</th>
<th>Jenny</th>
<th>Kevin</th>
<th>Luke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem-solving (ps) method or issue</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>solve by self</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>o active engagement in ps process</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>▪ fiddle/press buttons/play/search menus</td>
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<tr>
<td>▪ use help resources</td>
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<td>▪ simple to complex/specific/systematic</td>
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<td>o passively deal with problem</td>
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<tr>
<td>▪ turn off/come back later</td>
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<td>o figure it out by myself</td>
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<td>o fear of crashing/breaking computer</td>
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<td>o self-image as non-computer whiz</td>
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✓ = reported as used by participant,  × = reported as not used by participant

The data represented in the table above suggest that there may be a link between the attitudes of participants about themselves as technology users and their choice of problem-solving methods. Participants’ methods and related issues in dealing with technical problem-solving are explored in more detail in the following sections.
4.2.2.1 Problem identification

Dealing with problems encountered in normal use of IT demonstrates the sustained reasoning required of FITness. This reasoning commences with identifying and clarifying the nature of the problem so that action may be taken to address the problem.

Ann and Brian were the only participants who described how they would initiate clarification of the nature of the problem they encountered. Ann said that her first response would be to “ring one of my friends and ask why it’s not working”. Ann, therefore, relied on another person to identify the problem for her. Ann’s further actions in relation to the problem were concerned with implementing problem solutions.

Brian, on the other hand, said that he sought to distinguish whether the problem was one that he could manage to deal with or if it was concerned with the computer’s inner hardware. Brian affirmed that “with any problem I’d have a go first, unless it was internal”. Brian said that he considered “internal” problems were those that required removal of the external casing and working on the electronic components of the computer or other technology. Thereafter, Brian’s comments were focused on the types of actions he would take to achieve a solution to the problem.

Participants may have interpreted the phrasing of the researcher’s initial question, with its action orientation, to be concerned with their actions in applying their problem solutions, rather than on all of their problem-solving activities, both mental and manual. Indeed, many participant responses to the question were centred on describing the solutions that they adopted to deal with either a problem they encountered or a problem posed by the researcher. These actions are addressed in the next section.

4.2.2.2 Problem solution identification and implementation

The sustained reasoning of the intellectual capabilities component of FITness continues through identifying and implementing possible solutions to the initial problem. Participant responses to interview questions about their IT problem-
solving included descriptions of actions they took in finding solutions, and other issues they reported that influenced their approach to solving their IT problems. All of the participants reported that they tried in some way to solve the problem by themselves. Ten of the participants, that is, all except Jenny and Kevin, reported that they attempted to “fiddle” or “play” or “press buttons” or search the menus as they sought to find a solution to the apparent problem. For example, Debbie said that “I just fiddle around until it works”; Helen said “Hopefully I can just play around with them for myself and figure something out which is generally what I usually do”; and Gemma said that “I think the first thing I do is sort of try and solve it myself so I sort of fiddle around, press buttons or whatever”.

While this reflects some active engagement in the problem-solving process, it is a low-order method because it relies on learners encountering the solution by chance rather than purpose. Similarly, participants’ inability to articulate the specific purpose of their “fiddle around” actions suggests a lack of awareness of their own thinking processes.

Seven participants (Brian, Carol, Debbie, Gemma, Isabel, Jenny and Kevin) reported using other resources, such as help files, instruction manuals, or other resources on the subject’s WebCT site, to aid their finding a solution to problems they encountered. Their approach to using these resources ranged from reluctant or minimal use, to employing them as valuable tools in their problem-solving quest.

Gemma said that she was prepared to use help resources that were written in plain language that she could understand, because she said that she did not “actually understand the terminology what they’re using. But if the instructions are basic and I can understand it then I think I’d be ok.”

Isabel said that she used the balloon help features often available in software by “reading what the pop-ups are”. However she said that she preferred “definitely trial and error… read every little selection, drop down, click here, that type of thing… the answers are there for you so in understanding where it belongs, where it goes, how to put it there”.

Jenny reported, in her second interview, that she was prepared to use “the help function in typing what I want to try and do”. This contrasted with her initial
interview where she insisted that she would “ask for help” from her husband or classmate “because I think that I’m not a computer whiz, I’m not really able to delve into that sort of thing”. This change may reflect the effect of her growing IT confidence on her willingness to attempt solving IT problems on her own.

Debbie, on the other hand, reported that she was prepared to use help resources when she encountered a problem such as connecting or using new technology. She said that “I’d probably have a vague flick through the instructions, nothing in depth, and then I’d have a go at it and if it doesn’t work then I’d read the instructions a bit more in depth”. However, when faced with, for example, a printing problem, Debbie said that “I just fiddle around until it works. If it doesn’t, I try and get help”.

Carol reported that she would utilize the help resources after she had tried to solve the problem by herself. She said that she would “Play around with it and see if I can get past it myself or use the help menu… (and) have a look at the manual and see what it says”.

In contrast with most of the participants’ approach to using the help resources in the later stages of their problem-solving process, Kevin and Brian both reported that they read the help resources before initiating any other problem-solving action. Kevin said that he would “firstly read how to do it… and then I just basically just follow the prompts”. Similarly, Brian said that he would go “straight to the instructions first now because they’re usually friendly and fail safe”.

Ann and Fran, however, reported that they would not use help resources. Ann said “I don’t find help files on computers helpful though. It’s not exactly what you’re looking for, they never have exactly what you want.” Nor did she actively pursue the resources files on the subject’s WebCT site because she said that “well they (academic staff) never told us that” the resources were available. Similarly, when Fran was asked about her use of help resources such as help menus or manuals, she said “I don’t do that”. She said that she preferred to ask someone for assistance and that she would “look at manuals with software but only if I have to”.

Brian, Helen and Kevin attempted to approach their problem-solving in a systematic manner. They described their methods of trying to deal with basic
problems that they could manage with their level of expertise, followed by help seeking that took them further away from their own solutions.

For example, Brian said that he would:

start with the most simple thing first so for example the printer, make sure it’s been plugged in properly… If it gets more complicated, go to the help menu, if it doesn’t work if I have a written manual I’ll go to that, then start asking other people if they’re there for support, what can they do.

Helen described how her problem-solving actions started from what she knew of basic solutions to the need to generate other solutions. She said that “so I can only fix what I’d know from it which maybe the paper, the ink and that’s about all I can really, as far as I know, that could be wrong … So I just try to come up with another solution basically.”

Kevin, too, reported his approach to solving IT problems by starting with simple solutions and then seeking assistance from help resources or other people. He said that:

Well just say that your modem doesn’t connect you look at things like, have I installed it properly, if not you go and check it, there might be a power problem, make sure all the lights are on and you really, really just try to work the problem out. If you have to you go back to the book and if everything doesn’t work out make a list of what’s happened and go and see someone. I love problem solving so to answer that question, it’s very easy for me to do.

Participants also used more passive methods of dealing with problems that they encountered. These solutions may be considered passive because the participants’ actions do not address the problem directly. The two passive solution actions identified by the participants include switching off the computer and coming back to it later, and finding an alternative device, such as another printer or computer. Five participants (Brian, Debbie, Fran, Jenny and Luke) reported that they would shut down the computer and return to it at a later time if their problem solving efforts were unsuccessful. Brian, Eric and Helen claimed that they would find alternative equipment if they could not solve the problem.

For example, Debbie reported that she switched off the computer when she was unable to solve the problem. She said “I got a bit frustrated so I turned it off
and I go back later and try and do it again.” Similarly, Fran said “If sometimes I have trouble connecting to the Internet so I go away and make sure the phone is in the wall… or you just turn the computer off and start again.”

Luke described how his uncertainty about the nature of the problem was sufficient to cause him to shut down the computer. He said “my computer was freaking out on me last night so I ended up turning it off and going to watch TV for 20 minutes and came back to it sort of thing… It freaked me out and I had to turn it off.”

Jenny, too, reported her use of the switch-off method when her other problem-solving failed to achieve the result she wanted. She said “Well I try as best as I can to use all these methods that I’ve learnt over the years of thinking what it could be then if it doesn’t work I turn it all off.”

Brian, however, was the only participant who expressed his rationale for his use of the “turn it off” method. Whilst he said that he did not understand the technical reasons why this method worked, he had observed from his experience that “I find that a lot of computers, if you do turn them off and leave them for like two hours, they’ll fix themselves. I don’t know why or how it works.”

Another method that participants used, that may be considered passive because it did not deal with the problem directly, was to find alternative equipment. This alternative usually meant, for Brian and Helen, finding another printer to use, either on campus or to connect to the current computer. Both Brian and Helen claimed that they resorted to finding alternative equipment after they had tried unsuccessfully to fix the problem on their own. Brian said “And then if I really can’t do it, try and find a way around it whether if it’s my computer at home and it’s having problems save it until I can bring it to uni.” While Helen said that “at home when my printer doesn’t work, I’ve actually got two printers so I’ve got a back-up because quite often my printer doesn’t work so then I go and plug the other one in and usually that works.”

In contrast, when Eric described his actions with dealing with a computer problem in the classroom, his alternative solution was to complete the lesson without using the technology. He said that “there’d be certain things I could check
for but once I got past that I would not have a clue so I’d have to quit that and then start something else… Stop it and go to a back-up plan straight away and then complete that lesson.” However, Eric did not identify what those “certain things” were that he would check.

All of the participants reported that would seek help from other people when their own efforts proved unsuccessful. They described how they sought help usually after they had tried to solve the problem on their own. The people from whom the participants usually sought help were those most accessible at the time, such as family and friends, fellow students or the IT support staff in the computer laboratory. For example, Fran said “I’d probably ask my dad or someone”, while Ann said that “I just try to figure my own way out of it and if I can’t and it’s stressing me out, go and see the IT people”.

Ann’s comment also illustrates how participants’ emotional states prevented them from pursuing more problem solving on their own and prompted their help seeking. This was reflected by Carol who reported that “if I couldn’t get it to work, I just got too frustrated, I’d see if I could find someone who knew what to do.”

Others participants, such as Brian and Kevin, sought help from others as a last resort. For example, Brian said that “if I had the time and the resources I’d try and fix it, fix it myself or find out how to fix it and then take the appropriate means or ask someone else, I’d get in an expert.” Similarly, Kevin said “I’d exhaust every avenue that I know personally, how to get a file back, I’d do everything that I could possibly do and if all that failed I’d probably go to an IT person but firstly I’d exhaust every avenue I know.”

Isabel claimed that she was content to solve problems associated with using the software on the computer. She was firm, however, that she would not attempt to address hardware problems. She said:

If they went wrong, that’s when I don’t want to deal with them. Setting it up, that’s when I don’t want to deal with it, but yes getting my way around absolutely, I’d learn about it… for now I’m completely happy to be ignorant of it all and just have it already set up for me.

Participants also reported issues that influenced their problem-solving actions. Brian, Carol, Debbie, Gemma, Kevin and Luke all reported that it was important to
them to at least try to “figure it out” by themselves. Brian typified this type of response concerned with enhancing ones learning through problem-solving when he said that “Generally I try and work it out for myself because I think if I’ve done that then I’m more likely to learn it rather than if someone else just tells me how to do it and it might go straight in and straight out (of my mind).”

The benefit of problem-solving for Carol, on the other hand, was the satisfaction she experienced. She said that “I like the feeling when you achieve something and you figure it out for yourself and you haven’t had to ask anyone and that sort of thing.”

Kevin, too, emphasised that “I think you’ve really got to learn to try and work things out and if all else fails seek help.” However, another motivating factor for him was fear of being seen as intellectually lazy. He said that “I wouldn’t ask first because it could be something so simple and I’d feel like a goose if you go back without using your own brain, without think for yourself in trying to find it.”

On the other hand, Ann, Fran, Isabel and Luke said that their fear of crashing or breaking the computer inhibited their problem-solving efforts. This is exemplified by Luke’s comment: “I try to figure it out for myself first and if I can’t I don’t want to get too involved, I don’t want to crash my computer so I usually ring dad.”

Similarly, Jenny’s view of herself as “not a computer whiz” resulted in her not pursuing more than superficial problem-solving. She said that “I’m not really able to delve into that sort of thing.”

Eric and Isabel both reported that they were not prepared to devote the time to solving problems that might arise that they were unable to resolve immediately. Whilst Isabel’s time issues were primarily in relation to dealing with hardware problems, Eric said that he was not prepared to spend much time with solving problems associated with either hardware or software. These participants were also the only two who claimed that they would avoid solving difficult problems. This suggests that perhaps their decision to avoid more complex problems may be linked to their unwillingness to spend time on solving those problems.
Identifying and implementing solutions to problems that arise in using IT is an important part of the problem-solving process. However, problem-solving may be enhanced by testing the proposed problem solutions. This aspect of the participants’ approach to problem-solving will be addressed in the next section.

4.2.2.3 Solution testing

Testing the efficacy of the solution implemented to rectify the problem encountered when using IT demonstrates the end point of the sustained reasoning process of FITness. Most participants did not mention specifically how they tested the efficacy of their problem solutions. Fran, Debbie and Helen’s solution testing was limited to observing the successful outcome of the solution implementation. For example, Fran said that she would “push ‘OK’ or something and see if it works”. Similarly, Debbie said that “I just fiddle around until it works.” This suggests that participants were unable to identify which part of their solution addressed the particular part of the problem. Participants’ inability to define the IT problem or to test the efficacy of their solution, and to make the link between these processes, may impede their ability to learn from their experience and deal effectively with different IT problems in future.

4.2.2.4 Summary

Participants’ approaches to undertaking the sustained reasoning for solving IT problems, as an indicator of FITness, was explored within the interviews with participants. This sustained reasoning would be demonstrated through participants’ methods of identifying and clarifying the problem, identifying and implementing solutions to the problem, and testing the effectiveness of those solutions for dealing with the initial problem (NRC CITL, 1999).

Only one participant (Brian) identified his approach to clarifying the nature of the IT problem that he may encounter. Ann relied on someone else to identify the problem for her. Other participants did not mention if, or how, they would approach IT problem clarification. This may have resulted from their interpretation of the researcher’s question on this issue.
All of the participants attempted to solve their IT problems on their own. Ten of the participants reported that they actively engaged with finding a solution to the IT problem by “fiddling around”. However, they were unable to describe their “fiddling” in much detail, nor were they able to clarify the purpose of their “fiddling” actions. This suggests that participants did not consciously clarify their intentions or monitor their actions.

Seven of the participants utilized resources, such as instructional manuals or software-embedded help features, to assist their finding a solution to their IT problem. One participant’s (Jenny) ability to utilize this resource changed significantly with her progress through the course.

Three of the participants (Brian, Helen and Kevin) approached their IT problem-solving in a systematic way, commencing from simple solutions to more complex solutions. These participants utilized more resources as their problem-solving became more complex.

Seven of the participants (Brian, Debbie, Fran, Eric, Helen, Jenny and Luke) identified a passive approach to dealing with an IT problem. These passive approaches included switching off the computer and returning to it later, and finding an alternative computer or printer.

Debbie and Luke used passive methods when their emotions of frustration or “freaking out” terminated their problem-solving attempts. Brian, however, was the only participant who was able to articulate his reasoning for using a passive method of problem-solving; that is, his prior experience had shown this method to be effective, even though he did not understand the technical basis of it.

All of the participants reported that they would seek assistance from other people when their initial solutions proved unsuccessful. Isabel was the only participant who expressed her avoidance of problems associated with setting up IT. She claimed to be prepared to solve problems with using IT, but not with setting it up. Eric said that he would avoid using the technology in which a problem arose and change his classroom lesson to do so.
Other issues that influenced participants’ approach to their IT problem solving included a keenness to “figure it out” on their own in order to learn (Brian), or because of the satisfaction that successful problem-solving generated (Carol), or to avoid being perceived as intellectually lazy (Kevin). On the other hand, fear of “crashing” the computer (Ann, Fran, Isabel, and Luke), or a self-perception of not being “computer whiz” (Jenny) inhibited the problem-solving efforts of other participants. Eric and Isabel were the only participants who said that they were not prepared to waste time on problem-solving if their initial solutions proved to be ineffective, but they also reported that would avoid trying to solve technical problems beyond their initial efforts.

Nine of the participants did not mention their approach to testing their problem solutions. The solution testing of three participants (Fran, Debbie and Helen) was limited to observing “if it works”.

All participants were able to describe a range of solution strategies to their real or possible IT problems. These solutions included actively trying to solve the problem, or using passive solutions that would eliminate the problem. Nearly all of the participants were not able to describe their approaches to problem clarification or solution testing. Nor were they able to describe their perception of the link between problem clarification, solution implementation, and solution testing. This suggests that participants may not be aware of their approaches to these aspects of problem-solving.

Another important aspect of FITness is being open to new technologies and technological developments. Participants’ future orientation to learning IT is addressed in the next section.

4.2.3 Future orientation to learning IT

Analysis of issues related to participants’ future orientation to their IT development was drawn from data within interviews with study participants and their reflection assignments. Unfortunately, the EC group’s reflection assignment was changed from the original planned assignment by a member of the academic teaching team. This revised assignment no longer required students to consider their future IT development. Consequently, only the reflection assignments of the PE
group could be analysed. Issues also were identified from the interviews with each participant in both the EC and PE groups.

Three primary issues associated with participants’ future professional development with IT arose from the data sources. The most important issue is the recognition, by eight participants, of the need for their ongoing development with IT. Participants identified several resources that would assist their future development with IT. Resources in their employing school included school staff (8 participants), in-service programs (5 participants), an IT journal (2 participants), and their own pupils (2 participants). Four participants claimed that their own willingness to learn played an important role in their approach to their future IT development. While one participant was prepared to attend an IT course external to her employing school, three other participants specifically reported that they would not attend any program external to their school. Four participants claimed that they would rely on their friends and family informing them of new IT developments that they may be able to use in their professional practice. Three participants identified possible obstacles to their ongoing professional IT development. These obstacles included colleagues acting as poor role models for using IT in their teaching (1 participant), and inadequate IT resources available in their schools (2 participants). Table 4.3 illustrates the issues arising from participant interviews and their reflection assignments related to their ongoing future development of IT capabilities.
Table 4-3: Issues related to participants’ future IT development

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<tr>
<th>Participant Name</th>
<th>Ann</th>
<th>Brian</th>
<th>Carol</th>
<th>Debbie</th>
<th>Fran</th>
<th>Eric</th>
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Two significant issues arise from this data. Firstly, the participants’ acknowledged the need for their future IT development. This is an important precursor in initiating participants’ future IT development. However, analysis of the data indicates that participants would rely on familiar resources, such as staff and in-service programs, within their employing school to aid their development. This may reflect participants’ limited knowledge about professional development.
opportunities for practicing teachers. This finding, however, suggests that educational authorities may utilize teachers’ focus on their employing schools as a forum for encouraging teachers’ professional development. The following sections provide more detail about the issues identified from analysis of the relevant data.

4.2.3.1 Need for future development

The need for teachers to continue their professional development regarding IT skills was specifically mentioned by Ann, Debbie, Fran, Eric, Gemma, Helen, Isabel and Kevin. They recognised the changing nature of IT and the implications of that on teaching practice. Debbie’s comment typified these participants’ response: “I know technology is a thing that’s always changing and it’s always going to be around, getting more promoted in schools.”

However, Fran acknowledged that her pursuit of IT professional development would depend on the extent to which the school in which she was employed had access to and encouraged the use of IT in teaching. She said that “it depends on the environment in which I am teaching and how readily accessible IT is.”

Helen, on the other hand, articulated specific educational reasons for continued IT professional development when she wrote in her reflection that “it is important to continue to develop in using IT as it makes learning more engaging, increases teacher productivity and to develop skills for the ‘information age’.” Whilst these reasons were reiterated from the lectures, Helen’s inclusion of them suggests that she recognised their importance.

4.2.3.2 Resources for future development

Participants identified a range of resources that they would use to assist their professional IT development. These resources were categorised as those within their future school of employment, participants’ own willingness to learn, and other resources.
School resources

Brian, Carol, Fran, Gemma, Helen and Jenny identified their fellow teaching staff as resources on which they would draw to learn about new technologies. Helen summed up this approach when she said that most of her professional IT development would come “from networking with other teachers and professionals there is the opportunity to share ideas and hope to gain from other experiences and ideas.”

In contrast with using teachers as professional development resources in IT, Ann and Kevin identified the school IT personnel as their primary resource. Kevin said that he would “generally just go through the IT part of the school because most schools appear to have, or where I came from definitely had, IT people employed there.”

In addition to drawing on the IT expertise of fellow teachers, Ann, Carol, Gemma, Helen and Isabel identified the school in-service program as a source for learning about IT developments. This was reflected in Gemma’s comment that “I know through schools there are occasionally technology days where you can go and learn”. However, Ann and Isabel’s commitment to any school IT in-service program had its limits. Ann said that she would only attend “if it was an in-service and it was only for a day or something, maybe.” Similarly, Isabel would only be inclined to attend a school in-service program on IT if there were financial limits on what she be expected to pay to attend and “it depends how much I’d use it (the technology).”

Brian and Carol were the only participants who identified educational IT journals as a source of their professional development. Brian said that there “was a journal sort of thing that was sent to the school and it had all these new technologies that you could use in it so sort of looking at that and taking notice of it and reading it.”

Eric and Gemma identified their own future pupils as a resource for learning about IT development. Eric said that “kids will be able to show me stuff all the time”.

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Own willingness to learn

Four participants (Ann, Brian, Helen and Kevin) reported that a willingness to learn was one of the most important factors that would contribute to their professional development. For example Brian said that “I think it’s always important to continually try to learn. You can’t improve unless you’re willing to continue learning.”.

Other resources

Debbie was the only participant who indicated that she was prepared to attend IT professional development activities that were external to the school in which she was employed. Brian, Carol, and Jenny specifically mentioned that they would not attend such external courses. They indicated that they were more interested in courses in their content field of teaching. For example, Brian said that “at this stage I’d sort of trust my own ability to try and learn a new technology or something like that... unless I thought it would help a career in terms of... promotion and that sort of thing but I don’t think it will be likely.” Similarly, Carol said “I’d rather probably do something else, a subject that’s more related to child development or something like that.”

Four of the participants (Brian, Fran, Gemma and Luke) said that they would utilize their friends or family, who were knowledgeable about IT, to keep informed of technological developments. Once they became familiar with the new technologies, the participants indicated that they would then consider how to apply these new technologies to their classroom teaching. Brian said that he would “Listen to my girlfriend, she’s up to date with all that sort of thing.” Similarly, Gemma said that “A lot of my friends at the moment are doing IT course at uni and they’ve been showing me a few little things.”

4.2.3.3 Obstacles to future development

Analysis of participants’ interviews and reflections suggests that participants’ attitudes towards their professional development of IT for teaching, and their access to professional development resources, could influence their ability to engage with their continuing professional development. However, three participants (Ann, Fran
and Kevin) identified issues that could provide barriers to their future professional development.

Teaching staff who did not use IT in their teaching could provide a negative role model for participants’ professional development. For example, Ann said that:

one of my friends is a teacher and I was kind of asking for her help on the PowerPoint lesson I had to do for the other subject she said, ‘oh we’re supposed to use them but I don’t really do them’, but she’s been in the workforce for years and she’s probably not confident with the new technology.

The latter part of Ann’s comment suggests that her own confidence in using IT for teaching may counteract the effect of a negative role model.

A similar inhibiting effect on professional IT development could result from inadequate IT facilities in schools in which participants may be employed. For example, Fran said that “it would be hard to find the motivation to try new technologies where they are hard to gain access to or no one else is interested.” Kevin, too, recognised the limitation on professional development by poor access to school IT resources. However, he also identified the opportunity for continued development in technologically well-equipped school. He said that:

If I was to teach at a school located in a low socio economic area or an isolated school in the outback of Australia, it would be extremely hard to progress in my professional IT development as the facilities at the school or in the area may not offer new and innovative processes in which to learn and extend my base knowledge. On the contrary teaching at an affluent private school may enable my professional IT technology to further develop, as the technology facilities are constantly updated with new and innovative processes.

4.2.3.4 Summary

Whilst most of the participants acknowledged the need for their ongoing professional development with IT, they were prepared to utilize only those resources available through their employing school, such as their staff colleagues or in-service programs provided by the school. A minority of participants identified other sources from whom they may learn about IT developments, such as their friends and family, and their own pupils. This suggests that a school-based staff development program may be an effective way of enabling teachers’ ongoing IT professional development.
The next section reports findings in relation to the participants' use of self-regulated learning strategies in becoming fluent with information technology.

4.3 Self-regulated learning

This section describes findings related to participants’ use strategies to assist their learning to become FIT. The first part examines issues associated with participants’ use of strategies related to their planning and monitoring of their learning. The second part examines issues associated with participants’ use of strategies related to their cognitive development.

4.3.1 Planning and monitoring

This section presents findings, that participants discussed during the interviews, concerned with their use of strategies to aid planning and monitoring of their learning. Participants were asked about how they planned their learning within the subject generally, and for their assignments specifically, and how they identified their learning achievement. They were also asked about their use of the resources that had been provided so assist their planning and self-monitoring efforts.

Resources for strategic planning were provided to students, as part of the educational intervention within the “IT for Learning” (EDIT102) subject. The first was a general planning checklist of questions to help guide their general planning and preparation for the learning tasks in the subject. This general planning checklist was designed to help students focus on identifying what they needed to learn, the resources that would be useful to help them complete the learning, and the methods they would use to determine how well they were achieving the required learning. The general planning checklist contained generic questions that could be used for each part of the learning and assessment tasks.

The second resource consisted of resource development criteria rubrics for each of the software resource development activities, that is, creating a PowerPoint presentation, creating a web site, and creating a database using AppleWorks or spreadsheet using Excel. These criteria rubrics listed the types of software design and pedagogical features that assessors expected to see demonstrated for each
achievement grade. This resource development criteria rubric resource served to provide a planning guide to direct students to work towards setting their own learning goals and enabled them to use the rubric to assist their self-monitoring of their achievement.

The third resource was the educational software evaluation checklist. This checklist identified the key areas that students should address in their evaluation of the educational software. This resource provided a planning focus for students and could assist with their self-monitoring of their achievement, but it did not provide a rubric for grade achievement.

The fourth resource was a web design matrix table that could be used to plan all of the features necessary to include in the instructional web site that students had to construct for the web site skill assignment. This web design matrix table could assist participants to identify each web page required in the site, multimedia objects embedded in each page, and the hyperlink anchors and targets required on each page.

The researcher requested all participants to bring to the first interview their notes for planning their resource development activities. None of the participants remembered to do so, despite voicemail and email reminders. The researcher was, therefore, unable to analyse these participant notes as data sources for insights into participants’ planning strategies. Instead, the researcher relied on participants’ reports of their planning strategies given during the interviews. These reports are presented below.

Ann

Ann said that she used the topic of her PowerPoint presentation or web site to drive her planning. Ann said that she already had resources from a project on “school readiness in early childhood programs” that she had completed during her TAFE studies. She said that she chose to use these resources and topic for her PowerPoint presentation and web site resource development activities. Ann’s description of her topic choice was brief.
Ann described in more detail her plan for those assignments. She said that her plan focused on the page design such as choice and location of colour scheme, images, text format and links. Ann used the resource development criteria rubrics to assist in her choices. She paid particular attention to those rubrics that would give the highest marks for each software skill assignment. Ann said that “to get nine I have to do this (educational implications) and... to get at least an eight I have to do this, have this many pictures, as many links; so I definitely used that”.

Ann said that she also used the resource development criteria rubrics to check that her plan had included all the features necessary to get a good mark. This illustrates the use of the resource development criteria rubrics for planning and self-monitoring. Ann claimed that she felt confident in her plans and that this confidence enabled her to experiment with design features.

Ann chose to include educational implications that seemed relevant to her learning to become a teacher. Ann claimed that one of her lecturers advised students to create a list of friends’ details for the database resource development activity. Ann, however, said “that doesn’t make sense to me to do that when I’m studying early childhood so I did sort of a checklist of parent’s names, emergency contact numbers as if I was in a childcare centre.” Ann reported that this approach enabled her to achieve nine out of ten marks for that assignment.

Ann did not use any of the other planning resources provided. She said that she did not use them “probably because it was extra work” and “I don’t think anyone I know used those tools”.

Ann complained that students were not instructed in “burning to CD”, yet these instructions were available for download from the WebCT site. Ann said that she did not explore the WebCT site for resources that could have assisted her learning because “they (lecturers) never told us that”. This suggests Ann’s dependence on instructors’ explicit directions to learning resources.

Brian

Brian’s discussion of his planning focussed mostly on his use of the planning resources that had been provided. The planning resources to which Brian referred,
during the interview, were the resource development criteria rubrics and the educational software evaluation checklist. He said that he used these to direct his learning plans for those assignments.

Brian said that “I always use the checklist and criteria because it sets out what you’ve got to do”. This suggests that Brian used the resource development criteria rubrics and the educational software evaluation checklist to clarify what learning outcomes were to be achieved. Brian said that “I make sure that I’ve got all my information, all my documents that I want” to complete each assessment task.

Brian said that he kept the resource development criteria rubric next to him as he constructed each assignment because “It guides you, you can check things off and make sure it’s all OK.” In this way Brian said that he was able to “make sure I’ve covered every single one (criterion)”. Similarly, Brian reported that he found the educational software evaluation checklist useful because “it’s always good to make sure that you’re actually doing what the assignment wants”.

The resource development criteria rubrics and the educational software evaluation checklist provided a way for Brian to plan his future actions, as well as a method to check that the work he had completed met the assignment requirements. Brian, therefore, used these planning resources for planning his learning and monitoring of his achievement.

Brian used the term “checklist” when discussing his planning for the resource development activities. His meaning, however, conveyed that it was the resource development criteria rubrics to which he referred.

Carol

Carol used the content focus to plan her software skill assessments. When preparing the multi-media resource development activities (PowerPoint and web pages), for example, Carol first identified “what I wanted the topic to be, what sort of pages I’d want to include, how I saw the sequence and that sort of thing”.

Carol examined the resource development criteria rubrics to clarify the purpose of the assignment; she said that she otherwise “wouldn’t have known where to start if I didn’t know what it was going to be about”. The criteria for the
highest grade attracted Carol’s attention first. She acknowledged that she would “just make sure that somehow in my planning I’d include those just to have the extra bits to get the extra two marks”. Gaining marks, therefore, provided an incentive for Carol to use the criteria rubrics for the resource development activities.

Carol also used the resource development criteria rubrics to investigate the functions and language of the software. She described how she would identify a key word in the rubric, such as “hyperlink”, and look for that word in the Help file or ask another student how to find and use that program function.

Carol found the educational software evaluation checklist extremely helpful in identifying issues that her evaluation should address. She acknowledged that “otherwise I would have sat down and looked at it and I would have had no idea what sort of things I was looking for in a program”.

Carol used the resource development criteria rubrics and the educational software evaluation checklist to complete her assignments successfully by working to give the lecturers what she thought “they were expecting”. Carol, however, did not use the general planning checklist. Carol discussed learning to use the software only in relation to completing the assignment tasks. While she initially claimed that the planning resources duplicated her own planning process, Carol later acknowledged that she did not plan any assignments. She said that “when I’m writing an essay or something I don’t write a plan out or anything first. I pretty much just bang it in and then figure it out as I go. I’m not a planner.” This suggests an unstructured approach to Carol’s planning.

Fran

Fran used the resource development criteria rubrics for the resource development activities to plan what to include in those assignments. Fran did not elaborate on what she specifically tried to achieve in each assignment. She claimed that she “had a bit for every problem until eventually I had everything that was on there”. She was uncertain how to determine the standard of her achievement, but by addressing all of the criteria she claimed that “hopefully then it’s enough”.
The criteria, then, provided goals towards which she could strive and also enabled her to monitor her achievement of those goals by checking that her work included all of the criteria. Fran claimed that her being able to check her work against the criteria helped to increase her confidence that she was ready to complete the in-tutorial assessment successfully.

Fran did not use the website design matrix table. She described her website planning mainly in terms of her page design. While she “didn’t map it out properly or anything” she kept her list of resources for each web page “scribbled on a bit of paper”. When questioned about the website design matrix table, Fran claimed that “I don’t think I had much time” to use it.

Fran said that the educational software evaluation checklist assisted her approach to the assignment because it helped her identify “what the content of the assignment was”. Fran, however, did not elaborate on how knowing this actually helped her plan or complete the software evaluation assignment. Fran only used the planning resources that were directly relevant to her assignments.

Debbie

Debbie used the resource development criteria rubrics to plan the design content of her skills assignments. She said that she used the resource development criteria rubrics because “you want to give them (lecturers) what they want”. Debbie’s planning consisted of ensuring that her page design for each assignment included the features identified in the resource development criteria rubrics. Debbie sought to meet the challenge that striving for the highest marks provided because she said that “I guess you want to be able to do it and be up there”.

Debbie found the educational software evaluation checklist useful because it identified the features that she should examine in her evaluation. The checklist also enabled Debbie to confirm that her evaluation report had addressed all of the issues. The educational software evaluation checklist provided goals for Debbie’s report to achieve and enabled her to monitor her achievement of them.
Debbie said that she could not remember the general planning checklist and therefore probably did not use it to assist her plan her learning throughout the subject.

Eric

Eric used the resource development criteria rubrics to plan the content of his resource development activities. Eric found that the specific nature of the skill-based assignment criteria were easier for him to follow than those from other subjects he had undertaken. He said that “other courses’ criteria were very vague; they use a lot of big words and stuff whereas that (rubrics) was just set out straight”.

Eric’s used the educational software evaluation checklist to guide completion of the assignment. Eric reported that he could see that the checklist was a useful tool because “it helped save time” by identifying the features that the evaluation report needed to address. Eric mentioned several times the time saving benefit of the checklist.

Eric did not use the general planning checklist or the web design matrix table to assist his planning of his learning. He preferred not to read for himself, but to be shown by others. Eric said that “when it comes to reading stuff, if it’s written in a way that doesn’t apply to me I really have to concentrate on it. If I ask a mate and he explains it right, ok I learn.” Eric did not explain why he believed that the learning resources did not apply to him. Eric did not mention how he may have monitored his progress.

Eric’s limited use of planning resources reflects his focus on achieving immediate, tangible goals. His concern with saving time resulted in his choosing learning approaches that required the least effort on his part to reach the outcome that would be assessed.

Gemma

Gemma used the resource development criteria rubrics to direct her planning of the skill based assignments. She said that she believed that the lecturers’ purpose in providing the criteria rubrics was to assist student learning. Therefore, she said
that she used the criteria to set her learning goals for each of the resource
development activities “so I know that I’m on the same wavelength as what they
want”.

Gemma also used the criteria to monitor her progress of completion of those
goals. She said that she “wrote down every little thing that they wanted… and as I
was working through the framework of the subject (assignment) I’d tick off” what
she had achieved. This helped Gemma ensure that she included the features that
would enable her to get high scores in those assignments.

Gemma briefly mentioned using the weekly preparation checklists, but the
context of this indicated that it was the resource development criteria rubrics to
which she referred. Gemma made no other reference to the weekly preparation or
other learning checklists.

Gemma preferred the clarity of the criteria rubrics to the software evaluation
assignment checklist. She said that software evaluation assignment “was sort of just
again like an essay and there wasn’t really any clear indication for that assignment
what they expected”. Writing an essay demands more cognitive skills from the
learner. An essay requires judgement and a reasoned argument, whereas the
resource development activities either displayed the features or they did not.
Despite Gemma’ uncertainty about the software evaluation assignment she said that
she did use the checklist to write a paragraph about each of the checklist items.

Helen

Helen used a diary to aid the planning of her learning throughout the
semester. She identified what goals she need to achieve and their achievement
dates. The goals were mostly related to assignment completion. She broke these
goals into smaller sub-goals as sequential steps towards goal achievement.

At the end of each week Helen checked her diary and ticked the sub-goals
that she had completed. She found that the planning diary gave her direction and
ensured that she was able to meet the ultimate goals. Helen said that “and then if I
open it up and there’s no ticks at all because I haven’t done anything, well then I
know that I’d better start getting into it”. Helen reported that both the goal setting
and review of her goal achievement assisted her to maintain her motivation throughout the subject.

Helen used the resource development criteria rubrics to identify what learning she needed to demonstrate for each assignment. She said that “you’re going to use it if that’s what you’re being marked on”. Helen reported that her gaining high marks made her very happy.

The resource development criteria rubrics helped Helen to set her specific goals for each assignment. She also used the resource development criteria rubrics to monitor her learning by matching the criteria against what she had completed. Helen said that this helped her feel confident of her success when she was examined.

Helen used the weekly preparation checklists to help her identify and organise the resources she would need for the following week’s learning. She said that she did this to ensure that the resources would work, such as that the images “came up on the screen”.

Helen said that she commenced the software evaluation assignment by using the checklist questions in a table and writing her response into each adjacent cell. She reported, however, that she changed her approach to writing paragraphs that addressed each checklist item but not formally headed by that question. She said that she used the checklist questions to direct her evaluation to “justify why I answered it within that component”.

Helen reported that she usually planned her assignments by identifying what they needed to include within their structures. Helen recognised the similarity of her own planning with the checklist guide when she said that “I suppose it is a checklist; I’ve always done that”.

Isabel

Isabel use the criteria rubrics to identify her learning goals for the resource development activities. She said that each set of criteria “was just so clear” and enabled her to know what the assessor wanted. Isabel then set her learning goals to those identified in the criteria, especially those to get high marks. She said that “if I
want the full marks well they’re telling me how to get it then I’m going to do that”. Her strategy was successful for she reported gaining 9 out of 10 for each of the resource development activities.

Isabel said that she recognised that the criteria rubrics were concerned with her demonstrating her proficiency with the software. Therefore, she did not have to worry about the content she included being current. She said that this was important to her because she did not want to “spend hours and hours of time trying to put your time and effort in getting all this appropriate information when they’re not going to read it anyway”. This reflects Isabel’s strategic approach to her learning.

Isabel used the educational software evaluation checklist to guide the planning of her assignment. She said that the checklist helped her because “you knew what they wanted to know… so it was good to have those questions to keep you on track.”. Isabel reported that she attained 17 out of 20 for that assignment by using the checklist, and the group presentation gained 8 out of 10 marks.

Isabel did not use other planning tools that were available. She said that she was unaware of those tools and did not remember seeing them.

Isabel used only those planning tools to enable her to take a strategic approach to learning. She set short-term goals that duplicated those on the criteria rubrics or assignment checklist. She did not use other tools that could assist the planning of her learning.

Jenny

Jenny reported that she had never had the guidance of criteria rubrics in any other subject and found them helpful for clarifying what she was expected to learn. Jenny identified, from the resource development criteria rubrics, what was required to get the highest mark in each skill-based assignment and worked toward attaining that goal. She reported that she was very pleased with her mark of 9 out of 10 for each of those assignments.

Jenny used the resource development criteria rubrics to monitor her progress with the assignments. She said that she would “look at the requirements and start
and then have a look back at the requirements” to check that she was completing them correctly.

Jenny claimed that she used the general planning checklist for her weekly preparation and learning. She correctly identified the features of the general planning checklist. Jenny’s discussion of her use of it, however, suggested that it was the criteria rubrics to which she referred. How Jenny may have used the general learning checklist, therefore, remained uncertain.

Jenny did use the checklist for the software evaluation assignment. This checklist was a useful planning guide for her because she said that “if I didn’t have that I’d sort of be a bit a lost in what should I be looking for”. This tool helped Jenny identify the areas she need to address in her assignment.

Jenny used the planning tools to identify the learning goals that were set for the assignments. She planned her assignments to meet those goals and monitored her progress towards them by comparing her inclusions against the criteria.

Kevin

Kevin said that he appreciated having the resource development criteria rubrics to guide his planning of those activities. He reported that in other subjects he frequently pursued the lecturers to clarify the direction his assignments should take. Kevin said that the resource development criteria rubrics enabled him to “see exactly what he (assessor) wants and you follow that sort of guideline to a tee”.

Despite this, however, Kevin did not identify the criteria for the highest grade. Instead, he looked at what requirements would result in a mark of 7 or 8 out of 10. Kevin reported that the time he had available influenced his decision to aim for this mark. He said that he did not want to spend too much time on these assignments when he had assignments in other subjects to complete. Kevin said that he was satisfied with his results for the skills based assignments “because that had a lot of things that I learnt in getting that mark”.

Kevin used the resource development criteria rubrics to monitor his achievement in the resource development activities. He said “it’s great because you have something to measure yourself against”. Kevin claimed that he knew that he
would be successful in these assignments “because I knew I had more than what they asked for. So if they asked for four pictures I gave them eight and if they asked for music I gave them more than one song”. This approach suggests that Kevin assumed that presenting more examples of fewer software features/functions would gain him marks, instead of generating fewer examples of more software features.

Kevin did not use the general planning checklist because he said that he forgot about them, although he did remember the lecturers discussing the general planning checklist. He said that “I’ve had a habit of doing that throughout my uni. I probably do things harder than I probably could because I just don’t… just didn’t, I didn’t have the time or effort to do it”.

Kevin said that he only vaguely remembered the educational software evaluation checklist “because there’s been so much since then in other subjects”. He had no recollection of using the educational software evaluation checklist for his assignment preparation.

Luke

Luke made notes about his page design and procedures for using menu features to create his design during the in-class assessment for the software resource development activities. Luke reported that the purpose of the notes were to help him “remember how to do it”. These notes served as procedural reminders rather than as a planning guide, and, therefore, reflect lower order rehearsal planning strategies.

Luke recognised that the resource development criteria rubrics provided a guide for him to plan his resource development activities, yet he only looked at them once. He said that “I didn’t really draw on (resource development criteria rubrics) that much at all; I just tried to cram as much stuff into it as I could and hope for the best”.

Luke said that he viewed the resource development criteria rubrics as similar to each other. He reported that, for one skill-based assignment, “I actually meant to use the previous checklist but it won’t matter because it’s all the same kind of stuff
I think.” Whilst Luke used the term “checklist”, the meaning of its use indicated that it was the resource development criteria rubrics to which he referred.

Luke said that “I just wanted to make sure that it was educational and the natural kind of things I expect like that I was teaching you something”. This approach reflects Luke’s interest in the content of his teaching instead of his proficiency with educational software, which was the focus of this part of the IT subject.

Luke said that he used the educational software evaluation checklist to guide the planning of his software evaluation assignment. He said that used the checklist to ensure that he was “covering the right ideas”.

Luke’s brief look at the criteria rubrics for the resource development activities provided him with a forward, but vague, direction for planning those assignments. Similarly, his use of the educational software evaluation checklist enabled him to move onward with his assignment.

Luke acknowledged that the only way he recognised his learning achievement was “the final result I suppose because I wanted to get done what I got done”. Luke never mentioned any other method he used to assist him to monitor his assignments’ achievement of the required learning outcomes.

### 4.3.1.1 Summary

This section summarises the findings of examination of participants’ reported issues with their planning strategies. Participants’ discussion of their planning strategies focussed on their use of the planning resources provided as part of the educational intervention. The planning resources included a general planning checklist to assist student identification of learning goals throughout the semester, criteria rubrics for the resource developments tasks, a checklist to assist with the educational software evaluation task, and a matrix table for design of the web resource development task.

All participants reported using the planning resources of resource development criteria rubrics, and 11 of the 12 participants used the educational software evaluation checklist. However, none of the participants reported using the
general planning checklist or the web design matrix table. Table 4-4 lists the planning and monitoring resources that participants reported that they used to assist their learning.

Table 4-4: Planning and monitoring resources used by participants

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<td>educational software evaluation checklist</td>
</tr>
<tr>
<td></td>
<td>web design matrix table</td>
</tr>
<tr>
<td>Ann</td>
<td>x</td>
</tr>
<tr>
<td>Brian</td>
<td>x</td>
</tr>
<tr>
<td>Carol</td>
<td>x</td>
</tr>
<tr>
<td>Debbie</td>
<td>x</td>
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<tr>
<td>Fran</td>
<td>x</td>
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<tr>
<td>Eric</td>
<td>x</td>
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<tr>
<td>Gemma</td>
<td>x</td>
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<tr>
<td>Helen</td>
<td>x</td>
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<tr>
<td>Isabel</td>
<td>x</td>
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<tr>
<td>Jenny</td>
<td>x</td>
</tr>
<tr>
<td>Kevin</td>
<td>x</td>
</tr>
<tr>
<td>Luke</td>
<td>x</td>
</tr>
</tbody>
</table>

 ✓ = reported as used by participant, × = omitted from discussion or reported as not used by participant

**General Planning Checklist**

The most common reasons reported for not using the general planning checklist included: no recollection of the checklist, and that it required extra effort or time to complete. Carol claimed that she did not use it because she did not see herself as a advance planner. She preferred to work directly on her assignments. Eric reported that he would not read documents if someone else was available to show him what to do. One student, however, did undertake to plan how to undertake her learning throughout the semester. Helen did not use the provided general planning checklist because she believed that it duplicated her own planning system. Instead, Helen used her semester diary in which she identified assignment submission dates, their goals and sub-goals, as well as actions required to meet those goals. She listed these goals and actions each week in the diary to help her remain on task throughout the semester. Helen, therefore, was the only participant...
who utilized a general planning strategy for her learning in the IT subject throughout the semester.

**Resource Development Criteria Rubrics**

In contrast with the general planning checklist, all participants used the resource development criteria rubric tools for their resource development activities. While several participants referred to these rubric tools as “checklists”, their description of its use clarified that it was the criteria rubrics to which they referred.

The planning resources that participants reported using were those directly associated with completion of the resource development activities and the software evaluation assignment. Six participants reported that they used the criteria rubrics to give the assessors “what they want”. Eight of the participants reported that they used the criteria rubrics to clarify the outcomes required of the assignments and to set their learning goals to achieve those outcomes. Six participants reported that they used the criteria rubrics to determine the features required to achieve a particular grade, and to direct their learning efforts towards achieving the grade they wanted. Six of the participants reported that they used the criteria rubrics to assist them to check that their assignment plans would meet their learning goals or successfully give the assessors what they wanted. Table 4-5 provides an overview of the issues participants reported in using the resource development criteria rubrics.
Table 4-5: Participants’ reported issues with resource development criteria rubrics

<table>
<thead>
<tr>
<th></th>
<th>Give assessors “what they want”</th>
<th>Clarify outcomes &amp; set learning goals</th>
<th>Work towards grade achievement</th>
<th>Check progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ann</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Brian</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carol</td>
<td></td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>Debbie</td>
<td>✓</td>
<td></td>
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<tr>
<td>Fran</td>
<td></td>
<td>✓</td>
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<tr>
<td>Eric</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Gemma</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helen</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Isabel</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
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<tr>
<td>Jenny</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Kevin</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Luke</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analysis of this data suggests that a third of the participants seemed keen to ensure that their assignments addressed what they believed the assessors wanted. This reflects participants’ focus on seeking to meet goals external to their own perceived learning needs. Of these, only two participants, Gemma and Isabel, reported that they also used the resource development criteria rubrics to set their own learning goals. Debbie, Isabel and Kevin were keen to achieve specific grade results. It is likely that they believed that their strategy of giving the assessors what they wanted would help them achieve those grades. This reflects a strategic approach to their learning.

Most of the participants used the resource development criteria rubrics to identify and clarify the expected learning outcomes of each assignment, and to set their learning goals to meet those outcomes. Three participants (Carol, Isabel and Jenny), however, were eager that their learning also enabled them to achieve high grades.

Two thirds of the participants reported that the resource development criteria rubrics enabled them to identify the aspects of the software functions with which they needed to demonstrate their proficiency in order to attain a good result grade. While some participants strove to achieve the highest mark possible, others, such as
Kevin, were satisfied to identify their target result mark and only work towards learning the skills required for that mark and no more. This indicates that the resource development criteria rubric was a tool that assisted learners to identify the instructors’ goals for their learning, but the criteria also enabled learners to set their own goals quite purposefully.

Despite the specificity of the criteria, one participant used them only as a general guideline. Luke used the resource development criteria rubrics to give him a general direction but then generated a large quantity of features in his assignments in the hope that within that quantity the required aspects would be covered.

The resource development criteria rubrics provided a planning guide, but they also provided the opportunity for students to check their progress by comparing their assessment plan against the criteria. Some participants reported that their checking their progress in this way also contributed to their confidence in learning to use IT.

**Educational Software Evaluation Checklist**

Four of the participants reported that they used the educational software evaluation checklist to give the assessors “what they want”. Six of the participants reported that they used the educational software evaluation checklist to identify relevant issues to address in their assignment. One participant reported that he used the educational software evaluation checklist to save time in completing the assignment. This appears to have been an important issue for him, because he did not report any other issue concerned with his use of the educational software evaluation checklist. Two participants reported that they used the educational software evaluation checklist to check that their assignment was progressing satisfactorily towards what the assessors wanted, or that their assignment addressed the relevant issues. Yet these two participants did not report using the more specific resource development criteria rubrics to check their progress. One participant omitted any reference to the educational software evaluation checklist during either of her interviews. Table 4-6 provides an overview of the issues participants reported in using the educational software evaluation checklist.
Most of the participants used the educational software evaluation checklist to guide their planning of the software evaluation assignment. Kevin could not recollect using the checklist because he had no significant memory of undertaking the assignment. Ann omitted this educational software evaluation checklist in her discussion of the learning resources.

Several of the participants reported that the educational software evaluation checklist helped them to identify the relevant issues in software evaluation and, therefore, assisted them to complete the assignment. Similarly, a few of the participants viewed the educational software evaluation checklist as useful for giving the assessors what they wanted.

Eric was interested in the checklist because it saved him time. Gemma and Luke used the checklist to compare with their completed assignments to ensure content appropriateness.

The participants used the educational software evaluation checklist because it helped them to direct the focus of their assignment to the appropriate issues for the

Table 4-6: Participants’ reported issues with educational software evaluation checklist

<table>
<thead>
<tr>
<th>Issues → Participants</th>
<th>Give assessors “what they want”</th>
<th>Identify relevant issues</th>
<th>Save time</th>
<th>Check progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ann</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brian</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carol</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debbie</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fran</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eric</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Gemma</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helen</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isabel</td>
<td></td>
<td>✓</td>
<td></td>
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</tr>
<tr>
<td>Jenny</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kevin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luke</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
assignment and thus demonstrate their understanding of software evaluation. This reflects forward planning.

**Conclusion**

The planning resources, of the resource development criteria rubrics and educational software evaluation checklist, were able to assist learners to plan the direction of their learning, as well as provide a benchmark against which participants could measure their own performance. Participants reported that they used two of the planning resources to determine how successfully they were achieving the required learning.

Half of the participants specifically mentioned using the resource development criteria rubrics to monitor their achievement of the learning and assignment goals. However, only Gemma and Luke reported that they monitored their achievement using the educational software evaluation checklist.

The difference in the use of the resource development criteria rubrics and educational software evaluation checklist for self-monitoring could lie in the specificity of those planning resources. The resource development criteria rubrics identified particular features to be demonstrated in the resource development activities. The marking scheme enabled marks to be gained if those features were demonstrated.

The software evaluation assignment, however, required students to develop an argument and discussion about their analysis of the usefulness of various features of educational software. Participants may have found it difficult to judge the quality of their discussion and argument without more guidelines. Grade descriptors may provide a way to illustrate to learners how marks may be awarded for the quality of the argument and discussion about each of the evaluation issues. In this way, students may be able to identify relevant software evaluation issues to address, and set learning goals to identify the qualities of different levels of analysis, argument and discussion. Similarly, grade descriptors may assist learners to more readily monitor their achievement of the quality of their evaluation as well as the content of their evaluation.
The next section examines the learning strategies participants used to guide their cognition.

4.3.2 Cognition

Cognitive strategies include those methods and resources that learners use to assist their thinking and knowledge construction. Students within the EDIT102 subject were expected to learn to use a range of technologies, including both software and hardware, and to be able to plan the integration of those technologies into teaching practice. Effective learning required participants to develop their knowledge of these content areas.

The design of the educational intervention within this subject provided opportunities for participants’ cognitive development in relation to the content. The resource development criteria rubrics contained some features that students had not been specifically taught in class, nor were contained within the “Get started” notes. Similarly, students were expected to use technologies, such as storing their partially completed assignment files on a flash drive and submitting their completed assignments files on CDROM, for which they received “Get started” notes but no direct instruction. This provided an inquiry stimulus for students to develop their knowledge about these technologies.

In addition, two cognitive organisational strategy resources were included as part of, or resources for, assessment tasks. The first was a web design matrix table as a learning resource, available on the WebCT site, for students’ web site resource development activity. This web design matrix table provided a framework to enable students to identify the features, functions and resources for their website page design and site construction, and to clarify the links between them. For example, each web page would require a file name and a page title, images, and hyperlinks to other pages or files, formatting of text, and embedding of images. Listing all the requirements systematically for each web page helps web designers to conceptualise their site design and aid their site construction.

A concept mapping activity was included to introduce students to another cognitive organisational strategy to enhance their learning skill repertoire, and to
assist students to demonstrate their knowledge of the pedagogical application of IT. This was included as a compulsory part of the Task 3 assignment.

Cognitive strategies utilized by participants in their learning to understand the technology will be presented first. Then participants’ use of a concept map to demonstrate their knowledge of the pedagogical application of IT will be presented.

4.3.2.1 Understanding the technology

The ongoing advancement of technology requires that teachers be able to make sense of how the technology works so that they can adapt to technological changes and modify their use of the technology to the variety of their teaching tasks. Merely memorising procedural steps in using technology or rote learning the menus of a particular version of software may severely limit teachers’ ability to adapt to changes in technology and their teaching needs.

This section presents participants’ methods for developing their understanding of technology to which they were introduced in the IT subject. Participants’ were asked about what they did to understand how technology works and how to use it, particularly when encountering new technology. Participants’ responses were mainly concerned with new software. They rarely mentioned other forms of technology.

The methods that participants used to develop their knowledge of how to use technology reflect both lower and higher order cognitive strategies. Lower order rehearsal strategies are those that help to focus learners’ attention and increase their familiarity with novel content. Higher order cognitive strategies include elaborative and organisational strategies that assist learners’ knowledge construction through their purposeful and active engagement with the content being learnt.

The types of rehearsal strategies that participants reported using to learn to use the software they were introduced to in the IT subject included “playing around” with the technology (7 participants) but with no identified purpose, preferring to be shown by others how to use the technology (3 participants), keeping a record of procedural steps (1 participant), and repetition of procedures (1 participant).
Elaboration strategies that participants reported using included experimentation with specific functions or tasks (4 participants), discussing the technology with others (1 participant), relating the unfamiliar aspects of the technology to their prior experience (3 participants), using the help files (5 participants), and posing questions to guide their search of the software functions and help files (1 participant).

Three participants reported that they constructed mental maps of the software’s menus and functional outcomes. Mental maps reflect a cognitive organisational strategy because they enable participants to create a conceptual structure into which they may integrate new learning (Garcia & Pintrich, 1994).

Participants’ reports of the strategies and methods they used to learn to use technology, specifically the new software to which they were introduced in the IT subject, are provided below. Table 4.7 identifies the strategies and methods that participants’ used to explore the software they used for their assignments.
### Table 4-7: Participants' reported software exploration strategies and methods

<table>
<thead>
<tr>
<th>Participants</th>
<th>Rehearsal strategies</th>
<th>Elaboration strategies</th>
<th>Organisational strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unable to articulate understanding</td>
<td>Experimentation with specific functions or tasks</td>
<td>Mental map</td>
</tr>
<tr>
<td>Ann</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brian</td>
<td>✓ ✓ ✓ ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carol</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debbie</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fran</td>
<td>✓ ✓ ✓ ✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Eric</td>
<td>✓ ✓ ✓ ✓</td>
<td></td>
<td>✓ ✓</td>
</tr>
<tr>
<td>Gemma</td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Helen</td>
<td>✓</td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Isabel</td>
<td>✓</td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Jenny</td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Kevin</td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Luke</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

✓ = reported as used by participant,  ✗ = reported as not used by participant

Ann said that her preferred method for learning new software was to explore all the menu functions. She said that she liked “moving my mouse around and looking at it all” and “just have a little bit of an experiment”. Ann was unable to explain what her “experiment” entailed and how this method helped her understanding of the software. Ann said that she was not able to compare her own understanding with software diagrams because “diagrams pertaining to what is labelled on the computer isn’t as effective for me”. 

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Ann did not use the web design matrix table to organise her understanding of the interrelationships between structures and resources in website design and construction. She said that she “only vaguely” remembered the table and “didn’t know what the table was”. She said that she did not use it “probably because it was extra work”. This may have implications for her learning to manage larger hypermedia projects later when she is in teaching practice.

Brian

Brian said that, when learning new technology, he tried to “relate it to (my) prior experience… I’d try to look for familiar aspects and if they weren’t there then I’d go to ‘Help’”. Brian said that “like the difference between the PC and Mac Word. It’s very similar but there are differences in terms of formatting.” This suggests that he looked for the differences and similarities between different versions of software and different computer platforms. Similarly, when he considered another type of spreadsheet software that was different from Excel, with which he was familiar, Brian said that “I assume that it’s a spreadsheet and what you’re trying to do is the same thing, it’s just maybe different in how you go about doing it.” This suggests that he recognised the functional similarities between the types of software, but that the particular software menu organisation may be different.

Brian said that he had recognised that some menu functions within software would be located in familiar places, whilst others would be located elsewhere. This suggests that Brian created a mental structure of the ways in which software menu functions are organised. The quote below indicates that Brian recognised that some software would perform similar functions in different ways; it was just a matter for him of finding where the function was located:

“...There are the same pull down menus but it’s under a different map sort of thing, so you relate it to what you’ve done previously, so then you can try and learn how to do it on this version.”

The knowledge Brian had constructed about computer software from his prior experience enabled him to use learning strategies to build on that understanding. Brian said “I’m not afraid of using that Help section and using Search. If you’re looking for formatting, just search for ‘formatting’ and it’ll come up and help you”.

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His prior IT experience meant that Brian had a grasp of several IT terms, such as “format”. This enabled him to use the Help features effectively because he used the same terms to search the Help file that were listed in the Help file index.

Brian posed questions that directed his search of the software functions. The types of questions he asked depended on his knowing what he wanted to achieve with the software, such as “how can I improve this?, is there colour aspects?, what’s the format options?, how do I make this bigger?”. His goal-directed questioning then enabled his explorations of the software to become purposeful.

Brian’s preference for learning by himself meant that he usually only sought help from other people to check that his actions were correct. He said “I do like to learn how to do it myself and whether that’s being shown or whether it’s been telling me and then watching what I do and confirming it”. Brian, however, made no mention of using the web design matrix table provided to assist with conceptualising and managing the web site structural design.

Carol

Carol described how she would “press a lot of buttons” or “fiddle with it and play with it as I go” in order to learn new software because “I wanted to figure it out myself”. Her discovery approach to learning was guided by the resource development criteria rubrics that provided specific features to be demonstrated in the assignments. Carol described several times how she would “play with” the software, but she was unable to explain in what ways these explorations contributed to her understanding. She did, however, emphasise her enthusiasm for learning how to use the software by herself because she said that “I’m very stubborn. I wanted to figure it out myself”. Carol claimed that “I like the feeling when you achieve something and you figure it out for yourself and you haven’t had to ask anyone and that sort of thing.” This suggests that the emotion associated with achievement may influence learner independence.

Carol described the web design matrix table as “the table it had things like to put links and all that sort of thing”. This indicates that she had examined it and knew its purpose. However, Carol did not use this table because she said that “I just
like to actually just sit down and actually see the group do it and fiddle with it and play with it as I go.”

Debbie

Debbie focussed on being able to recall the steps in using the software. She said that “I think it’s important (that) I need to know how to do it”. She said that she liked to “just fiddle around, click on links and see what happens” when she was exploring new software. Debbie was unable to explain how this method enabled her to enhance her understanding of software functionality. This indicates that Debbie may have poorly developed metacognition.

Debbie said that she dismissed Help files as sources to aid her understanding because “I find that they don’t explain things very well”. This suggests that Debbie may have difficulty in being able to relate reading and thinking to her actions in using the software. Debbie could not remember the web site design matrix table and concluded that she did not use it.

Eric

Eric was unable to describe in detail the methods he used to understand the computer technology or the ways in which those methods enabled him contributed to his understanding. Eric said that, when faced with a new computer, he would “associate that with a past computer” but he could not explain how he did that. He said that he would “would just click it and see if it’s the same and then once it is the same that confirms that I can use it like the old computer”. Eric did not explain how he tried to understand how to use computer technology that was not “like the old computer”.

Fran

Fran had considerable difficulty remembering what actions she took to learn the features of new technology, including software. Her initial response was that she would “just play around”. Eventually, Fran described how she explored the software to see how it worked. She claimed that she recognised the similarities of some features between software, such as “the basic stuff like the cut and copy”. She said that she required help, however, to understand the unfamiliar software features.
Whilst she sometimes looked at the Help function, she usually asked another person to show her how to do it. Fran preferred to be shown how to use a particular software function because “you see how it’s done and then you can do it yourself”. Fran described her learning only in terms of being able to use the software functions. She could not articulate how her learning actions enhanced her understanding of the software. This suggests that Fran may have poorly developed metacognitive skills.

Gemma

Gemma said that she liked to “play around” with computer software to learn how to use it. She said that by “playing around” she meant that she would select a menu function and explore “what it contains and what it does”. Gemma said that she felt confident to explore and experiment with the software menu functions because she knew that “you can’t break it (the computer)”. Sometimes Gemma’s “experiments” resulted in her making mistakes. She was undaunted by her mistakes because she said that “if it doesn’t work you can try it again” to learn how to perform the action correctly. Gemma said that her mistakes also assisted her learning because “if I needed to use that program again then I’d know not to do it”.

Gemma said that “I just try and link stuff” to understand the relationship between the menu label with the consequent action it performed. She said that she found that repeated practise helped to enable the linked “stuff” to become “sort of embedded in my brain”.

Gemma used some appropriate software terminology in describing her actions, such as “font”, “header”, “menu”, “insert”. This indicated that Gemma was beginning to learn the difference between software objects, such as “font” or “header”, and a software action on those objects, such as “insert”. Learning to use the terminology of IT correctly may assist the development of the conceptualisation of how technology works. However, despite Gemma’s familiarity with some IT terms, she said that when she encountered difficulties using the software she tended not to use instructional manuals because “I don’t actually understand the terminology that they’re using”. Instead, Gemma called on the help of her friends who were undertaking IT studies to tell her or show her what to do. This suggests
that her understanding of the relationships between IT functions and their terms may be incomplete.

Helen

Helen’s approach to learning new technology, including software, was focussed on achieving specific tasks. She said that she would identify what she needed to achieve and “fiddle around with things …(to) just try and do it”. Helen said that if her explorations of the menu functions did not reveal her desired goal then she would “go to the help menu and say, how do I whatever or whatever and then do it that way, just go straight for those shortcuts”. Helen said that “I wouldn’t look that much into it” in terms of seeking to understand the functional organisation of the software. This suggests that she was not particularly interested in making explicit her understanding of the software functionality, she just wanted to use it.

Isabel

Isabel reported that her primary method for exploring unfamiliar software was “just trial and error”. She said that trying to find the solutions by herself contributed to her being able to remember them. Isabel said that her explorations also revealed “other things you can use in the future”. This suggests that Isabel was able to link her current discoveries with her perceived future needs in using the software.

Isabel was familiar with several of the in-built software help features. She reported that she used the Help options as well as the hover-help feature to learn the purpose of particular icons: “it’s pretty self-explanatory… you merely have to put your arrow over the picture and it will tell you what that shortcut is for”.

Jenny

Jenny said that she would think about the content and design of her assignment presentations while driving to class. She said that she experimented with the software as “I’d try things and then I’d trash it and then I’d try it again doing it a different way, just sort of experiment with lots of things”. This suggests that her focus on the content design and formatting, provided a purposeful goal for
her learning “experiments”. However, it also meant that Jenny remained unaware of how she learnt through these experiments.

Jenny reported that she would use the Help feature of software if she could not understand how to perform a task. However, she said that because “computers can be so overwhelming” she was more likely to ask someone to “show me how it works”, rather than spend the time trying to understand it. This suggests an expedient approach to task completion rather than seeking to understand software functionality.

Kevin

Kevin described himself as a learner before he commenced his description of the methods he used to learn new software or technology. He said “I’m a visual learner” and consequently he needed to “play around with it and work it out” by constructing “maps in my head”.

Kevin said that his mental maps started with what he already knew because “you’ve got roads that you know …so you have a base of something”, from which his exploration of the software could “branch off the different road since there’s different menu bars”.

Kevin, however, did not limit himself to simply memorising the software “road map”, he actively engaged with new functions he encountered, because he said that “You learn concepts by just really going over something and really analysing it and also asking questions”. He said that the types of questions he asked to guide his search of the software included: “what does this program actually do and extend on how much you can do with it?”. Ultimately, Kevin’s explorations enabled him to add to his mental map of the software’s functionality because he said “I know that this road branches off there and that branches off there”.

Kevin’s comments demonstrated that he was able to distinguish between his characteristics as a learner and the learning methods he preferred to use. His awareness of the effect of those methods on his learning success may have implications for his future learning development and academic success.
Luke

Luke kept an exercise book beside his computer in which he would intermittently “jot stuff down… just to try and keep a record” of the procedural steps. He did this to remind himself what steps to complete, because he said that “sometimes you get somewhere and you’ve got no idea how the hell you got there”. This suggests that Luke relied on memorising procedural steps rather than seeking to understand how software is functionally organised.

Luke was unable to describe any other methods he used to make sense of the technology that he was learning. Luke said that “I think just sort of you learn from it without realising”. This reflects a lack of awareness of his own ways of learning.

4.3.2.1 Summary

None of the participants used the web design matrix table to assist with their conceptual organisation of their web site design. Isabel’s comment is typical of participants’ responses about the web design matrix table:

No, I don’t remember what table. I don’t know what you’re talking about. I don’t remember seeing a table.

Most of the participants were able to describe the methods they used to learn to use the software they encountered. Some of these methods included: “playing” or “fiddling around” with the software to “see what happens”, being shown by others, keeping notes and repetition. These methods reflect a rehearsal-type of learning strategy and may be the starting point for learning how to make sense of how the software works. This method is only useful, however, when it leads to the construction of some sort of understanding of the software’s functionality. “Playing around” with the software to observe “what happens” is a superficial description of student actions. Participants, generally, did not elaborate on this description to explain in what ways their observations revealed their understanding of how the software’s functionality is organised. Participants' poor ability to identify the ways in which their learning methods assisted their learning suggests their poor metacognition.

Luke described keeping a note book to record instructions on how to complete various software tasks. He found this useful to remind him what buttons
or menus to select for each task, though his inconsistent use of the note book makes
this method less effective than it otherwise might have been. Even at its most
effective, this method of listing the steps to complete a task only helps the student
to recall the procedural steps, not understand how the program is organised. Notes
to stimulate recall may assist functional use of some aspects of the current version
of a particular piece of software, but these notes do not create a conceptual map of
the software functionality.

Most participants (all except Debbie, Fran and Luke) used methods that
reflected elaboration cognitive strategies. These included: experimentation with
specific software tasks, discussing the software functions with others, relating the
unfamiliar to the familiar aspects of computers, using the help file and posing
questions to guide their search of the software.

The criteria rubric for the resource development activities provided a specific
task-focus for some participants’ learning of the software. Other participants found
that actively experimenting with menu functions helped them to understand these
functions better. One participant (Gemma) reported learning from the mistakes she
made as well as her successes. Her belief that her actions would not break the
computer may have provided her with the confidence to learn, including being
prepared to make mistakes and learn from them.

Isabel reported that the mutual interplay between fellow students helped to
clarify her understanding of how the software worked. This participant recognised
that she would learn less effectively if she was told how to do it instead of working
it out for herself.

Other participants (Ann, Brian, Carol, Helen, and Isabel) described using the
Help function of the software to assist their understanding of the software’s
functions. Using the Help file necessitates that users have some idea of what it is
they are looking for in the Help file. Isabel utilized the contextual hover help
function which is built into numerous current software. This illustrates a software
user’s ability to understand how assistance is embedded into the functional aspects
of the program, instead of consulting a stand-alone Help file.
Other participants (Debbie, Fran, Eric and Jenny) did not use the help function regularly. They either could not understand the help file instructions or they preferred to be instructed directly by other people. This reflects their focus on being able to perform the technical tasks without necessarily understanding how or why they do so.

Question-directed use of the Help feature and clarifying understanding through explaining to other students reflect elaboration cognitive strategies (Hofer et al., 1998). These strategies exemplify participants’ increasingly active engagement with learning IT and suggest the beginning of their ability to adapt to unfamiliar software.

Gemma found that repeated practice helped her to “link stuff” that then became “embedded in (her) brain”. Conceptualising the relationship between software menus and their functional outcomes reflects a cognitive organisational strategy for learning. Gemma used practice repetition to construct her knowledge not to rote learn the locations of particular menu functions, which would be a rehearsal-type of learning strategy.

The key for some students’ sense-making was in relating what they found in the new software to what they had previously encountered, such as identifying common menu functions as text formatting, editing and document printing. Once they had established what functions were familiar, they were able to examine other menu features. Only two participants (Brian and Kevin) specifically mentioned mapping the structural menu functions of software as cues to understanding how to use the software. This reflects higher order cognitive organisational learning strategies.

This contrasts with other participants who are more concerned with “doing” and less with understanding the functional structure of the program. Helen’s comment reflected this:

I wouldn’t look that much into it. I’d just go to file and whatever else and see what other functions are available to me and if I wanted to do something.

Here, Helen expressed her desire to find a software function that is relevant to her immediate task focus. She seems less concerned with understanding how those
functions are organised so that she may more readily find the functions she needs for future tasks. This short-term goal focus is less likely to enable meaningful future-oriented learning and is more likely to result in a time-consuming “search and see” method for each new task that she must complete.

Both Brian and Helen had prior experience with university learning, Brian from completing the first 2 years of his degree, and Helen from completing another degree prior to her teaching studies. Yet both participants used different approaches to their learning. Brian sought to understand, while Helen sought to “do something”. This suggests that there may be other factors that influence their approach to learning to use IT.

Overall, 18 reports of the use of higher order strategies were reported by participants, while there were 12 reports of the use of lower order strategies. Four participants reported using more lower order than higher strategies. Four participants reported using more higher order than lower strategies. Another four participants reported using an equal number of more higher and lower order strategies. Table 4-8 illustrates the number of strategies reported as used by participants.
Table 4-8: Number of lower and higher order strategies reported as used by participants

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Lower order learning strategies</th>
<th>Higher order learning strategies</th>
<th>used more lower order strategies</th>
<th>used more higher order strategies</th>
<th>used equal number of higher and lower order strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rehearsal strategies</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Elaboration strategies</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Organisational strategy</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Participants</td>
<td>Ann</td>
<td>Brian</td>
<td>Carol</td>
<td>Debbie</td>
<td>Fran</td>
</tr>
<tr>
<td>Ann</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Brian</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Carol</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Debbie</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Fran</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Eric</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Gemma</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Helen</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Isabel</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Jenny</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Kevin</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Luke</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>15</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Participants’ use of cognitive learning strategies has implications for their being able to develop their independence in learning to use new technology that they may encounter in their future teaching careers. Fran, Eric and Luke only used lower order rehearsal strategies. Learning new technology may be particularly challenging for them if they continue to rely on using only that technology with which they are familiar or memorizing procedural steps without some conceptualization of the structural organisation of the technology’s functionality.
The eight participants who utilized higher order cognitive strategies may be better prepared to learn to use new technology that may be utilized in schools in future.

Participants’ demonstration of their understanding of the ways in which IT may be used in their teaching, through their use of a concept map as a cognitive organisational tool, is described in the next section.

4.3.2.2 Understanding technology for teaching

Students were required to demonstrate their understanding of the use of IT in teaching within the Task 3 Project. The design of the educational intervention within the IT subject utilized a concept map for this assignment purpose. The concept map provided an opportunity for students to experience a cognitive organisational strategy for learning. Analysis of the concept maps provided an opportunity to explore how participants were able to use this cognitive organisational strategy to illustrate their knowledge of the use of IT in teaching.

The concept maps were analysed for their use of relevant concept map features using Novak and Gowin’s (1984) scoring system, as well as for the student approaches to learning that were revealed through the content words of the maps. Accuracy of the concept maps’ content knowledge about the use of IT in teaching was not examined because it was not deemed relevant to this study’s purpose. The method of analysing the concept maps was presented in the Methodology chapter.

The concept map assignment tasks for the Early Childhood and Physical Education student groups were slightly different. This was explained in the Methodology chapter. Therefore, the results will be presented by participant group in order to make intra-group comparisons more accessible for the reader.

4.3.2.2.1 Concept map structural scores

Participants’ concept maps were analysed for their features that demonstrated meaning. These features included the number and hierarchical arrangement of concept nodes, and the relationships between those nodes that generated propositions.
Early Childhood participants’ scores

Luke gained the lowest total concept map structural score of 16. His map listed only ten concept nodes, of which seven were examples, within three hierarchical levels. Each of his sub-concepts at each level was less inclusive than its parent concept. This resulted in a score of nine for his hierarchical links. Luke’s map showed no linking words on the connecting arrows, so there were no meaningful propositions on his map. Similarly, Luke’s map showed no cross links between concepts.

Ann’s concept map listed 18 concept nodes within four hierarchical levels. All of her sub-concepts were subsumed under the higher concepts, with a result score of 85 for her hierarchical links. However, no meaningful propositions were apparent because there were no linking words on the arrows. The map showed no cross links or examples.

Brian’s map listed 31 concept nodes within nine hierarchical levels. Eight examples were listed. However, some of the examples were identified at sequentially lower levels, and were thus not less inclusive than the parent concept. This resulted in a score of 80 for hierarchical links. Three cross links were included, but they did not demonstrate synthesis of ideas. The lack of linking words on the connecting lines mean that there were no meaningful propositions. This also contributed to the difficulty in establishing cross-link synthesis.

Carol’s concept map identified 65 concept nodes within five hierarchical levels. Carol’s map was the most comprehensive of this group. Each of the sub-concepts was less inclusive than its parent, creating a hierarchical score of 320. Carol’s map, too, did not demonstrate propositions because there were no linking words on the connecting lines. This made it difficult to interpret the synthesis of the cross-links in her map. Carol duplicated four terms on her maps but did not provide cross-links between them. For example, “New tools” was listed at level three of the Researcher branch of both the Teacher and Student maps. Similarly, “software” and “hardware” was listed at level four of both Learner and Researcher branches of the Teacher map, and at level four of the Learner branch of the Student map. Yet there were no cross links between them.
Physical Education participants’ scores

Debbie’s concept map identified 17 concepts within three hierarchical levels. These concepts were organised into an appropriate hierarchy producing a hierarchical score of 80. There were no linking words on the connecting lines; hence no propositions were created. Debbie’s map did not include any cross links or examples. The complexity of Debbie’s understanding was not apparent from her concept map.

Fran identified nine concept nodes in her map, within three hierarchical levels. Each of these nodes was less inclusive than its parent, resulting in a hierarchy score of 40. Fran’s map did not include any example nodes, cross-links or linking words to form propositions.

Eric did not submit a concept map.

Gemma’s concept map identified 45 concept nodes within four hierarchical levels. Each sub-concept node was less inclusive than its parent, creating a hierarchical score of 220. The map provided 20 example nodes, but no cross-links or propositions via linking words.

Helen’s concept map identified 25 concept nodes within three hierarchical levels. Each sub-concept node was less inclusive than its parent, creating a hierarchical score of 120. The map provided no example nodes, propositions via linking words or cross-links.

Isabel’s concept map identified 25 concept nodes within four hierarchical levels. Each sub-concept node was less inclusive than its parent node, which resulted in a hierarchical score of 120. The map provided no propositions via linking words, cross-links or examples.

Jenny’s concept map identified 26 concept nodes within four hierarchical levels. Half of the sub-concept nodes was less inclusive than their parent nodes, creating a hierarchy score of 65. The other 13 concept nodes, however, were linked with directional arrows that set the sub-concepts as more inclusive than their parent nodes. This resulted in invalid hierarchical links which accrued no score. Jenny’s
map provided no propositions because there were no linking words between the nodes, no cross-links and no examples.

Kevin’s concept map identified 21 concept nodes within seven hierarchical levels. His concept map was spread across several pages. The primary concept and its four level two sub-concepts were on the first page. Each level two concept, and its related concept nodes, was included on a separate page. Fifteen of the 21 concept nodes listed were less inclusive than their parent nodes, creating a hierarchical score of 75. The map provided no example nodes, propositions via linking words or cross-links.

Table 4-9 illustrates participants’ scores for their concept maps. Participant scores were grouped by their course speciality to better examine their completion of the assignment tasks.
Table 4-9: Participants’ concept map scores of structural characteristics

<table>
<thead>
<tr>
<th>Concept map feature</th>
<th>Number of concept nodes</th>
<th>Number of levels</th>
<th>Propositions</th>
<th>Hierarchy</th>
<th>Cross links - valid &amp; significant</th>
<th>Cross links - no synthesis</th>
<th>Examples - separate node label</th>
<th>Individual’s score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants ↓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early Childhood</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ann</td>
<td>18</td>
<td>4</td>
<td>0</td>
<td>85</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>85</td>
</tr>
<tr>
<td>Brian</td>
<td>31</td>
<td>9</td>
<td>0</td>
<td>80</td>
<td>0</td>
<td>6</td>
<td>8</td>
<td>94</td>
</tr>
<tr>
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<td>5</td>
<td>0</td>
<td>320</td>
<td>0</td>
<td>8</td>
<td>4</td>
<td>332</td>
</tr>
<tr>
<td>Luke</td>
<td>10</td>
<td>3</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>Physical Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debbie</td>
<td>17</td>
<td>3</td>
<td>0</td>
<td>80</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>80</td>
</tr>
<tr>
<td>Fran</td>
<td>9</td>
<td>3</td>
<td>0</td>
<td>40</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Eric</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gemma</td>
<td>45</td>
<td>4</td>
<td>0</td>
<td>220</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>240</td>
</tr>
<tr>
<td>Helen</td>
<td>25</td>
<td>3</td>
<td>0</td>
<td>120</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>120</td>
</tr>
<tr>
<td>Isabel</td>
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<td>4</td>
<td>0</td>
<td>120</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>120</td>
</tr>
<tr>
<td>Jenny</td>
<td>26</td>
<td>3</td>
<td>0</td>
<td>65</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>65</td>
</tr>
<tr>
<td>Kevin</td>
<td>21</td>
<td>7</td>
<td>0</td>
<td>75</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>75</td>
</tr>
</tbody>
</table>

4.3.2.2 Approaches to learning

Participants’ concept maps were analysed for the approaches to learning that they demonstrated through the choice and use of the words contained within the concept maps. As explained in the Methodology chapter, deep learning was likely to be demonstrated through the use of words or phrases that elaborated, explained or provided examples of the issues identified in the lectures about the role of IT in teaching. Surface learning, however, was likely to be demonstrated through the use of words that duplicated or paraphrased those words in the lectures, but did not add any more detail.
Early Childhood participants

The words that Ann used in her concept map included both paraphrasing of key words and direct duplication of key words from the lecture notes. This reproductive method of concept generation reflects a surface approach to learning. In addition, each of the two level two concept nodes included three level three concepts nodes that were essentially the same. There were also three level three concept nodes that were duplicated under both level two nodes. Each of these concepts differed from its counterpart in terms of actor focus, for example, “develop student with awareness of the range of applications of ICT in society” in the teacher branch, and “develop an awareness of the range of applications of ICT in society” in the student branch of the map. Ann’s map did not identify any original concepts, nor did it show evidence of elaborating, explaining or exemplifying the existing concepts.

Brian used his own words to identify concepts that revealed his understanding. He also used his own words to provide examples of the concepts. This reflects a deep approach to learning.

Carol’s concept map utilized both original concept words as well as those duplicated from the lecture notes, either directly or paraphrased. The latter suggests a surface approach to learning, but this is taken further towards deep learning by the use of her own words and providing examples to illustrate her understanding.

Luke’s concept map appeared to illustrate a deep approach to learning because of the use of his own concept words and his use of examples. However, his map did not use those words to elaborate or explain the concepts. Seven of the 10 concept nodes were examples of the level 2 concepts. There were, therefore, too few concepts to sufficiently demonstrate his understanding of the issues.

Physical Education participants

All of the words in Debbie’s concept map duplicated those from the lecture notes. Her map did not include paraphrasing of the key words from the lecture notes, nor was there evidence of Debbie’s use of her own word to elaborate,
explain or exemplify her understanding of the concepts identified. This reflects a surface approach to learning.

Fran’s concept map included both paraphrasing of lecture note concepts and duplicating key words from them. However, Fran’s map combined multiple ideas within single concept nodes. For example, “Manager” (level 2 node) linked to a single level three sub-node which included six related concepts from the lecture notes. Fran’s map did not include her own words to elaborate, explain or exemplify the concepts. Fran’s map, therefore, reflected a surface approach to learning.

Gemma’s concept map included 45 concept nodes. Twenty five of these concept nodes duplicated key words from the lecture notes. The remaining 20 concept nodes exemplified hierarchically higher level concepts. Gemma’s provision of examples extended an otherwise surface approach to learning to a deeper level to demonstrate her understanding. Her map, however, did not include words to elaborate or explain the concepts.

Helen’s concept map included 25 concept nodes. These nodes included words duplicated from the lecture notes and paraphrasing of those ideas. In addition, Helen used her own words to elaborate, explain or exemplify those concepts. This demonstrated Helen’s effort to understand the concepts and reflects a deep approach to learning.

Isabel’s concept map identified 25 concepts, all of which duplicated key words directly from the lecture notes. No paraphrasing of those concepts was included. Her map did not show evidence of her using her own words to demonstrate her understanding through elaborating, explaining or exemplifying those concepts. This reflects a surface approach to learning.

Jenny’s concept map also reflected a surface approach to learning by duplicating 26 concepts from the lecture notes without any original words to elaborate, explain or exemplify her understanding of those concepts.

Kevin’s concept map reflected a deep approach to learning because he used original concepts that sought to elaborate or explain the key concepts from the lecture notes that he had paraphrased. However, his map did not include examples
to illustrate his understanding of those concepts. Analysis of the approaches to learning reflected in the participant concept maps is listed in Table 4-10.

Table 4-10: Participants’ approaches to learning reflected in concept map content

<table>
<thead>
<tr>
<th>Approach to learning</th>
<th>[Number of concepts]</th>
<th>Surface</th>
<th>Deep</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>duplicating key words from lecture notes</td>
<td>paraphrasing key words</td>
<td>using own concept words/ novel ideas</td>
</tr>
<tr>
<td>Participants ↓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early Childhood</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ann</td>
<td>18</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Brian</td>
<td>31</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Carol</td>
<td>38</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Luke</td>
<td>10</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Physical Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debbie</td>
<td>17</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fran</td>
<td>9</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Eric</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gemma</td>
<td>45</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Helen</td>
<td>25</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Isabel</td>
<td>25</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Jenny</td>
<td>26</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kevin</td>
<td>21</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

Summary

All participants demonstrated that they were able to use appropriate software to construct shapes, lines and text. They also were able to arrange those objects in a way that resembled a concept map.

Propositions in a concept map are created by the use of a linking word or phrase on a connecting line between two concept nodes. This creates a concept-link-concept organisation of ideas to generate meanings. Examination of those meanings enables researchers to interpret learners’ understanding of the content that the concept map represents.
None of the participants in EC or PE were able to create propositions of any kind in their maps. This made it difficult to interpret the accuracy or the comprehensiveness of their understanding.

Concept nodes in a concept map are usually organised hierarchically where a higher level concept node is more inclusive than each of the nodes below it. Concepts are, therefore, organised from the general to the specific. The range of hierarchy scores for the EC participants was considerable, from 9-320. The number of separate concept nodes and their arrangement from most to least inclusive affected participants’ score achievement.

Luke had a low hierarchy score because he had few concepts to organise. Carol had a large hierarchy score because she organised a large number of concepts hierarchically from most inclusive to least inclusive. In contrast, Brian also had many concepts to organise, but he hierarchically arranged several examples branching from each other, instead of from a common inclusive parent concept node. This prevented his map achieving a higher score on this criterion. Ann achieved a better hierarchy score than Brian, even though she had fewer concepts, because she organised her concepts appropriately from most inclusive to least inclusive.

Fran’s hierarchy score of 40 was the lowest, of the PE participants, because she had so few concepts nodes to organise. In contrast, Gemma identified the most concept nodes of all the PE participants, and organised them into an appropriate hierarchy. The significant number of examples that she provided boosted her hierarchical score. If Gemma’s examples were removed, then she would have identified the same number of concepts and achieved a hierarchical score equivalent to Helen and Isabel.

Helen and Isabel’s hierarchical scores were identical, as were the number of concept nodes that they identified. Helen’s examples, however, were included in the same concept node as that each sought to exemplify. This resulted in her gaining a lower score from her examples and their contribution to the hierarchy than they otherwise may have achieved if they had been listed separately and hierarchically subsumed.
Most of Kevin’s concepts were linked linearly. However, only some of his concepts were hierarchically subsumptive. This resulted in a low hierarchical score. Jenny’s map, on the other hand, reversed the link direction for half her concepts, which rendered them hierarchically invalid. This, too, resulted in a low hierarchy score.

Being able to identify and organise concepts appropriately requires that learners are able to categorise concepts separately. Fran combined several ideas into each level three concept node. Similarly, Helen included an example within each concept node instead of listing the examples independently. Consequently, both these participants produced fewer concept nodes than were possible from their word choice, which also affected their hierarchical score outcome.

Brian and Carol were the only participants whose concept maps displayed cross-links between concepts. The absence of propositions on the concept maps made it difficult for the researcher to interpret the validity or significance of those cross-links. Consequently, these participants’ maps were able to generate scores only for cross-links that did not demonstrate synthesis.

Three of the four EC participants’ maps identified examples as separate concept nodes. This contrasts with the PE group of participants where only one of the seven concept maps identified examples specifically. Helen provided examples, to illustrate her understanding, within their relevant concept nodes. Consequently, these examples did not contribute to her map score.

Analysis of the content of the concept maps provided another way to explore participants’ learning. The way in which participants used words in their maps provided an opportunity to interpret whether participants adopted a deep or surface approach to learning.

Ann’s concept map simply reproduced a range of ideas from lecture notes, either directly or through paraphrasing. Her map did not provide any words that illustrated her understanding by elaborating, explaining or exemplifying the lecture note ideas. This suggests that she adopted a surface approach to learning.
Carol’s concept map also used the lecture note concepts and her own paraphrasing of them. In addition, however, she used her own original concepts and examples. This suggests a deep approach to learning because Carol attempted to demonstrate her learning beyond the limits of the lecture notes.

Brian and Luke also used novel concepts and did not draw on the concepts from the lecture notes. They both, too, sought to illustrate their understanding through their providing examples. This suggests a deep approach to learning. However, consideration of their concept map scores reveals that Brian identified twenty more novel concepts than Luke. Yet they identified a similar number of examples, Brian identified eight example nodes and Luke identified seven examples.

The concept maps of five (Debbie, Fran, Gemma, Isabel and Jenny) of the seven PE group of participants who submitted a concept map reproduced the terms from the lecture notes and provided no original concepts words to explain their understanding. This reflects a surface approach to learning. Fran’s map did include some paraphrasing of the lecture notes but did not demonstrate any evidence of deep learning. Gemma’s map included twenty examples but no other evidence of deep learning.

Helen and Isabel’s concept maps achieved identical scores. Their maps differed, however, in the quality of each map’s content. Isabel used only those terms listed in the lecture notes and provided no examples. Helen, however, used some of the lectures’ terms but also used her own words to paraphrase the terms, elaborate, explain or exemplify them.

Kevin’s concept map showed similar signs of deep learning because he used his own concept terms to elaborate and explain his understanding of the lecture notes that he had paraphrased. So only two of the seven PE participants’ maps demonstrated characteristics of deep learning.

Other factors that may influence participants’ ability to become fluent with IT through self-regulated learning are addressed in the next section.
4.4 Other factors influencing learning FITness through self-regulated learning

Other factors that may influence students' learning to use IT were identified from the interviews with the participants. These are described below.

4.4.1 Prior IT experience

Participants were asked, during the interviews, about their previous experience with using IT. Participants’ discussion of their IT experience was limited to their using computers and computer software.

Ten participants except, Kevin and Luke, reported that they had used computers during their school years, university experience, or for their employment. Debbie, Fran and Eric were the only participants who reported having less than five years experience with computers.

All participants, except Luke, reported that they had used word processing software to complete assignments. Only four of the participants, Brian, Gemma, Isabel and Jenny, had used databases or spreadsheets before commencing the IT subject. Similarly only Debbie, Gemma and Isabel reported having used PowerPoint before. Brian was the only participant who reported learning basic computer programming at school.

Nine participants, all except Gemma, Isabel and Luke, reported that they had used computers to explore the Internet and to send and receive email. However, Brian and Luke were the only participants who reported that they had played computer games. Both of these participants also reported that they used computers to compose or play music. Table 4-11 lists the ways in which participants reported using computers before commencing the IT subject.
Table 4-11: Participants’ reported prior experience with computers

<table>
<thead>
<tr>
<th>Participants</th>
<th>Word Processing</th>
<th>Database</th>
<th>Spreadsheet</th>
<th>PowerPoint</th>
<th>Web Browser</th>
<th>Email</th>
<th>Games</th>
<th>Music Composition</th>
<th>Music Play</th>
<th>Programming</th>
<th>Formal Prior Learning</th>
<th>Used at School, University or Work</th>
<th>Years Experience</th>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
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<td>✓</td>
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<td>✓</td>
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<tr>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
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<tr>
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<tr>
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<tr>
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</tr>
<tr>
<td>Kevin</td>
<td>✓</td>
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<td>✓</td>
<td>5</td>
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<tr>
<td>Luke</td>
<td></td>
<td>✓</td>
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<tr>
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<td>3</td>
<td>9</td>
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</tbody>
</table>

All participants, therefore, commenced the IT subject with some experience with common computer software programs that could be used within teaching. This experience may have provided them with at least some familiarity with basic software functions on which the IT subject could build.
4.4.2 Computer platform familiarity

One of the factors that may have influenced participants’ ability to develop fluency with information technology was the type of computer platform with which they were familiar. Many schools use the Apple Macintosh computer platform. This platform is also the one used in the Faculty of Education computer laboratories.

All students reported that they were familiar with the PC computer platform and used this platform at home. Whilst they reported having some trepidations about using Macs, they reported that they found them easier to use than they had anticipated. In addition, using the two platforms provided the opportunity for participants to consider the similarities of computer functions between platforms. For example, Luke said “So that sort of made me think that every computer is relatively similar in some way; so it’s been good to try and do stuff here and then go home and try and do it at home.” Similarly, Isabel said “You adapt, like different things like ‘control C’ you change to ‘Apple C’”.

Overcoming their fear of a different type of computer through using it and recognising the similarities between computer platforms may enable participants to more readily transfer what they learn on one type of computer to another. This may enhance their adaptability to new technologies.

4.4.3 Attitudes to information technology

The researcher asked participants questions about their attitudes towards IT, especially in relation to their interest and anxiety with using IT, as these are common themes in the literature on attitudes to the use of IT. Participant responses were categorised by anxiety about using IT and interest in IT as these reflect different ends of the attitudinal spectrum.

4.4.3.1 Anxiety

Ann, Brian, Jenny and Kevin reported that they felt anxious or unsure of IT when they were learning something new about it. Ann’s response typified this when she said “I get anxious very easily if I can’t do something… Not knowing how to do it or I’m confused. It’s nerve-racking.” Their anxiety dissipated, however, when they were able to, as Ann said, “figure out how to do it”.

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On the other hand, Brian, Fran, Helen and Luke’s anxiety was concerned with their fear of the computer “crashing”, losing their work or not being able to complete their lesson as planned due to technological failure. This reflects participants’ fears about technology functions that may be beyond participants’ understanding or control.

Gemma’s anxiety stemmed from her concern about her teacher role assisting her pupils to learn to use computers. She said “I’m still a bit scared… I think I’d be able to show them but I don’t know if I could explain it to them in a manner that they would understand.” She did not, however, express anxiety about her own use of IT.

Fran was the only participant who expressed the view that her anxiety would prevent her from using IT in her teaching. When asked about how she would feel about being employed in a school where it was expected that teachers use IT in their teaching, Fran said “I hope I don’t do that. I’d be lost. I just feel comfortable doing all the ordinary work”.

Anxiety may be considered a negative disposition towards IT, yet the opposite end of the spectrum also needs to be considered. Participants were asked, therefore, about their interest in IT.

### 4.4.3.2 Interest

Ann, Brian, Debbie, Fran, Helen, Isabel, Jenny, Kevin and Luke all expressed that that they were not inherently interested in computers. Nor did their level of interest in IT change significantly as a result of learning about its uses in teaching. They primarily looked on IT in a practical way as a tool for teaching. Debbie exemplified this type of response when she said “I’ve never been overly interested in it that much and I don’t think I’m overly interested in it now. I just use it for what I need.” Similarly, Ann said “I suppose the interest comes from just wanting to teach and knowing that it’s a set part of the curriculum now. So an interest in that way but out of teaching probably, no interest in computers.”

In contrast, Carol, Eric and Gemma reported that their interest in IT had changed as a result of their learning. Carol said “I never used to be (interested in
IT). I dreaded actually this subject… I think the subject actually has made me a bit more interested in it.”

All participants reported that they acknowledged the usefulness of IT for teaching purposes. However, the change in Carol, Eric and Gemma’s level of interest in IT was associated with a change in emotional reaction to that usefulness. They became excited about learning to use IT for teaching. Carol said “I just got a digital camera… and so it’s all exciting trying to put that onto the computer… I think it’ll be exciting to use and change teaching so much”. Eric expressed enthusiasm for seeing how, with IT, “you can analyse (sport) performance… and if I wasn’t thrown in the deep end I wouldn’t have had a chance to experience all this”. Similarly Gemma said “I love computers… I think like it’s so much easier to type stuff off instead of handwriting it all out. I like them… I think I’ve grown heaps… It was fabulous, I was so excited.”

Isabel expressed contradictory views about her attitudes to IT. She emphasised that her focus was entirely practical, and yet she expressed excitement about the possibility of learning to use new technology in another IT subject. She said “So I just reckon it’s extremely exciting. We can do iMovies next year and I reckon that’s going to be awesome”.

4.4.3.3 Summary

Four participants’ (Ann, Brian, Jenny and Kevin) anxiety stemmed from their uncertainty about novel aspects of the technology. This anxiety disappeared, however, when they learnt to use it successfully. This type of anxiety, and its resolution, normally would be expected in novice learners of IT. Four other participants’ (Brian, Fran, Helen and Luke) anxiety arose from their concerns about the technology “crashing”. Fran was the only participant who expressed that her discomfort or anxiety with using IT would impede her use of it in the classroom.

Nine of the participants reported their lack of interest in IT itself, but they were interested in its purposeful uses for teaching. Three of the participants (Carol, Eric and Gemma) described that their interest in IT had increased as a result of their learning in the IT subject. This interest growth was associated with an excitement about the potential of technologies for the participants’ own teaching.
4.4.4 Computer self-efficacy

Computer self-efficacy refers to users’ confidence in their ability to use computers effectively. All of the participants reported that they were confident in using IT.

Nine of the participants (Ann, Carol, Debbie, Fran, Eric, Gemma, Helen, Jenny, Luke) reported that their confidence had increased as a result of their experiences in the IT subject. Jenny’s comment typified the responses of these participants when she said that “I’ve gone from, say on a scale of one to ten of knowing, maybe two about computers and now seven or eight, and now I’m heaps more confident just to jump on and use it, just get on there and have go.”

Gemma described how her knowing basic IT skills, as well as knowing how to find help, gave her the confidence to improve her IT abilities:

I’m more confident... It’s makes me want to learn more. That’s probably why I’ve spent a lot more time on the Webpage or even the spreadsheet, even though I knew how to do some of it, now I can improve on it, I can extend it... I mean I’ve got the basic skills to start so I know where to start, I know how to start and I know that if I had any issues with it I know where to go to ask for help, or even on the computer I know where to find the information now.

Carol reported how her increased confidence had allowed her to take on more responsibility for her home computer. She said that:

Even things like, because I’m now out of home, like mum doesn’t take care of the computer anymore, it’s my computer, so things like I never used to change the ink cartridge or anything like that so I’ve had to learn how to do that sort of thing and stuff so that’s a bit more exciting because I’m doing it myself, it’s my own.

Kevin reported that his confidence growth was only in relation to particular software with which he was previously unfamiliar. He said that:

I don’t think it’s given me more confidence to use computers because I’ve always felt that I haven’t been that bad in that way and I’ve always been confident in having a go. But in particular programs like spreadsheets, PowerPoint, web pages, yes it’s certainly given me more confidence in those specific areas.
In contrast, Isabel reported that she was confident with using IT “if it’s something that’s pretty basic and kind of parallel to what I’ve used before I’m quite confident to move my way around.” This suggests that Isabel’s confidence is linked to her use of familiar IT.

Whilst Brian claimed that his “ability has probably declined”, his discussion of this revealed that he meant that his knowledge of the range of new technologies was limited, and that he was “not keeping up with all the new things (technologies) that are coming up”. However, he did say that when he encountered a new technology in future, such as the digital audio recorder the researcher used, he would “really try and get the knowledge and skills involved”.

Participants’ successful development of contemporary IT skills through the first resource development activities may have contributed to participants’ confidence to continue learning about the use of IT in teaching. For example, Jenny said that “Those first three assignments were critical I think and having to practice them and get up to standard every fortnight, I think that was the main thing”.

Helen, however, found her confidence stemmed from applying her IT skills to a real context and creating real teaching resources for the Task 3 Project. She said that “my friend and I were probably a little bit more confident because we’d actually created something”.

The IT subject’s building on students’ prior knowledge was helpful for Brian’s confidence. He said that his “background knowledge was there and I didn’t think it would be at first, I thought I’d have to do a lot more and this is going to be so much harder, but it wasn’t as bad as I thought”.

Most of the participants’ confidence in using IT had improved by the end of the subject. Several participants felt confident enough to take on new technologies or extend their current learning. Only Isabel described her confidence as being limited to dealing with familiar technology only.
4.4.5 Motivation

Eight of the participants expressed views about what motivated them to continue their learning throughout the semester in the IT subject. Participant responses were categorised as either extrinsic or intrinsic.

4.4.5.1 Extrinsic

Brian, Carol, Debbie, Helen, Kevin, Luke claimed that meeting assignment submission deadlines was their primary source of motivation for their continued effort throughout semester. Carol said this plainly, that she was motivated “by the fact that you have to hand them in on time, the assignments”.

Isabel reported two separate, but related, issues that motivated her learning. The first was her wanting to achieve good grades. Linked to this achievement goal was her not wanting to waste the money that she paid for the opportunity to get her degree. Isabel said that “actually I have to keep having a reality check and saying, you know what? You’re paying for this. I don’t want to fail.”. Similarly, Debbie said that “I figure I’m paying good money to be here so I want to make sure I get the most out of it and do well and pass everything.”

Debbie’s motivation stemmed from her surprise at the degree to which IT was being used in teaching. Debbie realised the implications of what she was learning when she heard guest lecturers describe their use of IT in their schools. She said that “I was quite shocked about the extent that they were using IT.” Debbie recognised the need to keep up with technological developments when she said that “I was like, oh this is going to keep on growing and by the time we’re there we’re going to have to know more plus.”

Kevin also claimed that the cost of his course fees provided considerable motivation for him to succeed at his studies. He said that “I think, well this subject for instance is costing me money so if I don’t pull things out of this subject I’m just wasting my time.”

Luke, on the other hand, said that he was influenced to continue learning because of the “relaxed environment” in the IT subject.
4.4.5.2 Intrinsic

Brian reported that the relevance of the IT subject’s content to his future practice as a teacher assisted his motivation. He said that “I suppose motivation was a lot easier because I could see a lot more purpose in it”. His openness to learning also stimulated his motivation. He said that “you never know when you’re going to learn something new”.

Helen found motivation in her learning achievements. She said that “I think you can get a lot of satisfaction when you achieve something that from the beginning you thought you couldn’t achieve.”

Carol said that “I’m more motivated if it’s something that interests me”. Whilst Luke may have felt his motivation was enhanced by the relaxed learning environment within the IT subject, his interest also contributed to his motivation. He said that “it was all stuff that was quite interesting anyway so I never thought about it how I keep myself motivated.” This contradicted his earlier report of his interest in IT being a functional one.

4.4.5.3 Summary

Assessment deadlines provided an expected motivation for learning for six of the participants (Brian, Carol, Debbie, Helen, Kevin, Luke). Learning to use IT for teaching, however, motivated Brian and Debbie in different ways. Brian reported that he could see the purpose of learning to use IT in this way. Debbie, on the other hand, viewed her need to learn IT as an expectation of teachers by the time she will be working as a teacher. Both Debbie and Isabel cited, as a significant motivation for their successful achievement, their need to not waste the cost of their education.

Other participants’ learning was stimulated by intrinsic motivators, such as, the desire to “learn something new” (Brian), satisfaction with achievement (Helen), and personal interest (Carol and Luke).

4.4.6 Self-image

In order to explore participants’ self-image, the researcher asked participants to describe how they saw themselves. When participants expressed their uncertainty
about how to address this question the researcher suggested that “If I was meeting you for the first time and I didn’t know anything about you, what sort of things would you say to me in terms of telling me who you are, what’s important in your life, the roles that you play, how you see yourself? Those sorts of things.”

Ann, Brian, and Debbie described their personal characteristics related to work. For example, Ann and Brian described themselves, respectively, as “having a good work ethic” and being “hard working and fairly honest”. Debbie said that “I’m very independent. I’m fairly responsible I guess.”

Brian and Debbie also described themselves in terms of their temperament. Brian said that “I like to think of myself as very easygoing and approachable... I’m always willing to try anything that comes along, well most things.” Debbie said that “I’m pretty easygoing, happy.”

Other participants (Fran, Eric, Debbie and Jenny) described themselves as being a person who prefers to be outside. For example Eric said that “I’m an outdoor person, like I do triathlons so I’d rather be out training”. Debbie also reported that “I like camping and outdoor activities and stuff.” Fran, too, said that “I’d rather be outside... I get bored sitting in front of a computer, and tired... it’s just not fun. It’s all work.” This is not a surprising view from PE students.

Other participants were unable to describe their self-image or personal attributes. Instead, they described their interests or activities. These are addressed in the section on extracurricular activities.

Self-image as learner

Eight participants (Ann, Brian, Debbie, Fran, Eric, Gemma, Isabel, Kevin) described themselves as being “good” students, endeavouring to do the best they can. For example, Brian said that “I strive to do my best and that sort of thing. Not that I’m disappointed in my grades, I’m always looking for D’s and HD’s. I work very hard and I’m always looking to improve that.” Similarly, Gemma said that “I’m a good student, I’m one that’s very organised, very organised” and Kevin said “I think I’m a fairly conscientious student personally.”
In contrast, Eric said that “(I am) motivated, hard working, but (when) it comes to sitting down in front of a textbook and stuff, I have an attention span of about five seconds. If I look outside and it’s a nice day, bang I’m out the door on my bike, whatever, running somewhere.” This suggests that the reality of Eric’s actions may not meet his intentions. It also reflects his preference to be outdoors.

On the other hand, Helen said that “I make the grades but I probably could do a hell of a lot more. As a student I wouldn’t say I was hardworking... I guess I’ve just always made the grade without having to try too hard. I’ve just been lucky like that I guess.”

Jenny reported that she felt that it was a “privilege (to be)... a full time student... because my husband supports me so I don’t have to work like a lot of other uni students have to work on weekends.” However, she acknowledged that “I’d say I’m not a huge person that likes to study or anything, I’m more hands on, practical kind of person.”

Despite Ann’s claim that she wanted “to keep trying to get good marks”, she conceded that “It really isn’t probably my major priority in life, I could be a little bit more studious, that’s what I’m saying, but I try my hardest because everything else has to be in my life.” This suggests that Ann’s vision of herself as a learner was less important than other aspects of her life.

Isabel did not describe directly her self-image as a learner. Instead, she identified how she did not wish to be perceived by others. She said that “I don’t want to be seen as a huge partier with dismal grades, and I don’t want to be seen like a nerd with great grades, I really think you need that balance.” This suggests that the opinion of others is important to Isabel.

Luke described his reason for undertaking the degree. He said “I’m here now because it’s time to get a real job and do it properly, a career so to speak.” In order to achieve this he said that “I want to get through but I want to do well. I wouldn’t say that I’m an HD candidate or anything like that... I’m not too keen but I want to do well for myself... and I know that they (school employers) don’t particularly look at your marks.” This suggests that Luke’s view of himself as a learner is directed towards achieving his goal of a career in teaching.
Self-image as IT user

The researcher attempted to ascertain the participants’ views of themselves as users of IT. Most participants, however, described their confidence with using IT.

Brian viewed that he had not kept up with technological developments. He said that, consequently, “I’d probably say my ability has probably declined because I’m not keeping up with all the new things that are coming up.” Jenny saw herself as being “very basic with computers, not very advanced at all... An advanced user would be someone that can fix computer problems”. Kevin said that “I think I’m an average computer user but I think I’m ok, I think I can pick things up fairly quick.”

4.4.6.1 Summary

Eight participants described themselves as “good” students, but four participants saw themselves as people who preferred to be engaged in outdoor activities. Ann acknowledged that her desire to be studious was moderated by the other activities in her life. Isabel was concerned about other students’ image of her.

Three participants comments reflect different views about being a user of IT. Brian’s comments suggest that one should be aware of the latest developments in the field of IT. Jenny’s view suggests that solving IT problems is an important aspect of using computers. Kevin’s view suggests that one’s ability to be open to learning new technologies plays a key role in using IT.

4.4.7 Intellectual challenge

The aim of IT subject was to assist students to develop skills in using contemporary software and to be able to plan and develop educational resources for the application of IT to classroom teaching. However, participants’ reported perception of the degree of intellectual challenge they experienced during the IT subject focussed on their mastery of the technological tools only, and not on the application of those tools to their teaching.

Learning to use current software was perceived as an intellectual challenge by Carol, Debbie, Eric, Jenny and Luke. Their perception of this challenge primarily arose from their learning software skills that they did not have prior to commencing
this subject. For example, Luke said “One hundred percent, for sure, definitely (been an intellectual challenge). I didn’t know how to do a PowerPoint”, and Debbie said “It’s definitely making me think and remember, yes, it does engage your brain, definitely.”

While Carol had some prior experience with computers and using word processing software, she reported that it was being introduced to novel software that provided the challenge for her. She said that

I wouldn’t have been as interested I think if it was just really basic things that I’d seen before. If like say we just used Word or something like it and we had to explore that, that I probably would have got bored with because you use that pretty much every day for every assignment. So yes you get more interested because it’s a bit more challenging.

In contrast, Brian, Fran, and Gemma said that they had not felt intellectually challenged by learning to use the software because they had had prior experience with computers and software. Fran said “I’ve had a basic knowledge of what we’ve done previously to the course, in Year 12”. Similarly, Gemma said that the “I have used computers before and most people have used PowerPoint.”

Brian reported that he found the assignment challenging where he had to plan the use of computers to a real world context. It was the contextual application that provided the challenge for him. Brian said “this last assignment is quite challenging. Just because it’s so abstract, you have to make the classroom up, while you can use the classroom as the template, it’s quite hard to invent your own class”. Yet he later contradicted his perception of the intellectual challenge posed by the subject’s content when he said “In terms of intellectual quality, I wouldn’t think it’s been too challenging.”

4.4.7.1 Summary

Participants described their perception of the intellectual challenge of the IT subject with a primary focus on learning the software. Being introduced to novel software provided an intellectual challenge for five participants (Carol, Debbie, Eric, Jenny and Luke). The familiarity some participants had with the software hindered their perception of it as an intellectually challenging learning experience (Brian, Fran, and Gemma). Brian was the only participant who reported being
intellectually challenged by the assignment that required him to apply the principles he had been learning to a real world context.

4.4.8 Extracurricular activities

The researcher asked participants about their extra curricular activities. Ann, Debbie, Fran, Eric, Helen, Isabel and Kevin reported that they were engaged in some form of paid employment. Helen and Isabel reported having multiple jobs. Eric and Isabel admitted that they missed scheduled classes in order to work because, as Isabel said, “money was my priority”.

Sport was an extracurricular activity engaged in by all participants except, Ann and Luke. Brian and Fran were not specific about the type of sport they played. The both just said “I play sport”. Whilst Kevin reported that his sport focus was “Aussie rules”, Carol, Debbie, Eric, Gemma, Helen, Isabel and Jenny reported that they played multiple sports.

Gemma was the only participant who identified the amount of time she spent on her sport, “four or five hours a week” which she considered “not excessive”. Fran said that “I’m pretty heavily into sport” but did not specify how much time she devoted to it.

Eric said that his personal goal was to win at triathlon while he was young enough to compete. He said “My goal is I want to race elite for the triathlon”. Consequently, he recognised that this had an impact on his studies because he said that “(when) it comes to sitting down in front of a textbook and stuff, I have an attention span of about five seconds. If I look outside and it’s a nice day, bang I’m out the door on my bike, whatever, running somewhere.”

Brian’s interests were varied. He said that “I play sport and I’m into music... I play a number of instruments... Now I’m very much into film and that sort of thing, my girlfriend and I dabble in amateur documentaries”.

Luke was the only participant who identified his parental responsibilities as part of his extracurricular activities. He said that “my son, he sits at the top of the list every time and my fiancé… but I always make sure that I’m there if he wants to do something”.
Most participants identified their social activities as being important to them or consuming some of their free time. Socialising with friends and family was an important interest for six of the participants (Ann, Carol, Debbie, Helen, Gemma). Carol and Gemma ranked their social life as being of most importance to them. Carol said that “Probably I’d put my social life like being with friends and stuff at the top”, and Gemma reported that “Well I’d have family and friends first and then I’d probably have uni as second”.

Debbie viewed most of her activities through her enjoyment of them socially. She said that “Uni, that’s important for learning and socially, I really enjoy it... Work as well, I like where I work, it’s a nice social thing as well.”

4.4.8.1 Summary

Participants’ extra curricular activities may have been a factor in the participants’ commitment of time and effort towards their use of self-regulated learning strategies for developing their FITness. Seven of the participants indicated that they were in paid employment throughout their enrolment. Sporting activities were undertaken by ten of the participants. Not surprisingly, the participants undertaking the PE course reported the greatest commitment to their sporting activities. Only six of the participants specifically mentioned their social activities as being an important part of their lives. Carol and Gemma, however, placed their social engagements at the top of their priorities, outranking their studies.

This chapter described the findings of the study from analysis of multiple data sources. The next chapter will discuss the implications of these findings for the research questions of this study.
Chapter 5: Discussion and Conclusion

5.1 Introduction

This chapter presents a discussion of the findings of the study relevant to the research questions, and presents conclusions about the study and their implications for educators and future research.

This study was directed by a primary research question:

How can pre-service teachers use self-regulated learning (SRL) strategies to develop fluency with information technology (FITness)?

This primary question was sub-divided into three further questions that guided the research design, data collection and analysis:

1. What aspects of FITness can learners develop in a self-regulated learning environment?

2. What self-regulated learning strategies can learners use when learning to become fluent with information technology?

3. What other factors may influence learners’ becoming fluent with information technology through self-regulated learning?

The main findings from the study are discussed below in relation to each of the research questions.

5.1.1 Question 1: What aspects of FITness do learners develop in a self-regulated learning environment?

The educational intervention within the IT subject provided opportunities for learners to develop those aspects of FITness that were relevant to pre-service teachers and that were feasible within a single subject within the entire degree curriculum. These aspects of FITness included learners developing their: skills with contemporary software; intellectual capabilities of adaptability and problem-solving in using that technology; and a future orientation to professional development with IT. Each of these aspects will be discussed in the following sections.
Learners in this study developed skills in the use of contemporary technology

The learning design in the current study provided opportunities for learners to develop skills with contemporary technology through teaching resource development activities that reflected real world teaching practice. The resource development criteria rubrics and software evaluation checklists also provided an opportunity for learners to direct their learning towards relevant aspects of the technology. Learners in this study developed their skills in being able to use a range of contemporary software and other technology that is used within schools. They were able to complete the resource development activities successfully and use those skills to create teaching resources and plan for their use in a classroom setting. Learners in this study, therefore, were able to develop successfully the first stage of FITness. Being able to use contemporary software is equivalent to developing computer competence or computer literacy. This form of literacy is still deemed to be “one of the most essential skills in the knowledge society” (Mioduser, Nachmias, & Forkosh-Baruch, 2008, p. 29).

Participants’ achievement of being able to use contemporary technology, as the first level of FITness, suggests that they attained the standards for graduate teachers’ professional knowledge and professional practice by knowing how and being able to use IT to teach their subject content. Professional standards of teaching competence were developed, while this study was conducted, by the N.S.W. Institute of Teachers (NSWIT, 2005) and the Australian Institute for Teaching and School Leadership (AITSL, 2010). The national standards are available in an advanced draft form. Both sets of standards identify areas of teaching proficiency across three domains: professional knowledge, professional practice, and professional commitment/engagement. Each standard within each domain identifies levels or stages of professional competence to distinguish the characteristics of teacher expertise throughout their professional development. Similar levels of professional competence are included in both the N.S.W. and national standards, but the labels vary slightly. These levels include, state and national respectively: graduate teacher/graduate teachers, professional competence/proficient teachers, professional accomplishment/highly accomplished teachers, and professional leadership/lead teachers (AITSL, 2010; NSWIT, 2005).
This finding of pre-service teachers’ competence with current technology suggests that learning to become FIT may assist pre-service teachers to attain the standards for graduate teachers’ professional knowledge and practice for using IT to teach their subject content. FITness, however, requires intellectual capabilities in addition to computer competence. Teachers also need to be able to develop the intellectual capabilities to solve the problems they encounter in their use of IT for teaching (Markauskaite, 2007).

**Learners in this study demonstrated the intellectual capability of adaptability to different technology**

The ability to adapt to different technology is an intellectual capability that takes basic IT skills to a higher level of FITness. The learners in this study were given the opportunity to use a range of software to create the teaching resources and a concept map for the assignment tasks. Participants successfully demonstrated their ability to use all of the software programs. This suggests that the learning design encouraged participants to go beyond the limited instruction they received. Consequently, learners may be able to adapt to different or newer versions of software that they may encounter in their schools as graduate teachers.

The computers used within the IT subject’s tutorials were Apple Macs. These computers are commonly used in NSW schools. All participants in this study, however, were more familiar with the PC platform that they used at home or in their prior experience. Whilst their use of the Macs may have been initially challenging, all of the participants reported that they were able to use both platforms effectively by the end of the subject. Participants were able to describe their developing awareness of the similarities between the PC and Mac user interfaces. This suggests that the participants in this study may be able to adapt to using either of these computer platforms in their future schools of employment. This finding also suggests that encouraging learners to identify the similarities and differences between the computer platforms could be a useful starting point for preparing learners to think about ways to approach learning to use new technologies that they will encounter in their professional lives.

Being able to adapt to unfamiliar technologies is an important part of the intellectual components of FITness. Phelps, Hase and Ellis (2005) argue that
adaptability is largely ignored in the competency approach to computer training, especially for pre-service teachers. The current study has demonstrated that pre-service teachers are able to develop some adaptability to unfamiliar technology within a self-regulated learning environment. Future research may be able to clarify how adaptability is demonstrated in computer competence and, therefore, how to investigate the role of adaptability in pre-service teacher IT education, and types of instruction to foster the development of pre-service teachers’ adaptability as part of their FITness.

**Learners in this study attempted to engage in the intellectual capability of solving the IT problems they encountered**

The ability to solve basic IT problems that may arise in everyday use of IT is another intellectual capability of FITness. The design of the learning intervention in this study provided opportunities for learners to experience common IT problems. Participants in this study encountered a range of technological problems as they sought to learn a variety of productivity and educational software, and create presentations and teaching resources for the assignments. The resource development criteria rubrics provided challenges to stimulate learning, for example through the use of software features that had not been addressed in the tutorials. In addition, students were required to utilize some technologies, such as storing files on USB/thumb drives and CDs, printing, for which they received no specific instruction. Using these technologies generated problems that often occur in the real-world use of IT and required students to resolve these as they arose.

All of the participants in this study attempted to engage in at least some level of technological problem-solving. Ten of the twelve participants reported how they would “press buttons” and “fiddle around”. This reflects their active engagement in problem-solving. However, only seven of the ten participants added to this low-level solution-seeking by utilizing help resources, such as online Help or instruction manuals. A systematic approach to identifying solutions was described by only three of the participants.

Passive methods to deal with problems they encountered were reported by seven participants in this study used. These passive methods included turning off the computer and returning to it later, or finding alternative equipment to use.
All of the participants identified that they would seek assistance from others with their IT problems. This form of help seeking arose when participants were emotionally affected or frustrated by their ineffective solutions, or when they had exhausted their repertoire of solution strategies. These findings suggest that participants’ IT problem-solving may remain at a lower functional level and result in ongoing reliance on others’ help unless participants develop an effective systematic approach to problem-solving.

**Learners in this study were unaware of their problem-solving process**

Learners in this study did not articulate their approach to the problem-solving process. Although they were able to describe the methods they used to generate solutions to the problems they encountered, they did not explain how these methods were part of a broader approach to their problem-solving.

Problem identification and clarification, as the initial phase of problem-solving identified by the NRC CTL FITness report (1999), were addressed by only two participants. One participant asked another person to identify the problem for her. A second participant described how he sought to identify whether the nature of the problem was concerned with issues that he could address, such as with software or external connections, or with issues in the internal hardware or operating system that he believed were beyond his expertise.

Similarly, only two participants described their approach to judging the effectiveness of their implemented solution. These participants were concerned with whether the technology worked as they wanted. None of the participants were able to explain how their solutions addressed the issues of the initial problem. This is an expected consequence when the nature of initial problem is not clarified.

This suggests that participants’ emphasis on implementing solution methods may reflect the action orientation of sport-focused participants. It may reflect participants’ interpretation of the researcher’s questions. It is possible that it also reflects participants’ under-developed metacognitive abilities in their approach to solving the IT problems they encounter.
This finding is consistent with other studies (Hilberg & Meiselwitz, 2008; Markauskaite, 2007) that report the difficulty university students have in achieving higher order levels of IT literacy. Instead of FITness concepts, these studies (Hilberg & Meiselwitz, 2008; Markauskaite, 2007) used the conceptual framework and data collection instruments proposed by the USA Educational Testing Service (ETS, 2007) to define and measure ICT fluency. According to the ETS (2002, p.16) ICT literacy means “using digital technology, communications tools, and/or networks to access, manage, integrate, evaluate and create information in order to function in a knowledge society”. Inherent in these concepts are both cognitive and technical skills. The concepts of FITness and ICT literacy appear superficially different, but they both require higher order cognitive skills as well as technical skills. Therefore, the findings of these studies may be compared with the current study.

These studies differed from the current study in the student populations they sampled. The sample group of Hilberg and Meiselwitz’s study (2008) were drawn from undergraduate students undertaking a course in computer and information systems within an American university. Graduate students enrolled in a Masters of Teaching within an Australian university was the group from which Markauskaite’s (2007) study sample was drawn. Nevertheless, these studies’ investigation of university students may provide insights relevant to the current study.

Metacognitive reflection strategies have been used successfully with practising teachers (Phelps, Graham, Brennan, & Carrigan, 2006) and pre-service teachers (Phelps, 2007) within Australia to promote identification of their knowledge and beliefs that influenced their learning to use IT in their teaching. Developing metacognitive awareness of their learning to use IT assists teachers to become more self-directed and independent in their use of IT for teaching (Phelps, 2007; Phelps et al., 2006).

The findings within the current study and studies by Hilberg and Meiselwitz (2008) and Markauskaite (2007) are consistent in that the acquisition of technical skills and confidence with using IT does not lead to the cognitive capabilities of being able to solve IT-related problems. This suggests that underdeveloped metacognition and/or problem-solving skills are likely to have an impact on
participants’ ability to become fluent with information technology because they may be unable to use the technology independently. This is particularly important as that technology changes and develops in future. The current study contributes to knowledge in this area by demonstrating that first year undergraduate students from the PE and EC specialisations of a teaching degree at an Australian university also have difficulty in achieving the higher order aspects of fluency with information technology.

The studies by Phelps et al. (2006) and Phelps (2007) suggest that metacognitive reflection may need to be included explicitly in a learning design that seeks to foster teachers’ independence in their use of IT for teaching. Further research into pre-service teachers’ use of metacognition in IT problem solving could assist our understanding of this issue in order to assist the design of relevant instructional processes.

The emotions of learners in this study influenced their problem-solving self-efficacy

Half of the participants in this study described how their emotions encouraged them to pursue their IT problem-solving. They experienced satisfaction when they were able to “figure it out” on their own, or when they recognised the value that their problem-solving would contribute to their learning.

In contrast, other participants reported that their problem-solving efforts were inhibited by their emotions. Their fear of the computer “crashing” or frustration in not solving the problem quickly resulted in these participants adopting passive methods of problem-solving, or in seeking help from other people instead of solving the IT problem on their own.

These findings suggest that participants’ emotions contributed to their levels of confidence and persistence in solving their IT problems. The relationships between motivation, self-efficacy, problem-solving style and academic performance of university students has been shown to be a reciprocal one. A quantitative study of undergraduate students from a range of faculties at a Spanish university found that students’ self-efficacy for utilizing study strategies determined their ability to use their knowledge and skills effectively for learning (Fenollar,
Similarly, a study of undergraduate students studying psychology at an Irish university found that students’ ability to successfully engage with learning and problem-solving was affected by their motivation (Cassidy & Giles, 2009). The students’ motivation was, in turn, affected by their learning and problem-solving success.

The finding of the current study, undertaken in a different context with undergraduate pre-service teachers at an Australian university, is consistent with those studies. This suggests that such a reciprocal relationship between learners’ emotional reactions, motivation and their problem-solving performance may occur commonly across learning contexts.

The role of students’ emotions on their problem-solving motivation and efforts has implications for future educational practice and research. Instruction in, and practice of, the approach to solving common IT problems may lead learners to experience positive emotions when they successfully solve those problems. Associating these positive emotions with successful problem-solving may encourage learners to persevere with their problem solving efforts in future. Learners’ abilities to successfully apply their problem-solving skills to a variety of IT problems they may encounter may assist their development of this important problem-solving aspect of FITness.

Participants in this study had difficulty in developing the sustained reasoning of IT problem-solving, which is one of the intellectual capabilities of FITness. This suggests that participants’ experience in developing the technical skills with IT, both before and within the IT subject, was, by itself, insufficient to enable them to develop the high-level thinking skills required to become FIT.

This study found that participants experienced difficulty in developing the sustained reasoning of IT problem-solving. This contrasts with Prensky’s (2001) claim that young people are better prepared for a technological world because of their access to a range of technologies. Indeed, this study’s findings about participants’ experience and skill with IT is consistent with other research that suggests that such opinions, similar to Prensky’s (2001), about the level of IT expertise in commencing university students may be overly optimistic (Dawson,
Forster, & Reid, 2006; Drenoyianni, 2004; Katz, 2007). Consequently, this study confirms Bennett, Maton and Kervin’s (2008) argument that the concept of young adults as a “digital native” generation has little empirical foundation. The commonalities between the findings of this study and recent research literature suggests that the current study is still relevant to pre-service teachers in today’s IT teaching and learning environments.

**Learners in this study would rely on school-based resources for their IT professional development**

Despite the focus in the IT subject on the current and future use of IT in school education, only eight of the participants in this study acknowledged the need to engage in ongoing professional development with information technology. Participants identified primarily school-based resources that they would use for their IT professional development. These resources in the school in which the participants may be employed included other teaching staff or IT staff at the school (8 participants), in-service programs run at the school (5 participants), an IT journal that may be available at the school (2 participants), and their own pupils (2 participants).

Four participants in this study identified their friends and family as resources external to their school from whom they may learn about new technological developments. One participant indicated that she was prepared to undertake a course external to her school from which to learn more about the use of IT in teaching. Three participants emphasised that the only external course that they might consider would be in their field of teaching, such as child development.

The current study found that participants recognised the need for their professional development with IT and were able to identify sources for that development. This suggests that participants were able to begin thinking about their development of this aspect of FITness. However, it also suggests that participants did not develop a strong commitment to their professional development with IT. This has implications for the pre-service teacher preparation programs. Pre-service teachers may need guidance in identifying opportunities for their professional development as graduate teachers.
Developing a commitment to future professional development with IT is an important part of being FIT. Since this study was conducted, a commitment to professional development has become a key standard for teaching professional practice in Australia (AITSL, 2010; NSWIT, 2005). This study’s finding suggests that developing FITness may assist pre-service teachers to meet the teaching standards expected of graduate teachers with regard to their use of IT in their teaching practice. Future research investigating this link between FITness and teaching standards could add to our understanding of the potential relationship between these issues.

Learners in this study identified issues that could affect their professional development with IT. A willingness to learn was considered, by four of the participants, to be a major factor in their IT professional development. However, the reliance on formal and informal school-based resources by 10 of the participants may limit their options for their future development. This is particularly significant if the school resources are not conducive to teaching with technology. Inadequate IT facilities and other teachers as negative role models for using IT in teaching were identified by three of the participants as possible barriers to their IT development within their employing school. None of the participants addressed what strategies they might use to overcome these barriers in order to pursue their ongoing IT development.

This finding adds to the evidence from other studies (Adamy & Boulmetis, 2006; Lambert, Gong, & Cuper, 2008) that teachers’ modelling of ICT-integrated teaching may be a significant factor in pre-service teachers’ development of confidence in using IT for teaching. Adamy and Boulmetis’ (2006) study addressed pre-service teachers’ changes in confidence in using technology as a result of their seeing academic teachers model the use of IT in their own teaching. Lambert, Gong and Cuper’s (2008) study also used the modelling of IT integration by academic teachers as part of their study of pre-service teachers’ attitudes to the use of IT for teaching. Similarly, in the current study, participants observed their academic teachers in the IT subject modelling the use of IT in their teaching. However, participants were exposed, during their teaching practicum placements, to practising teachers and their attitudes and use of IT. One participant noted the discrepancy between her attempts to use IT in her practicum placement and her teacher not using IT in her teaching. This
suggests that the encouragement and confidence learners develop for using IT for teaching by observing their academic teachers, may be undermined by the attitudes and poor modelling of teachers that pre-service teachers might encounter on their practicum placements. Future research could enhance our understanding of the influence of modelling the use of IT in teaching on pre-service teachers’ attitudes to integrate IT into their teaching practice.

The participants were in their first year of their teaching degree. Their reliance on using school-based resources for their professional IT development may reflect their limited knowledge about professional development opportunities for graduate teachers. It may also reflect the participants’ reliance on opportunistic learning rather than their active seeking of development opportunities. This suggests implications for schools in terms of providing adequate opportunities for professional development with IT. Indeed, access to adequate professional development has been shown to be essential for teachers to integrate IT successfully into their teaching (Brinkerhoff, 2006; Culp, Honey, & Mandinach, 2005).

Participants in this study acknowledged their need for ongoing professional development with IT, and identified resources that may assist that development. This indicates that they have developed at least the beginning of this aspect of FITness. However, participants’ pursuit of their IT development may be hindered if they do not have access to adequate IT development opportunities within the schools in which they will be employed (Jamieson-Proctor & Finger, 2006).

Learners in this study were given opportunities within the educational intervention implemented in the IT subject to utilize self-regulated learning strategies in order to become fluent with information technology. The types of SRL strategies that pre-service teachers can use to develop FITness is addressed in the next section.
5.1.2 Question 2: What self-regulated learning strategies can learners use when learning to become fluent with information technology?

This study utilized a self-regulated learning design to assist learners to develop their FITness. Learners were given access to a number of self-regulated learning resources to assist their strategies for learning FITness. These resources were provided to aid learners’ development of important aspects of self-regulated learning, that is, planning and cognition. The significant features of learners’ use of these strategies and resources are discussed below.

Learners in this study used only those planning resources relevant to the assessment tasks

Learners used the assessment criteria rubrics that were provided for the resource development activities. These planning resources clarified the aspects of the assignments that would be assessed and identified the possible grades that could be attained at increasing levels of complexity. Learners used these resources to direct their learning efforts towards providing evidence of their learning that met their perceptions of their assessors’ expectations. This suggests a strategic approach to learning. However, by identifying the learning outcomes specified in the resource development criteria rubrics, participants needed to be able to identify the resources, such as text, images or audio files, that they would need to meet those learning outcomes. This suggests that participants used the resource development criteria rubrics for their forward planning of their learning.

Participants also reported using the resource development criteria rubrics to check that the outcomes of their learning activities matched the goal they planned to achieve. This suggests that participants used the resource development criteria rubrics for self-monitoring of their goal achievement.

Eight of the learners in this study used the resource development criteria rubrics to set their own learning goal or to achieve a particular grade. The goals of some learners were to achieve the highest grade. Two participants, however, were content to set a medium grade goal. Two participants used a “scatter gun” approach of providing many features in the hope that some matched the assignment requirements.
The checklist of features to address in the educational software evaluation assignment was another planning resource used by learners in this study. This resource helped learners to identify the evaluation issues towards which learners needed to address the assignment. Ten of the learners in this study found this aspect of the checklist helpful for giving the assessors what they wanted, identifying relevant issues to include in the assignment or to save time in completing the assignment. Others, however, expressed dismay that the checklist was not as specific as the resource development criteria rubrics had been. Consequently, these learners felt that they could not use the checklist to set their grade achievement or performance goals.

Learners used the resource development criteria rubrics and educational software evaluation checklist for forward planning of their learning. They also used these resources for self-monitoring in order to ensure that their assignments met the assessment expectations. This finding reflects the findings of Andrade and Du’s (2005) study of students’ use of rubric tools. Andrade and Du (2005) conducted focus groups with pre-service teachers who had completed a subject in educational psychology in which assignment rubrics were used. Participants in that study also used the assignment criteria rubrics to gain a particular grade or to meet their perceptions of what their teacher expected in the assignments. The similarity between the current study’s findings and those of Andrade and Du (2005) suggest that assignment criteria rubrics may help to focus students’ learning, but the degree of learning may be influenced by the achievement/performance goals of the learners.

Other resources were provided to assist learners to plan their general approach to learning throughout the subject. These included a general planning checklist and a web design matrix table. Learners in this study, generally, did not use these resources. Learners’ reasons for not using these resources included their being unaware of them, forgetting about them, or their perception of these tools as effort or time-consuming. Only one learner identified that she did not use the general planning tool because her own method duplicated the resource purpose.

Learners in this study used only those planning resources that were related directly to assessment achievement. They ignored or were unaware of the other
planning tools that were provided to them to assist their learning. This reflects a strategic, assessment-driven approach to learning during the Forethought, Planning and Activation Phase of Pintrich’s (2000b) SRL framework and has implications for educational practice that seeks to assist learners to develop their FITness.

Recent studies of the relationship between interest and goal adoption found that learning activities play a role in enhancing learner interest and consequent adoption of learner goals (Harackiewicz, Durik, Barron, Linnenbrink, & Tauer, 2008; Hulleman, Durik, Schweigert, & Harackiewicz, 2008). Both of these studies were conducted with undergraduate students enrolled in introductory psychology subjects at American universities. These studies found that learners who already had a high interest in the content area were likely to adopt mastery learning goals. However, they also found that learners with low initial interest may be stimulated by learning activities that they perceived as useful to their future goals. Consequently, the interest of these learners was likely to increase and they were more likely to adopt mastery learning goals as the semester progressed.

The current study included an active learning environment with learning activities focused on teachers’ real world tasks of developing IT-based teaching resources and plans for their use within teaching practice. It was anticipated that this design would enhance learner interest and motivation through the activities’ relevance for the participants’ future teaching practice, stimulate learner interest and assist higher order goal setting. Despite this design, participants adopted an achievement/performance goal orientation. Whilst only three participants confirmed that their interest in IT had increased as a result of their learning experiences during semester, nine of the participants claimed that they had little interest in IT and that their interest had not changed throughout the semester. This finding contrasts with those of Harackiewicz et al. (2008) and Hulleman et al. (2008) and suggests that learner interest in the content area of IT may play a significant role for pre-service teachers’ goal setting and experience of learning activities. That is, pre-service teachers with a low interest in IT may not adopt higher learning goals even if the learning activities are made relevant to their future teaching practice. Future research that examines this relationship between interest in IT and goal setting may enhance our understanding of these issues.
Learners in this study generally used lower order cognitive strategies when learning to use new software

Participants’ choice of learning strategies is relevant to the Control Phase of Pintrich’s (2000b) framework. Participants in this study tended to discuss their learning to use IT mainly with reference to the software programs they used. Nine learners in this study tended to use rehearsal-type strategies when exploring new software. Participants used terms to describe their methods of exploring the software that were similar to the terms they used to describe their methods of solving IT problems. These methods included: “fiddling around” or “playing” with the software to “see what happens”, keeping notes about procedures to follow, repetition of procedures, and being shown by others. Learners were unable to explain, however, how these methods enabled them to develop a working knowledge of the software. This suggests that learners did not develop a metacognitive awareness of their own learning methods.

Several learners did utilize elaboration strategies when learning new software. These included question-directed exploration of the software, using the “Help” features (5 participants), experimentation with specific software tasks (4 participants), discussing the software functions with others (1 participant), and relating the unfamiliar to the familiar features from their prior experience with computers (3 participants). Students’ use of “Help” resources has been found to be focussed on their attempting to complete learning tasks quickly rather than to enhance their learning (Aleven, McLaren, & Koedingen, 2006). Nevertheless, participants’ use of this range of strategies reflects learners’ burgeoning ability to adapt to unfamiliar software by engaging more actively with it.

This suggests that conceptualising how the software works, however, may provide a better way to integrate knowledge about specific technologies into a mental framework or schema for transfer to learning unfamiliar technologies in technologically changing teaching contexts. Only two learners utilized organisational cognitive strategies that may be helpful in this way. These learners created mental maps of the structural menu functions of software as cues to understanding how to use the software. In this way, they were able to aid their
cognition by integrating their understanding of the unfamiliar technology into their existing mental schema.

The use of mostly lower order cognitive strategies by participants in this study during the Control Phase of learning suggests that their focus was on action rather than understanding. Learners’ emphasis on being able to perform procedural actions with IT without creating an overall mental framework may limit their ability to adapt effectively to new technologies that they will encounter in future (Markauskaite, 2007; Urban-Lurain, 2003).

Metacognitive guidance or self-questioning tools have been shown to enhance learners ability to self-regulate and to develop conceptual structures for primary school teachers learning algebraic reasoning (Kramarski, 2008). The current study’s design included providing students with a general planning checklist which consisted of questions to ask of themselves and their learning. It was anticipated that this self-questioning tool may assist learners to improve their planning and metacognition. Participants’ failure to use this general planning checklist resource and their poor ability to articulate their learning methods suggest that learners’ current level of metacognitive knowledge and skills may hinder their ability to develop higher levels of FITness.

Practising teachers undertaking graduate study at a university in the USA demonstrated that they were able to articulate their knowledge of metacognition, demonstrate their own thinking processes out loud, and instruct their pupils in developing their metacognitive skills (Wilson & Bai, 2010). Participants in the current study were in their early years of their teaching preparation degree. Their use of lower order cognitive learning strategies suggests that they may not have had the opportunity to mature as learners or have had sufficient teaching practice by the time this study was conducted. They may need guidance in identifying and developing their metacognition, particularly in relation to their learning to use IT for their teaching. Future research that explores practising teachers’ use of metacognition in their use of unfamiliar technologies could shed more light on this issue.
Learners in this study were unable to use concept maps effectively to represent their knowledge

The concept map assignment provided an opportunity for learners to experience a cognitive organisational strategy as they sought to illustrate their understanding of the use of IT in teaching. Learners’ use of this higher order learning tool, however, reflected a surface approach to learning (Entwistle & McCune, 2004).

Participants in the current study received one 15 minute session where they were introduced to the features of concepts maps and concept mapping software, and given Get Started notes for the software. The instructions for the concept mapping task were included in the subject outline. No concepts were provided to learners. It was anticipated that this introduction to concept maps might stimulate learners to consider the usefulness of concept maps to represent their knowledge about how to use IT for teaching. In contrast, Trifone’s (2006) study provided multiple sessions for participants to learn about the features of concepts maps and concept mapping software. Participants were given the opportunity to practice and receive feedback on their own concept maps using concepts provided by the teacher. The participants in Zak and Munson’s (2008, p.34) study, however, received “information about concept maps, procedures on how to create concept maps, an example of a well-constructed concept map, and the instructions and materials for creating their own ecological concept map”. The concepts were provided to the participants.

The features of participants’ concept maps in the current study and Trifone’s (2006) study were scored using the method proposed by Novak and Gowin (1984). Zak and Munson’s (2008) study used a different scoring system, but examined similar meaning-making features, such as propositions.

Learners in the current study demonstrated their ability to use the concept mapping software to create concept map objects, such as text nodes and linking lines. However, the features of concept maps that help to convey meaning, such as the organisation of concepts, formulation of propositions, and creating a hierarchically subsumptive structure with cross-links, were used inconsistently, erroneously or omitted from the learners’ maps. This suggests that the minimal
instruction provided to learners in this IT subject may have been inadequate for first year university students who have not yet developed ways of identifying their knowledge structure. Consequently, this suggests that the design for learning to construct concept maps may limit the meaningfulness of the data that the concept maps generated.

However, the lack of the meaningful concept map features was also found in Trifone’s (2006) and Zak and Munson’s (2008) studies that provided more support for student learning concept map construction than the current study. This suggests that a factor other than instructional method might influence learners’ ability to construct meaningful concept maps.

The problems with meaning creation in the concept maps of participants in the current study suggests that learning to use the concept mapping software in addition to learning how to construct a concept map and generating their own concepts may have created an excessive cognitive load for participants. The increased cognitive load that unfamiliarity with concept mapping poses for learning was demonstrated in a study by Schaal (2010) of lecturer-generated concept maps for pre-service teachers learning biology at a German university. Hilbert and Renkl’s (2009) study of German police academy students also found that learning to create concept maps with computer tools generated a significant cognitive load for learners. This suggest that participants may have perceived the task of demonstrating their use of the concept mapping software to be more manageable by not engaging with the development of their conceptual knowledge of appropriate concept map features. Participants may have simply made a strategic decision about the amount of effort they were prepared to expend on a cognitively challenging assessment task. This would be consistent with their achievement/performance goal orientation.

Learners’ use of words in their concept maps reflected a surface approach to learning by reproducing or paraphrasing the lecture notes or identifying few concepts. Only two of the four EC and two of the seven PE learners’ concept maps included word usage that could be associated with deep learning by using novel concepts, examples, or explanatory terms. This may reflect learners’ interpretation of the assessment task as being a memory/knowledge testing task rather than a
knowledge integration and representation task. This suggests that clarifying the purpose of this type of assessment task may be important to consider in future educational planning.

Participants in this study were not able to use concept maps effectively to represent their knowledge and, therefore, did not use this cognitive learning strategy to enhance their self-regulated learning. This finding is not surprising in light of participants’ use of lower order learning strategies. This suggest that learners using lower order learning strategies reflects a low level of self-regulated learning. A similar finding was identified in Lim, Lee and Grabowski’s (2009) study of undergraduate students studying statistics. In that study, learners with low levels of self-regulated learning, as measured by the Motivated Strategies for Learning Questionnaire (MSLQ), were unable to use concept maps effectively for their learning, whereas the converse was true for students who demonstrated a high level of self-regulated learning.

Similarly, a recent study demonstrated the link between motivation, self-efficacy and approaches to learning among undergraduate psychology students at a UK university (Prat-Sala & Redford, 2010). The findings of this study revealed that learners with a high self-efficacy for reading and writing were likely to adopt a deep approach to learning. However, learners with a low self-efficacy for reading and writing tended to adopt a surface approach to learning. This contrasts with the findings of the current study where participants reported their confidence in being able to use IT and yet they adopted a surface approach to learning to construct concept maps.

The comparison between the findings of the current study and recent studies by Lim, Lee and Grabowski’s (2009) and Prat-Sala and Redford (2010) study suggest that there may be a reciprocal relationship between the level of self-regulated learning, self-efficacy in the content domain and the ability to create meaningful concepts maps for learning. Future research may be able to enhance our understanding of this issue, particularly with pre-service teachers.

Participants’ use of lower order cognitive learning strategies during the Control Phase may be a logical consequence of their setting of lower order strategic
learning goals during the Forethought, Planning and Activation Phase of Pintrich’s SRL (2000b) framework. This suggests a dependent relationship between the Control Phase and the decisions made during the Forethought, Planning and Activation Phase. This has implications for educational practice that encourages appropriate goal setting in the early stages of the learning process.

This finding suggests that decisions learners make about their learning goals may affect their subsequent thinking and actions throughout the learning cycle. Learners bring to the learning environment their experience from many aspects of their lives. It is likely, therefore, that other factors may have influenced participants learning to become fluent with information technology through self-regulated learning. These factors are addressed in the next section.

5.1.3 Question 3: What other factors may influence learners’ becoming fluent with information technology through self-regulated learning?

This section discusses other factors that may have influenced the learning of participants in this study to become fluent with information technology through self-regulated learning. These factors either arose from the data or were identified in the literature and considered of possible relevance to this study.

The prior experience with using information technology of learners in this study does not necessarily generate their metacognitive awareness

All of the learners in this study had at least some experience with using computers before enrolling in the IT subject. Ten of the participants reported that they had used computers at school, in their prior university studies or in paid employment. Nine of the participants had at least five years of experience with using IT.

The range of computer programs with which participants in this study were familiar, and the number of their years of experience with them, means that participants were not absolute novice computer users when they entered the IT subject. They had experience on which the IT subject content could build.

Despite participants’ IT skills developed from their prior experience, discussion of participants’FITness earlier in this chapter identified that they were
unable to develop higher order capabilities of being able to solve IT-related problems or articulate their problem-solving and learning methods. Participants’ poor ability to articulate the ways in which they sought to understand and use IT may reflect their under-developed metacognitive skills. This suggests that the development of IT skills, either from prior experience or within an IT subject, alone may be insufficient for learners to develop the metacognitive skills necessary for FITness. This finding is common to other studies of pre-service teachers’ IT literacy development (Hilberg & Meiselwitz, 2008; Markauskaite, 2007), and suggests that specific educational interventions may be required to assist learners to develop their metacognitive awareness in conjunction with their IT skills development.

Learners in this study perceived an improvement in their computer self-confidence

All of the learners in this study expressed an improvement in their self-confidence with using IT. Nine of the learners attributed their increased confidence with using IT to their experiences within the IT subject and were confident in being able to learn new technologies that they may encounter. This suggests that learners may be open to learning about and adopting new technologies in their future teaching if the practical usefulness of those technologies to their teaching practice is made evident to them. However, studies of pre-service and practising teachers’ use of IT by Hammond et al (2009) and Jamieson-Proctor and Finger’s (2006) found that pre-service and practising teachers’ computer self-efficacy may not be sufficient to overcome environmental and attitudinal barriers to the use of IT they encounter when they become graduate teachers.

However, half of the participant group who reported some improvement in their computer self-efficacy also reported that they lacked confidence and were unable to persist in their IT problem solving because of the negative emotions they experienced during their problem-solving activities. This suggests that attitudinal and motivational barriers could overwhelm the computer self-efficacy of novice teachers in their solving of IT problems. Future research could enhance our understanding of this issue by investigating the relationship of teachers’ attitudes and motivation in using IT in their teaching, and on their general computer self-efficacy and their self-efficacy for solving basic IT problems.
Whilst one participant viewed his computer skills as having declined, this may be due to his recognition of the range of technological developments with which he was not familiar. Kaminski, Switzer, & Gloeckner (2009) reported a similar view expressed by undergraduate students in a study of their perceptions of workforce readiness.

**Learners in this study perceived the usefulness of IT for teaching**

All participants in this study claimed to recognise the usefulness of IT for teaching purposes. Nine of the learners in this study indicated that they were not inherently interested in IT and that any interest they attached to its use was functional, as a teaching tool. This suggests that these participants perceived the usefulness of IT for their teaching role, despite their lack of inherent interest in IT.

However, three of the participants expressed an increased interest in IT due to their experiences within the IT subject. Not only did they see the potential for teaching purposes of the technologies they encountered, but they reported a feeling of excitement at considering how they might use these technologies in their future teaching.

This finding reflects similar findings from other studies (Angeli, 2004; Teo, Lee, & Chai, 2008; Yildirim, 2000) that found that pre-service teachers who participated in computer training perceived this technology as useful. However, Lambert, Gong and Cuper’s (2008) quantitative study of factors involved in pre-service teachers attitudes to IT revealed that those students with high levels of IT knowledge and skills held stronger beliefs about the usefulness of IT for teaching than their less knowledgeable colleagues. The current study differs from Lambert et al.’s study (2008) in its qualitative methodology that did not measure grades of pre-service teachers’ perception of usefulness. Nevertheless, the similarity of the current study’s finding to recent research suggests that the issue of pre-service teacher perception of the usefulness of IT remains a relevant factor in their development of IT skills for teaching.

This finding has implications for future educational practice in designing learning experiences that encourage pre-service teachers’ development of positive attitudes towards their use of IT in teaching, especially when their intrinsic interest
in the technology is low. Similarly, future research related to this area may investigate features of those learning environments and their influence on the development of pre-service teachers’ positive attitudes towards the use of IT in teaching.

**Learners in this study used extrinsic motivational factors to sustain their learning efforts**

Learners in this study claimed that developing their understanding of how to use IT effectively for teaching was important to them. However, this had less impact on their learning motivation than other factors. Participants reported that meeting assessment deadlines and successfully completing those assessments provided the primary motivation for their learning, possibly because they had little intrinsic interest in IT. Similarly, despite participants’ difficulties with sustained reasoning for their IT problem solving, participants reported that they were not intellectually challenged by learning to use IT.

Relying on extrinsic motivational sources may be a consequence of several other factors that impinge on these learners’ lives. Most of the learners in this study, like many university students (Krause, Hartley, James, & McInnis, 2005), were in some form of paid employment throughout the duration of this study. For some participants, work took priority over their attending class. Other learners in this study viewed their university course as secondary to their other interests, such as their social and sporting activities. Indeed, those participants who viewed themselves as being an “outdoor person” may have found it particularly challenging to maintain their focus on an indoor, technologically related activity. This may have been especially so for those participants who had no real interest in IT or who viewed themselves as not really being “a computer person”.

The learning design of the IT subject emphasised the integration of IT into teaching practice. Participants reported that they saw the usefulness of IT to their future teaching practice. However, several of the participants in this study still viewed IT as not being a core teacher activity. These participants saw it as a specialised aspect of teaching. When discussing other issues during the interviews, their real values about IT in teaching emerged. They claimed that they wanted to do “ordinary” teaching, or did not want to be employed in a school that expected
teachers to use IT. This suggests that participants’ low interest and motivation for using IT in their teaching after graduation could have an impact on their ability to develop the parts of FITness concerned with their independence in IT problem-solving and commitment to ongoing learning about IT. That is, pre-service teachers who wish to teach without IT are unlikely to develop the higher order thinking required of FITness.

This finding exemplifies the role that learner interest has on initial goal orientation adoption in the Forethought, Planning and Activation Phase of Pintrich’s SRL (2000b) framework and on the subsequent learning strategies that learners utilize within the Control Phase. The current study, therefore, adds to evidence from other studies about the effect of interest and goal orientation on SRL strategies and learning outcomes.

A study of Finnish and Serbian elementary pre-service teachers investigated the link between interest, attitude, experience and support in meeting educational technology standards set by ISTE National Educational Technology Standards for Teachers (Kadijevich & Haapasalo, 2008). The authors of this study (Kadijevich & Haapasalo, 2008) found that learners need experience with using IT in their teaching in order to improve their attitudes towards IT, and consequently enhance their interest in using IT in their teaching. This suggests that as participants use IT in the teaching after graduation their attitude towards its usefulness may improve, which, in turn, may enhance their interest in learning more about how developments in technology may contribute to their teaching practice. This may stimulate the commitment to their future professional development with IT and enhance their development of FITness as their career unfolds. Future research that investigates this relationship may enhance our understanding of this issue.

Summary

The findings of this study reflect key concepts of Pintrich’s (2000b) framework of self-regulated learning, that is, that learners’ knowledge about their motivation for learning, and knowledge about their cognition and metacognition play important roles in their identification and use of strategies for effective self-regulated learning. This is especially so for learners, such as the participants in this
study, whose learning interest is focussed on teaching content relevant to early childhood or physical education.

This study’s findings appear to be consistent with Goodyear and Ellis’ (2007, p.341) claim that “students interpret and prioritise task requirements”. Some of these interpretations and prioritisations are outside the control of lecturers designing the course. For example, learners purported to perceive the usefulness of IT to teaching, but this was tempered by their low interest in IT. Similarly, whilst most learners viewed themselves as “good students” and that learning was important to them, their extra-curricular activities and commitments (social, sport and employment) limited the effort they expended on their studies and so they focussed that effort on passing the IT subject. Consequently, learners in this study tended to use lower order cognitive learning strategies and tools. These strategies and tools assisted their completion of the assignment tasks and contributed to learners’ achieving the first level of becoming fluent with IT, that is, of developing skills with contemporary technology. However, the consequence of learners’ non-adoption of higher order cognitive learning strategies and tools was that the learners, generally, did not develop the higher order thinking necessary for developing the intellectual capabilities required to become fluent with information technology.

The findings of this study, therefore, suggest that learners may need more support in order to develop the level of self-regulated learning necessary for their professional development (Kadijevich & Haapasalo, 2008; Kramarski & Michalsky, 2009), particularly with regard to developing their fluency with IT. The implications of this study for educators is addressed in the next section.

5.2 Implications for educators

This study found that assessment rubrics can be useful tools to assist learners to set relevant learning goals, and monitor their achievement of those goals. The inclusion of specific and more complex rubrics for higher levels of achievement may also provide a learning stimulus for those learners seeking to strive for higher grades.
However, providing additional planning tools for learners is ineffective if learners do not explore the resources available to them on the subject’s WebCT site. Educators may need to assist learners to set appropriate learning goals, and draw learners’ attention to these resources on several occasions or create learning activities that require learners to use them. Learners can only develop their knowledge of self-regulated learning strategies if they are aware of, value and use the resources that can assist their learning.

Similarly, learners’ use of a cognitive organisational tool, such as concept mapping, will be less effective for higher order thinking if they use it within a surface approach to learning. The instruction on concept mapping provided within the learning design of the current study was brief, and may have been inadequate for learners to achieve the desired outcomes. Educators may need to provide more detailed and specific instruction to learners on how to construct concept maps for meaning creation and knowledge structure representation. Encouraging learners to adopt more elaborative and organisational cognitive learning strategies as they seek to develop their understanding of new technology may enable learners to develop deeper knowledge of IT structures and functionality. This could contribute to learners’ FITness.

Being able to solve common IT problems independently is a necessary feature of becoming fluent with IT. This study found that while learners were prepared to engage in attempting to solve basic IT problems, they lacked the metacognitive awareness of how their own thinking shaped their problem-solving efforts. Educators, therefore, may need to assist learners to identify an approach to problem-solving and encourage them to make their thinking explicit as they apply that process to solving IT problems. In this way, learners may begin to develop their metacognitive knowledge.

This study found that whilst these pre-service teachers may have had little inherent interest in IT, their practice in using IT to create teaching plans and resources helped develop their confidence in using technology for teaching, and assisted the development of their perception of technology as useful for teaching. This has significant implications on their future use of IT in their teaching and on their commitment to their future professional development. Educators may need to
consider the integration of IT into the broader curriculum of the teacher preparation degree so that pre-service teachers may see modelled good teaching practice with IT. Research suggests that the educators’ modelling of the pedagogical use of IT may contribute to pre-service teachers’ perception of its relevance to their own teaching practice (Adamy & Boulmetis, 2006; Collier et al., 2004; Gunter, 2001; Lambert et al., 2008). This may assist pre-service teachers’ recognition and acceptance of IT as part of good teaching practice, instead of adjunct or specialised teaching skills.

The effective instruction of tomorrow’s school pupils requires that pre-service teachers develop knowledge and skills in the use of IT for teaching, and develop appropriate self-regulated learning skills so that they may continue to adapt to technological changes throughout their professional lives. The findings of the current study suggest that pre-service teachers may need significant guidance and support to become FIT teachers of the future.

5.3 Further research

This study sought to investigate learners’ experiences with using self-regulated learning to develop their fluency with information technology. The study was exploratory in nature. It did, however, provide an opportunity for an in-depth examination of a specific context. The different types of data sources enabled examination of similarities and differences in emerging issues within that context. The findings of this study contribute to our knowledge about how learners use self-regulated learning in becoming fluent with information technology. The contextual features of this study mean that the findings may not be generalizable to all learning environments. However, the study findings do provide a stimulus for further research.

The context in which this study was undertaken was limited to first year pre-service teachers undertaking the physical education or early childhood teacher preparation programs in an Australian university. Further research could investigate how pre-service teachers in other content areas develop their FITness through self-regulated learning. For example, science or history pre-service teachers would be familiar with preparing classroom-based instruction. Their experience in
developing FITness through self-regulated learning may be different from the outdoor sporting-orientated participants of the current study.

Most of the participants in this study were in their first year of their degree course. They may not have had sufficient experience as university students to develop mature learning strategies. Pre-service teachers in their final year of study are likely to have a better understanding of teaching than those in their first year. Further research could explore how final year pre-service teachers utilize self-regulated leaning in their becoming fluent with information technology.

The current study found that participants’ interest in IT and their goal orientation may be related. Future research may be able to clarify the strength of that relationship, and the types of instruction that may assist pre-service teachers to set appropriate learning goals despite their low interest in IT.

Attitudinal and motivational barriers to novice teachers’ computer self-efficacy in their solving of IT problems were found in the current study. Future research that investigates the relationship of teachers’ attitudes and motivation in using IT in their teaching, and on their general computer self-efficacy and their self-efficacy for solving basic IT problems may contribute to our understanding of this issue.

The difficulty that the participants in the current study had with developing their metacognition for solving basic IT problems or learning unfamiliar technologies could provide the focus of future research. Future research that explores the development of metacognition in pre-service and practising teachers’ use of unfamiliar technologies may shed more light on this issue.

The findings of this study suggest that factors within the school environments in which the participants undertook their practicum placements may influence their adoption of IT for teaching. Further research could explore ways in which practicum environmental factors influence pre-service teachers’ attitudes towards and use of IT for teaching, and their development of FITness.

This study was limited temporally to a single semester within the lives of the participants. Their experiences as practising teachers since graduation may have
influenced their beliefs and attitudes about, and consequent use of, IT for teaching. Further research could explore the experience of recently graduated teachers in order to examine issues that may influence any change in values, beliefs and attitudes towards IT from those they espoused as students.

5.4 Conclusion

This exploratory case study makes a significant contribution to the limited knowledge base on pre-service teachers’ use of self-regulated learning to develop fluency with information technology. Recent studies related to the development of IT skills for undergraduate university students have used different constructs of IT fluency (Hilberg & Meiselwitz, 2008; Markauskaite, 2007) or have measured a single construct of FITness (Burns-Sardone, 2008). Other studies have investigated the use of technology to assist the development of self-regulated learning (Azevedo et al., 2008; Burner, 2007; Sitzmann et al., 2009). However, the experience of Australian first year pre-service teachers’ use of self-regulated learning as an instructional method to develop the FITness has not been adequately addressed in the research literature. This study has addressed that research need.

The findings of the current study suggest implications for educators to support the development of FITness through self-regulated learning, and suggest areas for future research. The need for teachers to become independent in their use of IT for teaching within technologically changing and complex contexts will continue to generate more issues for future research to explore.
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Appendices
Appendix 1: Human Research Ethics Committee Permission

FINAL APPROVAL
In reply please quote: RN:ES HE04/202
Further Enquiries: Eve Steinke (Ph: 42214457)

25 June 2004

Ms V Neville
28 Scarborough St
Bundeena NSW 2230

Dear Ms Neville,

I am pleased to advise that the following Human Research Ethics application has been approved. As a condition of approval, the Human Research Ethics Committee requires that researchers immediately report anything which might warrant review of ethical approval of the protocol, including: serious or unexpected adverse effects on participants, proposed changes to the protocol, unforeseen events that might affect continued ethical acceptability of the project and discontinuation of the research project before the expected date of completion.

Ethics Number: HE04/202

Project Title: Fitness through self-regulated learning: Towards the development of fluency with information technology.

Name of Researchers: Ms V Neville, Dr S Bennett & Dr J Herrington

Final Approval Date: 25 June 2004

Date for Renewal: 24 June 2005

This certificate relates to the research protocol submitted in your original application and includes all approved amendments to date.

Please note that research projects of long duration must be reviewed annually by the Committee and it will be necessary for you to apply for renewal of this application if this project is to continue beyond one year.

Yours Sincerely,

Assoc. Prof. Rod Nillsen
Chairperson, Human Research Ethics Committee

cc

Dr S Bennett & Dr J Herrington
Appendix 2: Participant Information Sheet

FITness through Self-Regulated Learning
EDIT102 Research Study

Victoria Neville (PhD student)
Supervisors: Dr Sue Bennett & Dr. Jan Harrington
Faculty of Education, University of Wollongong

Dear Student,

You have been asked to participate in the FITness through Self-Regulated Learning research study by Victoria Neville, under the supervision of Dr. Sue Bennett and Dr. Jan Harrington from the Faculty of Education at the University of Wollongong. The aim of this study is to investigate the influence of self-regulated learning on the development of capabilities for fluency with information technology in pre-service teacher education students.

If you consent to participate, your assignment work will be collected and analysed by the researchers. You will also be asked to participate in two interviews (no longer than 1 hour each) about your experience of learning to use information technology in this subject. These interviews will be audio-recorded and transcribed for analysis. Analysis will take place after the subject session has concluded and final marks have been submitted to the University. You will not be required to undertake any activities, other than the 2 interviews, beyond the usual requirements of the subject.

The following measures will be adopted to protect the identities of participants in the study:
- data collected will be stored securely in a locked filing cabinet in the Faculty of Education, and will only be accessed by the researcher and her supervisors
- identifying details, such as names and student numbers, will be removed from files prior to data analysis
- identifying details will be removed from any data used in publications arising from this study.

Your participation in this research is voluntary. You are free to refuse to participate and may withdraw from the research at any time by advising the researcher. Your refusal to participate in the research study does not exclude you from participation or requirements associated with the subject. Rather, it means that any information you may have provided in interviews or assessment tasks will be destroyed or returned to you if you wish, and not used in this research. Your refusal to participate or withdrawal of consent will in no way affect or your relationship with the Faculty of Education or University of Wollongong.

If you have any enquiries about the research, you can contact the researcher Victoria Neville by email at vmm53@uow.edu.au, or Dr. Sue Bennett by phone on 4221 5738 or by email at sue_bennett@uow.edu.au, or Dr. Jan Harrington phone on 4221 4277 or by email at Jan_Harrington@uow.edu.au. If you have any concerns or complaints regarding the way the research is or has been conducted, you can contact the Complaints Officer, Human Research Ethics Committee, Office of Research, University of Wollongong on 4221 4457.
Appendix 3: Participant Consent Form

FITness through Self-Regulated Learning
EDIT102 Research Study

Victoria Neville (PhD student)
Supervisors: Dr Sue Bennett & Dr. Jan Herrington
Faculty of Education, University of Wollongong

I have been given information about the FITness through Self-Regulated Learning research study by Victoria Neville from the Faculty of Education at the University of Wollongong. I have had an opportunity to ask the researchers any questions I may have about the research and my participation.

I understand that if I consent to participate my assignment work and interviews will be collected and analysed by the researchers. I understand that this analysis will be performed after the subject session has concluded and final marks have been submitted to the University. I have been advised that I will be asked to attend 2 interviews of no more than 1 hour’s duration, but will not be required to undertake any other activities beyond the usual requirements of the subject. These interviews will be audio-recorded and transcribed for analysis.

I understand that the following measures will be adopted to protect the identities of participants in the study:
- data collected will be stored securely in a locked filing cabinet in the Faculty of Education, and will only be accessed by the researcher.
- identifying details, such as names and student numbers, will be removed from files prior to data analysis.
- identifying details will be removed from any data used in publications arising from this study.

I understand that my participation in this research is voluntary. I am free to refuse to participate and I am free to withdraw from the research at any time. My refusal to participate in the research study does not exclude me from participation or requirements associated with the subject. Rather, it means that any information I may have provided in interviews or assessment tasks will be destroyed or returned to me if I wish, and not used in this research. My refusal to participate or withdrawal of consent will in no way affect or my relationship with the Faculty of Education or University of Wollongong.

If I have any queries about the research, I can contact Victoria Neville by email at vnm53@uow.edu.au, or Dr. Sue Bennett by phone on 02 4221 5738 or by email at sue_bennett@uow.edu.au, or Dr. Jan Herrington phone on 02 4221 4277 or by email at Jan_Herrington@uow.edu.au. If I have any concerns or complaints regarding the way the research is or has been conducted, I can contact the Complaints Officer, Human Research Ethics Committee, Office of Research, University of Wollongong on 02 4221 4457.

By signing below I am indicating my consent to participate in the FITness through Self-Regulated Learning research study, conducted by Victoria Neville under the supervision of Dr. Sue Bennett and Dr. Jan Herrington, as it has been described to me in the information sheet. I understand that the data collected from my participation will be used for conference and journal publications and I consent for it to be used in that manner.

Signature __________________________ Name (please print) __________________________ Date __________/________/________

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Subject Outline

EDIT102

Information Technology for Learning

Early Childhood, Physical and Health Education

Credit points: 6
Pre-co-requisite: N/A
Offered: Spring, 2004

Faculty of Education

University of Wollongong
Contacts

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Subject details

Subject Description
This subject provides students with the opportunity to learn and reflect critically on:

- The role of information and communication technology (ICT) in improving learning for all students;
- The support provided by information technology to the teacher in her/his professional activity and career.

Objectives
On successful completion of this subject students will be able to:

- Plan, manage and evaluate information rich learning environments;
- Integrate appropriate information technology in the curriculum in Early Childhood, Primary or Physical and Health Education;
- Use information technology to develop flexible teaching approaches to students with diverse learning needs and abilities;
- Use information technology to develop personal strategies in response to shifting demands and expectations of teachers in a rapidly changing educational landscape;
- Search the Internet, use word processing, data management (spreadsheets or databases) and authoring software packages.

Method of delivery
Delivery is through face-to-face classes with on-line resources and support.

Study Time
Students will be required to attend face-to-face classes as outlined on the subject schedule. Project teams are expected to arrange meetings in addition to classes.

Lecture/tutorial times
Check the timetable for class times.

Consultation times
Teaching staff will post consultation times for this subject on their office doors.
Attendednce requirements
A minimum attendance of 80% of tutorial classes is required. Attendance at lectures is strongly recommended.

Materials required
Students are advised to purchase a USB Flash drive of at least 64Mb. These are available from the Uni Shop or computer and electronics retailers.

Assessment Guidelines

Criteria
Assessment comprises three assignments: resource development activities (30%), educational software analysis (30%), and a project (40%).

To pass the subject: you need to ATTEMPT ALL components and obtain AT LEAST 40% of marks in EACH of the Assignments.

Marks will not be modified or scaled.

Submission
Assignments should be submitted in either in tutorial times. All text documents should be printed and other files should be provided on CD-ROM.

Assignment cover: Use the assignment cover sheet available from the Faculty of Education Homepage – http://www.uow.edu.au/educ/students/index.html. All electronic files must contain your student number in the document name.

Assignments will be returned in tutorial times or available from the assignment room.
Assessment Tasks

Task 1: Resource Development Activities
Due date: Ongoing assessment due in tutorial times
Weighting: 30%
Length: As specified

Resource development skills will be demonstrated individually and grades awarded during tutorial times prior to week 7. The activities below will enable students to demonstrate the application of skills they have learned in tutorials. Each activity is worth 10 marks.

ACTIVITY 1: Multimedia presentation
Due in Week 2 tutorial

Create a brief multimedia presentation for a class using PowerPoint on a topic of your choice. You should include a minimum of five slides demonstrating the use of text, at least 2 graphics, and a least one imported sound file.

ACTIVITY 2: Web site
Due in Week 4 tutorial

Use the content you collected for your PowerPoint presentation as the basis for a Web page. Design new navigation and page layouts appropriate for a Web site, and add more text and images. Include at least 3 links to external Web sites and add an engaging activity for students involving those sites.

ACTIVITY 3: Database (EC only)
Due in Week 6 tutorial

Create a database to record details of the resources you collected for your PowerPoint presentation and Web page. You should include a range of field types as appropriate, including text, number, calculation, pop-up or radio. Collect additional relevant resources until you have at least 10 records in your database.

ACTIVITY 3: Database (PHE only)
Due in Week 6 tutorial

Create a spreadsheet using the data and the instructions provided on the subject WebCT site.
Task 2: Educational Software Analysis
Due date: Presentations will be scheduled in tutorials during Week 7-9 as required. Individual component must be submitted in the tutorial in Week 9.
Weighting: 30%
Length: As specified below

ACTIVITY 1: Group presentation
Due in Week 7-9 tutorial as scheduled
(10 marks)

In your small group select a piece of educational software, and explore how it operates. Present your findings in 10 minutes to your tutorial class using the following format:

- Present an overview of the software including a short demonstration of a key feature.
- Comment on the pluses, minuses and interesting aspects.
- Present some ideas for classroom implementation.

ACTIVITY 2: Individual analysis
Due in Week 9 tutorial
(20 marks)

Using the guidelines on the WebCT site for your specialisation undertake an individual analysis of educational software.

Task 3: Project
Due date: Due in Week 13 tutorial
Weighting: 40%
Length: N/A

This assignment requires that you complete a project task related to your specialisation. The project will include a group and individual assessment component. Check the subject WebCT for guidelines for completing the task.
Schedule

The subject is structured in two parts. In Weeks 1-6 students will attend two lectures per week about general and specific concepts of using information technology for teaching and learning. In Weeks 7-13 there will be no formal lectures but students will be expected to meet independently in their small groups to work on their projects.

Students will attend a one hour tutorial each week of the session. In Weeks 1-6 students will be supported to develop and apply skills in using particular software packages. Tutorial classes in Weeks 7-13 are set aside to schedule group presentations on educational software and to allow project groups to report on their progress and seek assistance from their tutor.

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<thead>
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<th>Week</th>
<th>Classes</th>
<th>Tutorial topics</th>
<th>Assessment due</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Lectures as per the timetable.</td>
<td>Multimedia presentations</td>
<td>PowerPoint presentation</td>
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<tr>
<td>2</td>
<td></td>
<td>Web page development</td>
<td>Web site</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Database construction</td>
<td>Database/Spreadsheet</td>
</tr>
<tr>
<td>4</td>
<td>Project work in small groups.</td>
<td>Educational software presentations and project team support and reports as required.</td>
<td>Educational software analysis</td>
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Additional information

Plagiarism
Students should refer to the University of Wollongong’s policy on Plagiarism available on the University Online Calendar, http://www.uow.edu.au/handbook/courserules/plagiarism.html
Plagiarism is not acceptable and may result in the imposition of severe penalties.

Assessment Submission by Post
The date of submission by post for distance students will be the postmark date stamped on the assignment envelope.

Extensions
For specific guidelines regarding extensions please refer to the Special Consideration Policy and important application deadlines available at:

Late submission
For specific guidelines see Student Responsibility Policy
http://www.uow.edu.au/about/teaching/rop_students.html#7

Performance grades
HD High Distinction 85-100%
D Distinction 75-84%
C Credit 65-74%
P Pass 50-64%
PC (undergrad only) Pass Conceded 45-49%
F Fail (unsatisfactory completion) 0-49%

Medical certificates
Refer to Special Consideration Policy -

Supplementary examinations
Supplementary examinations may only be permitted in extenuating circumstances such as verified illness beyond the student’s control or for religious reasons.
Refer to Code of practice Teaching and Assessment

Contacts:
Education Student Services Centre
Building No 23, Ground Floor

Telephone 61 2 42213 981
Facsimile 61 2 42213 892
Email sis@uow.edu.au
Student OnLine Services http://www.uow.edu.au/student/sols
# Appendix 5: Comparison of IT competencies from source documents

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<td>Use of IT to support teacher roles</td>
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<td>Integrating IT into curriculum</td>
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<td>✓</td>
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<td>Evaluating, selecting &amp; using educational software</td>
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<td>Designing technology-supported activities</td>
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<td>Choosing appropriate technologies for learning activities</td>
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<td>Using software tools in teaching practice</td>
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<tr>
<td>Locating and using electronic resources</td>
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<td>Developing IT skills in the future</td>
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<td>Emerging developments in IT</td>
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<td>✓</td>
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<tr>
<td>Understanding &amp; using basic computer operations</td>
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<tr>
<td>Developing skills with a range of software</td>
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<tr>
<td>Developing collaborative teamwork skills</td>
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<tr>
<td>Creating electronic teaching resources</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>solving common IT problems</td>
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<tr>
<td>Communicating ideas about using IT</td>
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<tr>
<td>Thinking about IT abstractly for solving real world problems</td>
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Appendix 6: EDIT102 WebCT resource windows

EDIT102 WebCT site pages

[EDIT102] (EDU04) Information Technology For Learning - WebCT 4.1.3 - Microsoft Internet Explorer

Homepage

EDIT102 Information Technology For Learning

Welcome to EDIT102 for Spring session 2004. Please contact Dr Sue Bennett (sue_bennett@uow.edu.au or 4221 5738) if you have any questions about this subject.

- Outline
- Resources
- Lecture Notes
- Assignments

[EDIT102] (EDU04) Information Technology For Learning

Physical and Health Education

<table>
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<tr>
<th>Tasks</th>
<th>Description</th>
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<tr>
<td>Task 1</td>
<td>Please refer to the Subject Outline</td>
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<tr>
<td>Task 2</td>
<td>Web Site/Software Evaluation Checklist&lt;br&gt;Task 3b - Marking Criteria</td>
</tr>
<tr>
<td>Task 3</td>
<td>Key Teaching Strategies - from the NSW Board of Studies, PEP/PEAP Report Document (1991)</td>
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Early Childhood

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Description</th>
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<td>Task 1</td>
<td>Refer to Subject Outline</td>
</tr>
<tr>
<td>Task 2</td>
<td>Task Description</td>
</tr>
<tr>
<td>Task 3</td>
<td>Task Description</td>
</tr>
</tbody>
</table>

Click here for the "Assessing Computer Software for Young Children" website

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Appendix 7: EDIT102 Instructions Assessment Tasks 2 & 3

Task 2: EC

Educational Software Analysis

Due date: Presentations will be scheduled in tutorials during Week 7-9 as required. Individual component must be submitted in the tutorial in Week 9.

Weighting: 30%

Length: As specified below

ACTIVITY 1: Group presentation

Due in Week 7-9 tutorial as scheduled

Weighting: 10%

In groups of 3, select a piece of educational software suitable for children in early childhood years (2 - 8 years of age). Explore how it operates.

1. Present your findings in 10 min to your tutorial class using the following format:
   - Present an overview of the software including a short demonstration of a key feature.
   - Comment on the suitability of the software for young children.
   - Present some ideas for implementation of the software in early childhood settings.

2. Prepare a 1 page handout for the students in your tutorial. The handout should include: the names of the presenters; the software title; recommended age; a brief overview of the key features; your ideas for EC classroom implementation

Criteria for assessment

1. Clarity of oral presentation: articulation, time management.
2. Ideas organised logically and coherently.
3. Use of evidence to support ideas.

ACTIVITY 2: Individual analysis

Due in Week 9 tutorial

Weighting: 20%

Length: approx. 2000 words (including on-line computer software review)

This assessment component requires you to critically analyse the developmental appropriateness of a piece of computer software for young children. To complete this task select software designed either for children of age 3-4 or for K-2 students and analyse it as follows.

- Evaluate the appropriateness of selected software for young children using the lists of Criteria as a guide (download from WebCT).
- Discuss the value of the software for children’s learning and play. Follow the WebCT link to access the Assessing Computer Software for Young Children. Click on Add a Review to complete the questionnaire. Answer all the questions, print out your answers and add the review. Attach the printed form to your paper as an appendix.

Criteria for assessment

1. Ideas organised logically and coherently.
2. Use of evidence to support ideas.
3. Evidence of analytical skills in using information.
Task 3: EC Project

Due date: Due in Week 13 tutorial
Weighting: 40%
Length: N/A

This assignment requires that you complete a project task related to the Early Childhood specialisation. The project will include a group (part 1) and an individual (part 2) assessment components.


Weighting 30%
Length N/A

Working in groups of two or three (2-3), develop a plan for implementation of ICT in an early childhood setting of your choice (preschool, child care, or K-2). To complete the project, utilise the information that you gained from tasks 1 and 2, as well as from your readings and observations in early childhood settings.

As a group, draw a plan of the early childhood setting which you have chosen for ICT implementation (it can be real or hypothetical). Decide on the hardware (computers, printers, video etc.) and software that you want to use in the EC centre to set up productive learning experiences for children and an effective working environment for staff. To make such a decision, think of activities that can be supported and enhanced by ICT and plan the implementation accordingly. Look at the activities of both the staff and the children that can be supported by technology. For example, think of the ways that ICT can support and enhance the process of child observation, storage and sharing of the information between the staff members. Or, look at the range of appropriate software that can be used for making children’s learning more effective and fun. Consider as many areas as possible.

Collect and create all the information in electronic form. Use the technology skills you have developed in the tutorials and drawn upon the concepts from lectures, presentations and your own research and reading. This might include descriptions and discussions (text files in Word document), diagrams, tables, pictures, lists of software, power point presentation, html files and so on. Organise the information in coherent manner and burn on to a CD.

Criteria for assessment
1. Ideas organised logically and coherently.
2. Use of evidence to support ideas.
3. Attention to detail, use of illuminating examples to illustrate the ideas.
Part 2. **Individual reflection**

**Weighting** 10%

**Length** approx. 500 words plus a diagram

In this task you are required to reflect on your group work in the project as well as on your study in the subject on the whole.

1. Reflect on your work in the project. How did the group work go? What responsibilities did the members of the group undertake and what was your contribution to the project?
2. How did the work on the project (as well as in the subject on the whole) help you to understand the ways that you can use ICT in your future work as an early childhood educator and in your current study as a student?
3. Use SMARTideas concept mapping software to draw a concept map to integrate and interconnect the multiple ways that you can use ICT in your study and work.

**Criteria for assessment**

1. Ideas expressed in a clear and concise manner.
2. Elaboration of ideas and their visual representation
PE Task 2

Assessment Tasks

Task 2: Educational Software Analysis

Due date: Presentations will be scheduled in tutorials during Week 7-9 as required. Individual component must be submitted in the tutorial in Week 9.

Weighting: 30%

Length: As specified below

ACTIVITY 1: Group presentation - Physical and Health Education specialisation

Due in Week 7-9 tutorial as scheduled

(10 marks)

In your small group (4) select a piece of educational software ie. an interactive teaching and learning resource and conduct an evaluation.

Sources:

On reserve in the CRC

| 611.71/5 - The Ultimate 3d skeleton | 613.707/5 - Body systems |
| 612/44 - The magic school bus explores the human body | 641.1/19 - Sante for good health |
| 612/48 - All about ourselves | 641.1/20 - Eat smart |
| 612/49 - The ultimate human body | 796.0712/2 - World of sport |
| 613/3 - Health | 613.707/5 - Body works *On the Edge |
| 613.07/22 - Megabite: an in your face journey | *Responsibility (teacher educators and undergraduates resource) |
| 613.07/22 - Megabite: an in your face journey | *Shift |

1) ActiveHealth: www.activehealth.uow.edu.au/
2) BlueWeb'n: www.kn.pacbell.com/wired/bluewebn/
3) Edna: www.deakin.edu.au/fac_edu/edna/
   www.edna.edu.au/edna/page1.html
4) Merlot: www.merlot.org
5) ThinkQuest: www.thinkquest.org

Present findings in 10 minutes to your tutorial class using the following format:

+ a 1 page summary handout for each group member

Groups will select a Learn about or Learn to from one of the three Strands (Strand 1- Self and relationships; Strand 3- Individual and community health; Strand 4- Lifelong physical activity (see sign-up sheet)

- Present an overview of the software including a short demonstration of a key feature.
- Comment on the pluses, minuses and interesting aspects (see Evaluation criteria on WebCT).
- Present some ideas for classroom implementation (suggested teaching strategy for the appropriate Stage).
ACTIVITY 2: Individual analysis
Due in Week 9 tutorial (20 marks)
Using the guidelines on WebCT for Physical and Health Education, undertake an individual analysis of educational software.

Physical and Health Education

For this analysis you are to select 2 websites (with the major purpose of Project support) that are not already listed on ActiveHealth for your selected strand area and:
1. Describe how you found the site
2. Conduct an evaluation of the sites using the Evaluation Checklist (download from WebCT).

Appropriate websites will be entered on ActiveHealth for student and teacher use.
PE Task 3
Assessment Tasks

Task 3: Project
Due date: Due in Week 13 tutorial
Weighting: 40%
Length: N/A

This assignment requires that you complete a project task related to your specialisation. The
project will include a group and individual assessment component. Check the subject WebCT
for guidelines for completing the task.

Physical and Health Education

Part 1: Pairs project - (30 marks)

Your project involves modifying two lessons which address a specific content area (separate
or sequential) that PCHPE teachers have traditionally used to teach the learn about’s and
learn to’s in the current syllabus (these lessons currently involve little or no technology in the
learning strategies used):

- You may use the Strands that you have previously used in Task 2.
- You may use lessons provided as case studies or contact individual schools. In this
  case, original plans must be attached.

1) Your role is to develop two learning activities, including all resources (one for each
lesson) and the appropriate teaching strategy, necessary to complete the activities.
Activities will utilise those skills developed in Weeks 1-6. These will be integrated into the
lesson plan format to be distributed in lectures and available on WebCT.
(Note that only the relevant section of the lesson needs to be presented on the lesson plan
template e.g. the introduction – i.e. if you were to develop a PowerPoint on nutritional
requirements, you would develop the presentation, content for the teacher, additional
worksheets).

2) Provide an overview of the processes you utilised in the construction of your learning
activities.
   a) Why did you choose the teaching strategy you did?
   b) What is the advantage/disadvantage of this technology-based approach over other
      approaches?
   c) What skills will you and the students need to utilise the learning activity?
   d) How will I make an assessment of whether the outcomes have been met?

Part 2: Individual assessment (10 marks)
(approx. 600 words)

Think back to the beginning of Semester 2 and your level of knowledge and skills in using
IT for teaching and learning.

Now think about your current level of expertise in using IT for teaching and learning.

1) How has your confidence and competence in using IT for teaching and learning
changed throughout the semester? Use Inspiration® to highlight the points made in
each of the teaching roles described in Week 2.

2) Discuss what learning tools and strategies you have used that you think may have
   contributed to this change.

3) Discuss how you will continue your professional development in using IT for teaching and
   learning.
Appendix 8: Goal setting resource - general planning checklist

Asking yourself and answering the following questions may help you to get started with your thinking for each assignment.

Ask yourself these questions for each assignment:

1. What is the purpose of this assignment?
2. What do I have to produce for this assignment?
3. What knowledge and skills do I need to be able to complete this assignment?
4. What knowledge and skills do I already have?
5. What knowledge and skills do I need to develop?
6. What learning strategies & resources may assist my learning?
7. How will I identify & correct any learning errors I make?
8. Have I met the assignment expectations?
9. How will I know that I have met the assignment expectations?
Appendix 9: Goal setting resource - Task 1 resource development
criteria rubrics

PowerPoint

**EDIT 102 Task 1 – PowerPoint Marking Criteria**

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<td>• There is insufficient detail to complete the set task.</td>
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<td>• A basic slide show containing five slides, text, at least 2 graphics and one imported sound.</td>
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<td>• Makes use of the more advanced features eg. transitions, animations, hyperlinks etc</td>
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<td>• Has an educational application</td>
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<td>• Is pedagogically sound</td>
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Web site

**EDIT 102 Task 1 Marking Criteria**

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<td>• A basic web site with text, more than 2 images, and at least 3 links to external Web sites.</td>
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Database

**EDIT 102 Task 1 Marking Criteria**

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<td>• There is insufficient detail to complete the set task.</td>
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<tr>
<td>• A basic database that contains text, number, calculations, pop-up and/or radio fields. Along with 10 records.</td>
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Spreadsheet

**EDIT 102 Task 1 – Spreadsheet Marking Criteria**

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</thead>
<tbody>
<tr>
<td>Spreadsheet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Substantial parts of the assignment are incomplete and/or</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• There is insufficient detail to complete the set task.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Makes use of the following: 2 calculations, 1 meaningful chart and basic formatting features.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Has good use of colour, style, and layout.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Makes use of the more advanced features eg. sorting, et c</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Is presented in a way that is extremely useful and easy for a teacher use.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 10: Cognitive planning resource for Task 1 Activity 2 - Web
Design Matrix Table

<table>
<thead>
<tr>
<th>Column</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Html file name</td>
<td>enter the name of the web page file into the first column.</td>
</tr>
<tr>
<td>Page title</td>
<td>enter the title of the web page into column 2.</td>
</tr>
<tr>
<td>files to be inserted into this page</td>
<td>enter the names of the image or sound files that you wish to use within each web page.</td>
</tr>
<tr>
<td>Hyperlink from (anchor)</td>
<td>into column 4 enter the text from which you will make a hyperlink to another page or object</td>
</tr>
<tr>
<td>Link to (node)</td>
<td>into the last column enter the name of the file to which the hyperlink should connect</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Html file name</th>
<th>Page title</th>
<th>files to be inserted into this page</th>
<th>Hyperlink from (anchor)</th>
<th>Link to (node)</th>
</tr>
</thead>
<tbody>
<tr>
<td>index.html</td>
<td>Home</td>
<td>book.gif teacher.jpg</td>
<td>&quot;Table of Contents&quot; text anchor</td>
<td>toc.html</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;Contact details&quot; text anchor</td>
<td>contact.html</td>
</tr>
<tr>
<td>tree1.html</td>
<td>Types of Trees</td>
<td>eucalypt.jpg pine.jpg palm.jpg wind.snd</td>
<td>pineapple image anchor</td>
<td>wind.snd</td>
</tr>
</tbody>
</table>
## Appendix 11: Educational website evaluation checklist for Physical Education stream

### EVALUATION CHECKLIST

<table>
<thead>
<tr>
<th>Name of site</th>
<th>URL</th>
<th>Comments</th>
</tr>
</thead>
</table>

### Content – Quality
- Is the information current?
- Is the information accurate?
- Is the information comprehensive?
- Is it of the appropriate scope and depth for the intended audience?
- Is the language at an appropriate level?
- Is there a better source for this information/resource? (book, video etc.)

### Content – Creditability
- Are the authors, organisation identified?
- Are the authors/organisation reputable?
- Does the site provide balanced evidence, free from bias?
- Is the site well presented? Professional?
- Does the site make appropriate use of media? (eg. graphics, video, audio etc.)
- Is the design of the site and media used appealing for the intended audience?
- Is it motivating?

### Links
- Does the site provide links to other appropriate sources?
- Do the links support or detract from the site?

### Stability and Functionality
- Does the site work? Does it work with the available technology?
- Might there be technical limitations to using the site?
- Can I easily navigate around the site?

### Interactivity
- Can the user interact with the site?
- Are there mechanisms for feedback?

### Teaching perspective
- What aspect of the syllabus does it relate to?
- How can I use the site?
- What learning strategies does it support? (eg problem solving, inquiry etc.)
Appendix 12: Educational website evaluation marking criteria rubric for Physical Education stream

EDIT 102 Task 2b – Individual Analysis Marking Criteria

<table>
<thead>
<tr>
<th>Mark</th>
<th>F (&lt; 50%)</th>
<th>P (50 – 64%)</th>
<th>C (65 – 74%)</th>
<th>D (75 – 84%)</th>
<th>HD (85 – 100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis of Two Educational Websites</td>
<td>• Substantial parts of the assignment are incomplete and/or there is insufficient detail to complete the set task.</td>
<td>• A descriptive evaluation of two suitable websites, using the criteria given.</td>
<td>• A descriptive evaluation that shows some signs of an analytical approach</td>
<td>• An analytical and coherent evaluation drawing on lecture notes, current readings, or personal experiences.</td>
<td>• An in-depth, analytical and coherent evaluation drawing on lecture notes, current readings, and personal experiences.</td>
</tr>
</tbody>
</table>

This assessment guide describes the criteria for each grade level. Your assignment will be marked out of 20 and that mark will reflect the standard of your assignment within the grade band.
Appendix 13: Educational software evaluation checklist guides for Early Childhood stream

# CHECKLIST FOR EVALUATING SOFTWARE FOR YOUNG CHILDREN


<table>
<thead>
<tr>
<th>Child Features</th>
<th>Teacher Features</th>
<th>Technical Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is/Does the software program...</td>
<td>Is/Does the software program...</td>
<td>Is/Does the software program...</td>
</tr>
<tr>
<td>Emphasise active learning processes</td>
<td>Adaptable to suit individual students (age and ability)</td>
<td>Available for Macintosh and Windows</td>
</tr>
<tr>
<td>Encourage self-discovery and experimentation</td>
<td>Correspond with KLA subject matter</td>
<td>Aesthetically pleasing</td>
</tr>
<tr>
<td>Age appropriate</td>
<td>High educational value</td>
<td>Easy to install and set up</td>
</tr>
<tr>
<td>Child controlled (set own pace, changes etc.)</td>
<td>Suitable for both genders</td>
<td>Runs at suitable speed (minimal waiting)</td>
</tr>
<tr>
<td>Suitable for independent use</td>
<td>Offer multiple language options</td>
<td>Appropriate sounds effects and music (not distracting)</td>
</tr>
<tr>
<td>Promote creativity and divergent thinking</td>
<td>Include teacher support material and/or user manual</td>
<td>Realistic animations and graphics</td>
</tr>
<tr>
<td>Intrinsically motivating</td>
<td></td>
<td>Clear, distinct and easy to understand speech</td>
</tr>
</tbody>
</table>
SELECTING AND ASSESSING CHILDREN’S SOFTWARE


Age Appropriate:
- Expectations of the program match and/or respect children’s developmental needs
- Software’s content and style of presentation reflect developmental expectations
- Methods used to present information or activities is suitable for the expected age of the user
- Contains objects and situations recognisable to children from a range of different backgrounds (universal)

Child in Control:
- Children are able to initiate and decide the flow, sequence and/or direction of activities
- Software facilitates active rather than passive or re-active involvement
- Children may explore the software at their own speed – no set limit on activity time
- Children may return to a main menu whenever they desire
- Unlimited opportunities for trial and error – able to experiment with different options
- Children able to utilise program with minimal adult supervision

Clear Instructions:
- Visual instructions including pictures for non-readers or beginning readers. For example, a red stop sign indicates to children to ‘stop and wait.’
- Verbal instructions. Also for non-readers and to reinforce written instructions.
- Simple, precise directions that clearly state activity requirements

Complexity:
- Program commences at its easiest level to ensure all children can experiment and operate it.
- Logical learning sequence – Options for increases in complexity are given at various intervals
- Introduces children to skills and/or knowledge which may be transferred to other real-life situations.
- Encourages children to operate within their Zone of Proximal Development

Non-violence:
- Software is free of violent objects, characters and actions
- Software models positive social values, such as caring, co-operation, sharing and friendship.

Process versus Product:
- Children engage in the processes of discovery and exploration. Products from such exploration becomes ‘secondary’
- Intrinsically motivating for children – no over-use of extrinsic rewards

Technical Features:
- Software is easy to install, with clear and concise directions for the user
- Runs quickly, with minimal time between activities and is reliable to operate smoothly
- Colourful, uncluttered, realistic graphics
- Animated graphics do not distract children, rather provide a more accurate and real model of an object
- Sound effects and music are realistic
- Provides a print option during suitable activities (creative drawing etc.)
- Provides an option for multiple languages, catering for NESB and ESL children
IT teaching integration checklist


EDIT102 Information Technology for Learning
Checklist for Technology Integration Planning

Use this checklist when planning to integrate technology into the classroom. You don’t have to follow these steps sequentially, but should work through them to support your planning process. Ask yourself these questions!

A. Why am I using technology?
Consider your aims in using or choosing a particular technology for a particular learning situation.
• What is the teaching or learning problem I am trying to address by using technology?
• What advantage do I perceive in using technology in this situation?
• Will the advantage be worth the effort required for me to implement the plan?
• How does the plan fit with the curriculum?

B. What are the learning outcomes?
• Are these mandatory learning outcomes from the syllabus?
• Is there specific knowledge or skills I want my students to learn?
• Are there more general outcomes I want my students to achieve?

C. What assessment strategies are appropriate?
• What kinds of performances do I expect from the students to show what they have learned?
• What is the best way for me to assess students’ progress and products, e.g., written tests (multiple choice, true-false, matching, short answer, essay, report, etc.), performance checklists, rubrics?
• Do assessment instruments already exist or do I need to create them?

D. What teaching strategies and learning activities will I include?
• Will students work individually, in pairs, in small groups, in large groups, as a whole class, or a combination of these?
• Will I use directed or constructivist teaching strategies, or a combination of these?
• How will I sequence the activities?
• How much time will I need for these activities?
• Do I need to provide extra resources or support for students to scaffold or extend the technology-related activities?
• What strategies will I use to encourage all learners to engage with the technologies?

E. What practical issues do I need to consider?
• How many computers and copies of software will I need?
• Are these available?
• Over what period of time and how often will I need these?
• Do I need to book a computer lab?
• Do I need a projector and is one available?
• What other equipment do I need (e.g., printer, paper, storage etc.) and how will I access it?
• Are there any legal or copyright issues?
• Have I addressed issues of student privacy, safety etc.?
• Have I catered for any students with disabilities?
• Am I familiar with the software?
• Have I included time to set up and test the equipment before the lesson?
• Will I need to save my files or the students’ work?
• What is my backup plan in case I can’t run the activities?

F. How do I know it’s working?
• What evidence will indicate that the new strategy is working?
• What data will I collect (e.g., own reflections, student work, student comments etc.)?
Use this information to decide how you will address any problems with the implementation so that you can improve it next time.
Appendix 14: Interview Question Type and Investigative Focus

<table>
<thead>
<tr>
<th>Interview Question</th>
<th>Investigative focus</th>
<th>Question type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>experience/ behaviour</td>
</tr>
<tr>
<td><strong>Interview 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is your name, gender, age &amp; year you commenced this degree?</td>
<td></td>
<td>demographics</td>
</tr>
<tr>
<td>Have you used computers before commencing this subject?</td>
<td></td>
<td>Prior IT experience</td>
</tr>
<tr>
<td>What purpose have you used computers for before this subject?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How many years have you used computers before commencing this subject?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How have you learnt to use computers before this subject?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What type of computer (Mac or PC) have you primarily used before commencing this subject?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What type of computer do you use now? What is the reason for your choice?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Where do you usually work on computers for this subject, at home or at university computer laboratory?</td>
<td>Study environment</td>
<td>✓</td>
</tr>
<tr>
<td>What are your reasons for working on computers in that location?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How would you describe your self as a student?</td>
<td></td>
<td>Self-image</td>
</tr>
<tr>
<td>How would you describe your self as a user of IT?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do you feel about the intellectual challenge of learning to use IT?</td>
<td></td>
<td>Forethought/ Motivation/ Goal orientation</td>
</tr>
<tr>
<td>How do you think these feelings influence your approach to learning in this subject?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is it more important for you to learn the knowledge and skills for using IT in your teaching and learning, or more important that you get a good grade in this subject?</td>
<td>Forethought/ Motivation/ Goal orientation</td>
<td>✓</td>
</tr>
<tr>
<td>Why is your choice more important to you?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How does your choice influence the way you approach learning in this subject?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interview Question</td>
<td>Investigative focus</td>
<td>Question type</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>How interested are you in learning to use IT?</td>
<td>Forethought/ Context/ Task Perception/ Interest</td>
<td>✓</td>
</tr>
<tr>
<td>How do you think that your level of interest effects your effort and ability to learn to use IT?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How useful do you think learning to use IT will be for you in future?</td>
<td>Forethought/ Context/ Task Perception/ Utility or Value</td>
<td>✓</td>
</tr>
<tr>
<td>How does your perception of the usefulness of IT effect the way you approach your learning in this subject?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How useful do you think learning to use IT will be for you in future?</td>
<td>Monitorin g/ Behaviour/ Awareness of effort or environment</td>
<td>✓</td>
</tr>
<tr>
<td>How does your perception of the usefulness of IT effect the way you approach your learning in this subject?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do you think that your ability to learn to use IT is affected by the amount of effort you put into learning?</td>
<td>Monitorin g/ Behaviour/ Efficiency</td>
<td>✓</td>
</tr>
<tr>
<td>How much time per week do you spend on learning in this subject?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do you organise your study schedule?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What do you do during these study times?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Where do you do your study?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there any problems associated with your study environment (noisy, shared, too small, etc)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How confident do you feel in being able to learn the range of knowledge and skills required in this subject?</td>
<td>Monitorin g/ Behaviour/ Self-efficacy</td>
<td>✓</td>
</tr>
<tr>
<td>How does your level of confidence affect the amount of effort you put into learning?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How did you plan to learn what was required in this subject?</td>
<td>Forethought/ Cognition/ Goal setting</td>
<td>✓</td>
</tr>
<tr>
<td>What did you do to plan how to approach each assignment?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How anxious do you feel when you are working on the assignments?</td>
<td>Monitorin g/ Behaviour/ Self-awareness</td>
<td>✓</td>
</tr>
<tr>
<td>What do you think contributes to this level of anxiety?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What do you do to try to understand how technology works and how to use it?</td>
<td>Control/ Cognition/ Cognitive strategies</td>
<td>✓</td>
</tr>
</tbody>
</table>

242
<table>
<thead>
<tr>
<th>Interview Question</th>
<th>Investigative focus</th>
<th>Question type</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do you ensure that your learning is directed towards meeting the subject requirements?</td>
<td>Monitoring/ Cognition/</td>
<td>experience/ behaviour</td>
</tr>
<tr>
<td>How do you feel when you encounter a computer learning task that is difficult or complex?</td>
<td>Monitoring/ Behaviour/ Control/ Behaviour</td>
<td>opinion/ values</td>
</tr>
<tr>
<td>What do you do to help your learning in this situation?</td>
<td>FITness problem-solving</td>
<td>emotions</td>
</tr>
<tr>
<td>How do you feel about working with other students on learning tasks?</td>
<td>Peer learning</td>
<td></td>
</tr>
<tr>
<td>How helpful is this for your own learning?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>From whom do you seek help with your learning to use IT?</td>
<td>Monitoring/ Behaviour/ Help seeking</td>
<td></td>
</tr>
<tr>
<td>How does this help your learning?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What do you do to learn to use new hardware or software that you have never used before?</td>
<td>FITness adaptability</td>
<td></td>
</tr>
<tr>
<td>What do you do when you encounter a technical problem with technology you use?</td>
<td>FITness Problem-solving</td>
<td></td>
</tr>
<tr>
<td><strong>Interview 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What marks did you gain for the assignments so far?</td>
<td>FITness use contemporary software</td>
<td></td>
</tr>
<tr>
<td>How satisfied are you with the results?</td>
<td>Reflection/ Motivation/ Affective reaction</td>
<td></td>
</tr>
<tr>
<td>Some students have felt that their good marks for the first 3 assignments did not mean anything because many other students also gained similar marks.</td>
<td>Forethought/ Motivation/ Goal orientation</td>
<td></td>
</tr>
<tr>
<td>How do you feel about this?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How important is it to you to get better marks than other students?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If I was to meet you for the first time in a setting away from the uni, how would you describe yourself to me?</td>
<td>Self-image</td>
<td></td>
</tr>
<tr>
<td>How has your learning experience in this subject effected your ability to learn to use IT?</td>
<td>Reflection/ Cognition/ Cognitive judgement</td>
<td></td>
</tr>
<tr>
<td>How has it effected your ability to learn generally?</td>
<td>Reflection/ Motivation/ Affective reaction</td>
<td></td>
</tr>
<tr>
<td>How has your confidence to use IT changed throughout the semester?</td>
<td>Reflection/ Context/ Evaluation</td>
<td></td>
</tr>
<tr>
<td>What do you think has contributed to this change?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interview Question</td>
<td>Investigative focus</td>
<td>Question type</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Your assignments provided opportunities for you to use a variety of tools (such as flow charts, concept maps etc.) to guide your learning.</td>
<td>Reflection/ Cognition/ Cognitive judgement</td>
<td></td>
</tr>
<tr>
<td>How helpful were these to your understanding of the principles &amp; processes of learning to use IT?</td>
<td>Reflection/ Behaviour/ Choice</td>
<td></td>
</tr>
<tr>
<td>How might you use these tools in future?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(questions about specific SRL tools if not mentioned by participants)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You were given a general checklist of questions to help guide your completion of the assignments in this subject.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you use the checklist?</td>
<td>Reflection/ Behaviour/ Choice</td>
<td></td>
</tr>
<tr>
<td>For which assignments did you use the checklist?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What led you to use /not use the checklist?</td>
<td>Reflection/ Context/ Evaluation</td>
<td></td>
</tr>
<tr>
<td>How helpful did you find the general checklist for planning the assignments?</td>
<td>Reflection/ Context/ Evaluation</td>
<td></td>
</tr>
<tr>
<td>How did you use the skills assignment rubrics to complete the assignments?</td>
<td>Control/ Cognition/ Cognitive strategies</td>
<td></td>
</tr>
<tr>
<td>There was a web site design matrix tool provided on the instructions for completing the web design assignment. How did you use that in planning your web site assignment?</td>
<td>Control/ Cognition/ Cognitive strategies</td>
<td></td>
</tr>
<tr>
<td>How have other people helped your learning in this subject?</td>
<td>Reflection/ Motivation/ Attribution</td>
<td></td>
</tr>
<tr>
<td>What did the academic teachers do in class that you found helped your learning?</td>
<td>Reflection/ Motivation/ Attribution</td>
<td></td>
</tr>
<tr>
<td>How has your interest in learning to use IT changed, if at all, since the beginning of semester?</td>
<td>Reflection/ Motivation/ Attribution</td>
<td></td>
</tr>
<tr>
<td>What do you think has contributed to this change?</td>
<td>Reflection/ Motivation/ Attribution</td>
<td></td>
</tr>
<tr>
<td>How has the amount of effort you put into learning to use IT changed throughout the semester?</td>
<td>Reflection/ Motivation/ Attribution</td>
<td></td>
</tr>
<tr>
<td>What do you think has contributed to this change?</td>
<td>Reflection/ Motivation/ Attribution</td>
<td></td>
</tr>
<tr>
<td>How useful do you think that learning to use IT will be to your future role as a teacher?</td>
<td>Reflection/ Motivation/ Attribution</td>
<td></td>
</tr>
<tr>
<td>Interview Question</td>
<td>Investigative focus</td>
<td>Question type</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>What do you think has contributed to your perception?</td>
<td>Reflection/ Motivation/ Attribution</td>
<td></td>
</tr>
<tr>
<td>How confident do you feel in being able to utilize IT in the classroom in your future role as a teacher?</td>
<td>Reflection/ Motivation/ Affective reaction</td>
<td></td>
</tr>
<tr>
<td>What do you think has contributed to your level of confidence?</td>
<td>Reflection/ Motivation/ Affective reaction</td>
<td></td>
</tr>
<tr>
<td>How confident do you feel about learning to adapt your current knowledge &amp; skills with computers to new software or hardware that you will encounter in future?</td>
<td>Reflection/ Motivation/ Affective reaction</td>
<td></td>
</tr>
<tr>
<td>What do you think has contributed to your level of confidence?</td>
<td>Reflection/ Motivation/ Affective reaction</td>
<td></td>
</tr>
<tr>
<td>How confident do you feel in being able to solve basic technical problems that you may encounter in using IT?</td>
<td>Reflection/ Motivation/ Affective reaction</td>
<td></td>
</tr>
<tr>
<td>What do you think has contributed to your level of confidence?</td>
<td>Reflection/ Motivation/ Affective reaction</td>
<td></td>
</tr>
<tr>
<td>How has your ability to learn to use IT changed throughout the semester?</td>
<td>Reflection/ Cognition/ Cognitive judgement</td>
<td></td>
</tr>
<tr>
<td>What do you think has contributed to this change?</td>
<td>Reflection/ Cognition/ Cognitive judgement</td>
<td></td>
</tr>
<tr>
<td>How is the way you undertook learning in this subject different from or similar to how you learned in other subjects?</td>
<td>Reflection/ Context/ Evaluation</td>
<td></td>
</tr>
<tr>
<td>How you will continue your professional development in using IT for teaching and learning.</td>
<td>FitNess future orientation</td>
<td></td>
</tr>
<tr>
<td>What else would you like to tell me about your experience?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>