Changes that develop in Teachers' Information and Communication Technology (TICT) mediated practice over time: A five year longitudinal, qualitative study

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Certificate of Originality

I hereby declare that this submission is my own work and to the best of my knowledge it contains no materials previously published or written by another person, or substantial proportions of material which have been accepted for the award of any other degree or diploma at the University of Technology Sydney (UTS) or any other educational institution, except where due acknowledgment is made in my thesis. Any contribution made to the research by others, with whom I have worked at UTS or elsewhere is explicitly acknowledged in the thesis. I also declare that the intellectual content of the thesis is the product of my own work, except to the extent that assistance from others in the design and conception in style of the project and the presentation and linguistic expression is acknowledged.

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Abstract

Information and Communication Technology (ICT) has been in schools for a number of years now, however little is known about what actually takes place when teachers bring ICT into their professional pedagogical practice. This study contributes to this understanding by examining the lived experiences of five teachers in their ICT mediated practice over a period of five years.

To extend current understandings of change in teachers' ICT mediated practice this study uses a qualitative and longitudinal approach with grounded theory strategies. Assorted analysis contributed to the longitudinal component. This involved the analysis of pre-existing qualitative data of the teachers combined with primary data collection and analysis. Importantly, this study situates ICT mediated practice in order to examine the complex interrelationship between context, engagement with context, and development in individual teacher's ICT mediated practices over time. Aspects of Professional Practice theory and Socio-cultural theory were used to examine this relationship.

A significant finding of this study is that teachers' ICT mediated practices are changing and that the process of change is complex. Two factors were found to contribute to the complexity. One was the central role of professional identity in teachers' ICT mediated practice. It was found that change begins in a teacher's professional identity before it is observed as changed classroom teaching practice. A second factor contributing to complexity of change in ICT mediated practice was teachers' consistent use of particular aspects of their context (the syllabus, teachers' own status in school hierarchy and, non-school uses of ICT) and individual factors (teachers' core approaches to teaching and learning and also their ability and motivation to develop themselves professionally) as resources to inform the decisions they made in their ICT mediated practice. A theoretical model of change in ICT mediated practice is presented. The model indicates the teachers' use of contextual and individual resources was pronounced when they engaged with changes in their context they considered to be critical to their professional identity associated with their ICT mediated practice.

This study also makes a methodological contribution by showing that a qualitative longitudinal approach using grounded theory strategies and focusing on a small number of participants facilitates identifying and examining the significance of context and individual factors for change in TICT mediated practice. The use of context and individual factors supported explaining change in TICT mediated practice is more complicated than simply a change in actions a teacher performs in the classroom. This methodology also assisted in providing evidence that while on the surface, a teacher may look like their TICT mediated practice is not changing, there can be non-observable changes in their individual factors and professional identity (which sustain and influence the observable changes) which precede observable changed classroom practice.

Abbreviations

BOS: Board of Studies

DET: Department of Education and Training

ICT: Information and Communication Technology

ICT mediated practice: Information and Communication mediated practice

IPT: Information Processes and Technologies

IT: Information Technology

MP: Mediated practice

NSW: New South Wales

TICT mediated practice: Teachers' Information and Communication mediated practice

Chapter 1: Introduction

With the first gray light he rose and left the boy sleeping and walked out onto the road and squatted and studied the country to the south … When it was light enough to use the binoculars he glassed the valley below. The soft ash blowing in loose swirls over the blacktop. He studied what he could see. (McCarthy, 2006, p.6).

1.1 Background to study: Spread of ICT to workplaces and rapid innovation

This thesis focuses on examining how and why teachers' Information and Communication Technology (ICT) mediated pedagogical practices change over time. The above quote is taken from the novel *The Road*, written by Cormac McCarthy. *The Road* is a narrative that portrays the careful expedition by two individuals along a complex, and at times unpredictable path over time. This excerpt is used because the journey documented in the novel parallels the longitudinal, exploratory and systematic nature of this study. As the quote suggests, this chapter introduces the journey of examining change in teachers' ICT mediated pedagogical practice. An overview is presented of this practice in terms of the factors that have stood out in my examination of it as significant to our understanding and that warrant further examination of it.

The rapid distribution of ICT throughout many facets of society is an important consideration for examining change in teachers' ICT mediated practice. In particular, the influence that the increasing use of ICT and expectations for its use is having on people's lives. One highly visible influence of ICT is the way it is impelling change in workplaces. It is evident that bank-tellers, mechanics, nurses, builders, and those in many other occupations, are becoming familiar with the ICTs that have been introduced into their workplace. Also evident are the ways they are developing to work with the technology, to support greater precision and efficiency in their professional practice.

The classroom is an socially important and demanding workplace, and ICT has been brought into that environment as well. Like professionals from other areas, teachers are coming to terms with using ICT as part of their daily practice and are developing expertise in using it. Teachers' professional practice involves pedagogical elements that include teaching students about ICT, as well as using ICT to support their overall learning at school. How teachers do this is of importance to us all. The learning that young people are involved in at school, how well they achieve in that learning and the knowledge they acquire are important not only to themselves but to society. The skills and knowledge they can contribute to the community are for example, important to the economic international competitiveness of a country. How teachers use ICT in their practice, particularly their classroom practice is, undeniably a topic of considerable importance not only to teachers, students and schools but to society as a whole.

Importantly, for the concerns of this study, diverse and ambiguous contexts mediate the ways teachers think about and undertake their practice with ICT. These contexts may influence the content a teacher focuses on when teaching with ICT, the type of learning they facilitate in students' uses of ICT and the value they place on ICT as part of teaching and learning. The contradictory and diverse environment in which teachers' ICT mediated practice is situated, prompts asking if all these contextual factors have an influence on teachers' practices. Which elements of their context do teachers listen to and prioritise and which do they dismiss? Teachers' practices mediated by ICT, the context in which this practice is situated and which it is complicated by, and the questions that arise, provide the foundations and form the backdrop for this study.

Before beginning this study, I was a teacher working with ICT, who took up an opportunity to research teachers' practice mediated by ICT. My work as a research assistant on that project began an interest for me in examining teachers' practices with ICT and in reading the research literature on this practice.

The study I was involved in, the *e.ffects* study (Hayes, 2006, 2007), was a large-scale longitudinal, qualitative study, funded by the Australian Research Council, which focused on a number of case study schools in Australia to examine the ways ICT was contributing to the organisation of the school, to student learning and teaching. As part of the fieldwork for that study I had the opportunity to talk with a small number of teachers about their practices mediated by ICT. I was also able to revisit discussions with some of these teachers each year over the three years of the study. What stood out for me in these discussions was that the teachers referred to many factors outside their school when talking about their teaching practices mediated by ICT. They used these 'outside-school' factors as reference points when explaining why they were using ICT in the ways they did or did not. Some discussion points they referred to included, their own children's use of ICT in their university studies, media images of children staying inside using their computer instead of playing outside and, the purchase of a digital camera and the ways they used it on their holiday. Discussion points such as these, led me to an appreciation that teachers' practice mediated by ICT takes place within a broad context that spans beyond schools and of the ways that various aspects of this context influenced their practice.

What also gained my attention when working on the *e.ffects* study was that the ICT practices of the teachers participating in the study were changing over time. Over the three years of that study, change was evident in the participants' teaching, from the classroom observations I was documenting. I also observed that different teachers were changing their practices in different ways and it was evident from the data that this depended on what had become important to them in their use of ICT. A change common to many teachers participating in the *e.ffects* study was that they demonstrated a greater valuing of ICT as part of their practice. This was evident in the increased time they gave to: thinking about ICT as part of their practice, talking about it and planning for its use. My reading of the research literature on teachers' practices with ICT however, was presenting a view of this practice that was different to my experiences with teachers in the *e.ffects* study (Conlon & Simpson, 2003; Cuban, 2001; Dawes, 2001; Facer, Furlong, Furlong, & Sutherland, 2003). I identified a tone of frustration in the research literature regarding the lack of change evident in teachers' practices with ICT. It was evident from my reading, that with the implementation of ICT in schools teachers were expected to use ICT frequently in their teaching and to adopt constructivist practices which would extend and transform student learning (Facer, et al., 2003; McCormick & Scrimshaw, 2001). The research literature indicated that according to these measures, most teachers had not changed their practice. A dominant argument in the research literature is that while ICT has been in schools for a number of years now, teachers have at best, demonstrated minimal change in their practice with ICT.

The findings that the research literature was presenting about teachers' lack of change in their practice with ICT did not resonate with my experiences with teachers in the *e.ffects* study and the changes I identified in their practices. Also, findings which indicate no change in practice were counter-intuitive to my observations and experiences of the effect that ICT was having on many other professional practices. This inconsistency led me to think about and examine methodologies that might support findings of no change or minimal change in teachers' practices mediated by ICT.

My experiences in the *e.ffects* study supported identifying a limitation in the way many studies approached examining change in teachers' practice with ICT. A close examination of the methodologies used to identify teachers as not changing or minimally changing in their practice with ICT showed that many studies did not acknowledge the situated nature of this practice and/or the individualised nature of teaching with ICT (Al-Fidail & Mellar, 2008; Rakes, Fields, & Cox, 2006). Many studies examining change in teachers' practices with ICT conceptualised ICT to be the singular medium of change in this practice (Conlon & Simpson, 2003; Cuban, 2001; Samuelsson, 2006). These studies drew on a belief that once ICT was in schools teachers would change their practice and this change would happen quickly. My experiences in the *e.ffects* study and the thinking and reading initiated as a result of my experiences, led me to conceptualise teaching with ICT as a situated practice that is influenced by the context in which it is situated. Teachers' practices with ICT obviously take place in classrooms. What happens in a classroom however is influenced by the culture of schools and educational institutions as well as government teaching and learning policies. A situated practice can therefore be defined as a practice that is contributed to by the context it takes place within, the beliefs this context communicates about the role of schools and teachers, and the place of ICT in teaching and learning (Flick, 2009; Yates, 2001). This is different from considering lack of change as a feature of individual pathology or as an ill-response to the resourcing of schools with ICT. Importantly, teaching with ICT does not exist in isolation from teaching in general.

Teachers' practices mediated by ICT have also been positioned in much of the empirical research (see Drent & Meelissen, 2008; Haydn, 2003; Tondeur, van Braak, & Valcke, 2007) as separate from the significant impact ICT is having on contexts outside school. As stated earlier in this chapter, the increasingly important place given to ICT in society is having a substantial impact on the lives of individuals and the ways they work and function. This is evidenced in the increasing use (and expectations for use) of ICT in everyday social, cultural and economic tasks such as: applying for a driver's learner permit or government financial assistance for families and aged pensioners, use of social networking sites, and using open access information sites to contribute to one's formal and informal learning. It is reasonable to suggest that opportunities for such uses of ICT would influence the ways teachers engage in these activities as users of ICT in their personal life. These non-school uses of ICT would also communicate beliefs about teaching, learning, children and schools, particularly given the extensive use of ICT by children and youths. This would contribute to how teachers conceptualise their professional role in society, how they need to undertake this role, and where ICT fits into their professional practice. Examining teaching practice as part of the context in which it takes place contributes to understanding its complexity and how the many interrelated factors in which it is embedded influence it (Kemmis, 2009; Goodson, Knobel & Lankshear, 2002; Schofield, 1995, Bigum, 2002).

Another common expectation evident in the research literature (see Bauer & Kenton, 2005; Chen, 2008; Conlon & Simpson, 2003; Yost, 2003) was that all teachers were expected to change their practice in the same way, to constructivist style teaching. Consequently, teaching with ICT was not conceptualised as a practice undertaken by individuals. My own teaching experiences, as well as my experiences in the *e.ffects* study helped me to understand that teachers are individuals who make meaning of their professional practice in terms of their engagement in their professional, personal and technological contexts. Teachers' interpretation of their practice with ICT is represented by how they observe their practice mediated by ICT, how they discuss it, and the language they use to make meaning of their engagement with their contexts. Their engagement is influenced by their own unique knowledge set, beliefs and values, all of which have been contributed to by their experiences over time. A consequence of their individualised engagement is that it contributes to the particular types of teaching strategies they use, the classroom management they prioritise and their conceptualisation of children in the teaching and learning process. Given the distinctive trajectory of each person's life, change in teaching with ICT should not be conceptualised as a universal phenomenon.

An examination and judgement of change in teaching with ICT is more complete if it takes into account teachers' narratives. Including teachers' individual experiences with ICT provides a space for examining what informs their interpretations of their context, the ways these influence teachers' practices with ICT, and why (Connelly & Clandinin, 1999).

Furthermore, there is a trend in the research literature to conceptualise change in teachers' practices with ICT as improvement rather than change. A number of studies examining change in this practice (Bauer & Kenton, 2005; Chen, 2008; Samuelsson, 2006; Yost, 2003) provide information about the ways teachers have been expected to improve and how they are not living up to these expectations. It is on this basis, that lack of change by teachers has been identified in such research. Bigum (2000) however argues:

> Rather than necessarily improving an existing set of circumstances, for example the teaching of geography, we might expect the teaching of geography to be changed with the deployment of computing and communications technologies and to be changed in unpredictable ways. … The question of whether things have improved becomes a more difficult issue and perhaps one that is less important than understanding how things have changed and what the implications are for teachers and learners (p. 132).

An examination of change and what pans out for teachers with the implementation of ICT in schools, importantly, will provide a basis for future planning and for supporting teachers in ways important to them. To equate change with improvement, unfortunately, can only invite a focus on the shortcomings of teachers, and this does not meaningfully contribute to future planning.

1.2 Rationale for the study: Deepening understanding to inform future practice

Identifying inconsistencies between my experiences with the teachers in the *e.ffects* study and the research literature on change in teachers' practices with ICT, underlined the importance of foregrounding the contextualised and individualised nature of teaching mediated by ICT. This approach importantly supports deepening our understanding of this practice and our potential for guiding it in a way that will meaningfully contribute to teaching practices and thus to student learning.

I have developed the term Teachers' Information and Communication Technology (TICT) mediated practice to conceptualise my approach to researching this practice in this study. 'Teacher' is positioned at the beginning of the acronym, because it is teachers and their practices, not the technology, that is the core concern of this study. The term ICT is included because a significant proportion of teachers' use of technology is to access information and to communicate. For the most part in this study, this involved computers and the internet, but it is not limited to this technology. The term 'mediated practice' is used because teachers' use of ICT as part of their professional practice is influenced by the many factors embedded in the broad context in which it is situated. The term 'TICT mediated practice' is used throughout this thesis: however, at times, the term is adjusted to 'ICT mediated practice', to reflect varying sentence structures.

In order to research change in TICT mediated practice meaningfully I have also taken into consideration methodological arguments in the research literature regarding examination of this practice. The body of literature I draw on to inform this study is that which directly examines change in teachers' practices with ICT. Underwood (2004, 2004b) and Selwyn (2008), each identify methodological assumptions and boundaries commonly used in evaluations of changing ICT mediated practice as possible hindrances to examining the important and more difficult questions about educational uses of ICT. Change in TICT mediated practice has been identified as one such difficult question. The fast moving pace of innovation in ICT has contributed to a preoccupation in this field of research with focusing on latest innovations and what these innovations may potentially offer learning (Underwood, 2004). This, Underwood observes, has led research in educational use of technology to become uniform, limiting, with a priority to find out about the technology rather than the user of the technology. Many studies that focus on model use of ICT by or early adopters, or which trial and explore new technology resources, are evidence of this (Cuban, 2001; Hennesy, Deaney, Ruthven, & Winterbottom, 2007; Lewin, 2000; Yost, 2003). Underwood observes that focusing on the technology has led to a field of research which has not taken the time to build on and embed knowledge of the educational use of ICT in its history. She identifies that longitudinal research which focuses on the user can positively contribute to filling this gap. She states that no other type of research carries such evidential weight for understanding the effects of technology on the user.

A second methodological limitation identified in research on TICT mediated practice is the overuse of constructivist practices in place of theory (Selwyn, 2008; Underwood, 2004). Constructivist practices have numerous definitions however the term broadly refers to learning in which the individual makes their own meaning from experiences strongly related to their prior knowledge. The literature referring to constructvism related to ICT often however equates constructivism with student-centred learning. Reflecting this, there is a consistent reference to the role of the teacher as one who guides learning, rather than explicitly teaching (Chen, 2008; Killen, 2009; McCormick & Scrimshaw, 2001). Underwood states that constructivist practices have been used as a mantra rather than a theoretical tool in research on the educational uses of technology, and this has resulted in this area of research being dominated by simple, descriptive models of the use of ICT (2004). Constructivist practices have been used in research as a characteristic of teachers improving in their practices with ICT. Minimal use of other theoretical perspectives limits the depth of data analysis researchers are able to achieve in this area of research.

Similarly, Selwyn (2008) observes a disconnect between research in education and in other disciplines, in how they approach researching practices with ICT. He identifies that research in ICT within the discipline of Education, approaches technology as a neutral and blank canvas; this limits the understanding such research can provide. Selwyn argues the need to follow the lead of research outside Education, which conceptualises ICT use as a site of complex and intense social conflict between established and new practices, beliefs and knowledge. Such conflict can be understood for example between new and established processes of communication, time/space configurations and relationships between information and user (Poster, 2005; Goodson, et al, 2002).

1.3 Thesis statement

In this thesis, I argue that TICT mediated practice does not take place in isolation from the pressurised, diverse, ambiguous and intense contexts in which it is situated. Nor is it separated from the complexities of teachers' individualised narratives that contribute to their engagement with these contexts. This study makes a contribution to knowledge by focusing on the TICT mediated practice of individual teachers and providing evidence and explanation of the complex interrelationship between context, engagement with context, and the associated learning that takes place as part of this practice. In addition this study makes a methodological contribution by using methods that support the opportunity for examining different types of change that may be developing in teachers' ICT mediated practice, as well as providing nuanced detail and theorisation about the changes that may be occurring and why they are.

1.4 Research aims and questions

An aim of this study is to identify the structures and understandings that dominate and drive change in TICT mediated practice. It is also to provide evidence about the process teachers go through in prioritising potentially conflicting aspects of the context in which their practice is situated. This facilitates demonstrating the ways that teachers produce knowledge in an ambiguous and unclear context and the influence of this on the development of their practice. In other words, this thesis is concerned with what actually happens when ICT meets teachers in schools. Specifically, how TICT mediated practice is influenced by the already established contexts and narratives of teachers (Selwyn, 2008).

This study is framed around three research questions:

1. How do TICT mediated practices change over time?
2. What induces change or continuity in TICT mediated practice?
3. What ways do teachers think about and interpret their ICT mediated practice?

In posing and addressing these research questions, this study responds to methodological needs identified by leaders in this area of research (Selwyn, 2008; Underwood, 2004). It does not discard the research on change in teachers' uses of ICT, but offers a methodology, setting and theory for examining change in TICT mediated practice for new understanding. This study responds to Selwyn's (2008) thesis, below, which prioritises an 'open' approach to researching teachers' uses of ICT in their practice.

> Such 'state-of-the-actual' research questions necessitate taking as broad an approach to technology and education as possible in terms of methods, settings and theoretical approaches. They also involve having as broad a mind as possible regarding the realities of ICT use. Education technologists cannot afford to dismiss alternative perspectives out of hand simply because they do not immediately concur with the starting-points of other researchers from outside their field.

This study is a qualitative, longitudinal study using grounded theory strategies. It takes as its focus the knowledge, behaviours and goals of five teachers in primary and secondary schools in their TICT mediated practice over a period of five years (2001-2005). The data analysis is focused on examining the long-term influence of the individualised meaning teachers make of their contexts and how this contributes to the changes that develop, or don't develop, in their ICT practice. Data analysis took place between 2006 and 2008. Documentation of the study took place over the course of the study; however, it was the primary focus of this study during 2009 and 2010.

Data collected between 2001 and 2005 relate to a different form of educational technology than in 2010. This historical data however continues to be of significance to our understanding of how teachers uses of ICT change because there is a significnat need to understand the ways digital technology mediates knowledge and understandings and how this relates to changed practice. Which technology it is and what it can do is of much less importance, than how teachers as the users of this technology is interpret technology in relation to their practice

1.5 Significance of this study: Research, policy and practice:

TICT mediated practice is the key factor contributing to how well schools can capitalise on ICT for student learning. Current research often presents teachers as not changing their TICT mediated practice. Consequently, this has contributed to a culture of frustration, and a divided environment for developing future paths of change capitalising on using ICT to develop innovative teaching and learning, and the management of both. Therefore, the implications of this study are important for research, policy and practice (classroom and management).

To address this frustration and find out more about change in TICT mediated practice, this study uses a different approach to that often used to examine change in TICT mediated practice. An aim of this study is to make a methodological contribution. This study focuses on the subjective narratives of five teachers and their TICT mediated practices. It is not expected that the findings from this study will be generalisable to the practices of all teachers (Bogden & Biklen, 2003; Flick, 2009). Using a methodology which supports developing rich, holistic descriptions of the complexity of their TICT mediated practice will however contribute to answering questions about how currently practising teachers are making sense of their ICT experiences.

This study is therefore significant in that it reports, in detail, a method for examining educational uses of ICT that is useful for building a foundation for future research. Using this methodology will provide new, additional knowledge about change in TICT mediated practice. This will support more informed decision making in new policy development for the meaningful leading and managing of future TICT mediated practice. This thesis will also be an empowering resource for teachers in that it will share the narratives of other teachers' ICT mediated practice; this may contribute to reflection on and affirmation of their own practices.

1.7 Structure of this thesis

This thesis presents the purpose, process and outcomes of this study in five chapters. Chapter 2 presents a review of the literature pertinent to change in TICT mediated practice. The chapter focuses on critiquing leading/seminal studies focusing on change in teachers' practices with ICT, as well as research that offers 'alternative' perspectives for understanding this practice. The review is organised around the methodologies of this body of research literature and how change in teachers' practices with ICT has been identified, examined and represented. A conclusion drawn from the review is that we have information on the scale of ICT use and the types of uses teachers are engaging students in at a single point in time. An additional conclusion drawn is that repetitive methodologies have hindered a deep understanding of teachers' individualised engagement with ICT. Greater depth of understanding is needed about how and why they make decisions about using ICT within the changing context of their own set of variables. Also the changes in contexts and pedagogy that develop over time associated with those decisions.

Chapter 3 presents a description of and rationale for the methodology and methods used in this study. In particular it aims to show how as broad an approach as possible was used to examine change in TICT mediated practice. The methodological framework of this study—iterative, qualitative, longitudinal study centering on a small number of participants—is explained and rationalised in terms of addressing research gaps. The method *assorted analysis* (which involves analysis of pre-existing data together with new data collection and analysis) is explained as integral to the longitudinal component of this study. The second section of Chapter 3 provides a detailed explanation of the layers of data analysis and management used to reduce and organise the participants' pre-existing data (drawn from the *e.ffects* study), and how this was used to guide further data collection and analysis. Details of measures that were employed to improve trustworthiness of the findings and meet accepted ethical standards are also explained. Reflecting the iterative nature of the methodology of this study, this chapter also presents with an impression of the data, where the further analysis needed to gain a greater depth of understanding of change in the participants' TICT mediated practice was identified. It also describes the application of aspects of professional practice theory and socio-cultural theory to deepen analysis of the data.

Chapter 4 presents the findings integrated with discussion for all the Research Questions. Three key findings presented and theorised in this section are that: the participants prioritised particular contextual and individual resources to inform their TICT mediated practice; the resources the participants prioritised, privileged and hindered particular types of TICT mediated practice; and critical moments experienced by the participants were associated with their professional identity. This chapter begins with a theoretical model developed from data analysis, which explains the ways participants engaged with their context and how this contributed to change in their TICT mediated practice. This is followed by a detailed explanation of the theoretical uses of the participants' voices drawn from analysis to illustrate the explanation. Chapter 4 presents the findings integrated with discussion for all the Research Questions. Three key findings presented and theorised in this section are that: the participants prioritised particular contextual and individual resources to inform their TICT mediated practice; the resources the participants prioritised, privileged and hindered particular types of TICT mediated practice; and critical moments experienced by the participants were associated with their professional identity. This chapter begins with a theoretical model developed from data analysis, which explains the ways participants engaged with their context and how this contributed to change in their TICT mediated practice. This is followed by a detailed explanation of the theoretical uses of the participants' voices drawn from analysis to illustrate the explanation.

Chapter 5 presents the contributions of this study. These are presented first in terms of the data itself in relation to TICT mediated practice in schools and second in terms of new thinking about and understandings of methodologies that can be used to examine change in TICT mediated practice. Included in this discussion are the implications for policy, practice and research. Following this is a conceptualisation of professional learning around ICT, which is explained in terms of the Rudd Federal Government's *Digital Education Revolution*. This chapter closes with the contributions it makes to the *e.ffects* study, as well as recommendations for future research in change in TICT mediated practice.

Additionally, each chapter begins, as this chapter did, with an excerpt from the novel, *The Road,* written by Cormac McCarthy. The excerpts are used as an introduction to the place and purpose of each chapter within the journey of this study and where each chapter is situated in terms of the thesis.

Chapter 2: Literature Review

What is that Papa?
It's a dam.
What's it for?
It made the lake. Before they built the dam that was just a river down there. The dam used the water that ran through it to turn big fans called turbines that would generate electricity.
To make lights.
Yes, to make lights.
(p.19 McCarthy, 2006)

A review of empirical research that examines change in teachers' practices with ICT is presented in this chapter. The above excerpt from the novel *The Road* refers to using existing resources as a foundation for creating something new and of value. Similarly, this review is an important stage in this study as it explains the knowledge we have of this practice upon which this study was built. This literature review was necessary to inform the initial planning and premise for the study, as well as the progression of the study.

The previous chapter introduced this study by outlining an inconsistency I identified between my experiences with teachers in the *e.ffects* study and the findings presented in the research literature on change in teachers' practices with ICT. As explained, my engagement with the teachers in the *e.ffects* study over time facilitated observing changes in their practices mediated by ICT that were individualised in terms of when they changed and how they changed. Additionally, I was identifying many diverse factors from their context that were influencing (complicating) the changes that developed. These factors ranged from their own children's use of computers, to the increasing use of ICT in the business world. Conversely, findings presented in much of the research literature on change in teachers' practices mediated by ICT indicated that teachers' practices were not changing or at best were changing only minimally with the resourcing of ICT in schools. Also, that teachers were expected to change in pre-determined ways in that they were often expected to change their practice quickly, and also in similar ways to each other, with the implementation of ICT in schools.

The discord between my own experiences and the research literature led me, and supported me, to understand this dissonance. To gain further understanding I embarked on an examination of the methodologies used in the empirical research presenting these findings.

As stated in Chapter 1, this study aims to build on prior research so that it is a useful and meaningful study with integrity (Shulman, 1999). This chapter details what is known about the questions raised in Chapter 1 regarding change and teachers' practices with ICT, what is yet to be known, and where the gap lies. For example, some questions raised in Chapter 1 centred on which aspects of their context are important to the TICT mediated practice of teachers, how teachers make meaning of these aspects and how this contributes to their ICT mediated practice.

This review is positioned within the empirical research on teachers' practices with ICT and draws on research focusing on change in this practice as well as building on previous literature reviews that have centred on this practice. In 1991 Sutton (1991) concluded her review of 10 years of research on difference in educational uses of ICT in schools. A conclusion she drew in that review was that there was still a great deal for researchers to do in this field in order to gain a deep understanding of the complexity of difference in use. Volman and van Eck (2001) built on the work of Sutton's review of the research literature of the 1980s. They state a striking finding of their review, was that little research had been done in the context of schools: the majority were laboratory style studies and did not appear to be particularly suitable for solving problems arising from the introduction of ICT in schools. The present study takes place twenty years after the review by Volman and Eck. In this literature review I focus primarily on research that has taken place in schools and focuses on understanding teachers' practices with ICT and how and why they change. This review informed this study in important ways; it supports understanding and valuing the design of this study as one which can meaningfully inform future planning and management of TICT mediated practice and will also contribute to understanding the phases of research on the educational uses of ICT that have taken place over the years.

A number of researchers have observed that research on teachers' practices with ICT has primarily focused on describing teachers' use of ICT and how this use has changed their practice. In her review of recent research and reports in European literature (see Eurydice, 2004; OECD, 2006), Drenoyianni (2006) identified four noteworthy characteristics which have been used to understand how ICT changes education. These characteristics focus on the type of ICT teachers used, how often, what they used it for and the changes to their practice due to their use. Similarly, Underwood (2004) has observed that research literature on teachers' practices with ICT has primarily focused on the characteristics of teachers' ICT practices that lead to the successful integration of ICT into schooling contexts and the effect of the use of ICT on teachers: for example, teachers' changing attitudes to technology. I concur with this observation of the literature on teachers' ICT practices, and consequently the review presented in this chapter focuses on factors which have been identified in the research about how teachers use ICT and the influence this use is understood to have on their ICT mediated practices.

This literature review begins with Section 2.1, which centres on three characteristics I have identified to be the most commonly used in research publications as evidence of change in teachers' practices with ICT. These are: teachers' high frequency of use of ICT, teachers' use of ICT primarily to teach curriculum content rather than ICT skills, and teachers' use of a constructivist style of teaching when using ICT in classroom teaching. These characteristics have been used as organising principles in this review. These characteristics are similar to those noted by Drenoyianni (2006). However, Drenoyianni's characteristics focused not only on teachers but also on students and schools. In this review I have adjusted these characteristics according to how I interpret the body of literature on teachers' practices with ICT to conceptualise appropriate (successful) teaching practice with ICT, and additonally how these characteristics have been used in research to examine and understand change in this practice.

A number of key points made in the next section (Section 2.1) are in relation to these characteristics and their use in research on change in practices with ICT. They include: a) most teachers are not changing in terms of these three characteristics; b) these characteristics place ICT and the type of change it is expected to bring about as the primary focus of the study and, c) using these characteristics as evidence of change produces some research design problems, in that they provide limited understanding of change that may be panning out outside these expectations. The research that has been undertaken in this area is positioned in this review as a stage in the research that has given us background information; however, there is now a need to change the way we are examining this practice, to support gathering other types of information. Section 2.2 focuses on methodologies that have commonly been used to examine change in teachers' ICT mediated practices. These include the use of continua, which focus on teachers progressing through a pre-determined number of stages in their practice. However, there is a lack of longitudinal studies. The main point made in this section is that the dominance of such approaches in research is limiting tracing, examining and developing a deep understanding of change in teachers' practices with ICT.

Section 2.3 discusses the literature review in relation to the Research Questions. It addresses what we know in relation to each Research Question, what is still unclear, and the method and methodologies used in this study that address the gaps identified in the literature. This section is an important foundation for understanding and valuing the design of this research, which is explained in Chapter 3.

Furthermore, the term TICT mediated practice, which was introduced in Chapter 1, is a term I have created to represent the individualistic and situated nature of teachers' practices with ICT. This is not a term used in the research literature on teachers' uses of ICT. I therefore use the term 'teaching practice with ICT' when reviewing the literature. This is because the literature often focuses on teachers' uses of ICT in their classroom teaching.

2.1 Characteristics often used as evidence of change

A principal concern dominating the empirical research on change in teachers' practices with ICT is proposing forms of teaching, fit for the digital age. As stated in the introduction to this chapter, three characteristics have consistently been used as evidence of change in teachers' practices with ICT. Many studies interpret teachers demonstrating any of these three characteristics in particular ways, to have accepted ICT and to have changed their practice in ways which have been proposed to be capitalising on the educational benefits of these resources (Bauer & Kenton, 2005; Becker, 2000; Conlon & Simpson, 2003; Cuban, 2001; Hennesy, Ruthven, & Brindley, 2005; Hermans, Tondeur, van Braak, & Valcke, 2008; OECD, 2006; Pelgrum, 2001; Warschauer, Knobel, & Stone, 2004). What follows is a detailed explanation of how this area of research is interpreting these characteristics, the contexts of these studies/papers and their findings. The present study does not intend to rely on these three characteristics as a framework for examining change in TICT mediated practices. How these characteristics have been used in research has informed the design of this study so that it will provide information that is meaningful and that goes beyond what is already known about change in TICT mediated practice.

2.1.1 Frequency of use of ICT

In the research literature, frequency of use of teachers' practices with ICT refers to how often a teacher uses ICT in their classroom teaching. A number of evaluative studies have been developed, based on the understanding that a teacher's frequent use of ICT in their classroom teaching is indicative of 'changed' practice (Bauer & Kenton, 2005; Chen, 2008; Conlon & Simpson, 2003; Cuban, 2001, 2001b; Levin & Wadmany, 2005; OECD, 2006; Watson, 2006a). Some studies used a scale to indicate the degree of frequency of use (Cuban, 2001b; OECD, 2006). For example, Cuban (2001b) ranged frequency of use from occasional users (teachers who used ICT at least once a month in their classroom teaching), to serious users (teachers who used ICT at least one or more times a week in their classroom teaching). Other studies compare whether a teacher's use is increasing over time (Conlon & Simpson, 2003). A common finding these studies present is that most teachers are not using ICT in their classroom teaching frequently; therefore, a conclusion being made in many studies is that teachers have not changed their practice with ICT (Bauer & Kenton, 2005; Conlon & Simpson, 2003; Cuban, 2001, 2001b; Watson, 2006a). Such a conclusion is reasonable: however, this approach to examining change can only provide a small part of the story. For example, how is the quality of this use and its contribution to student learning factored into this conclusion?

Cuban's (2001, 2001b) mixed method evaluation of teachers in Silicon Valley, California, and their practice with ICT is a leading study regarding change in teachers' practices with ICT, which is consistently drawn on by other researchers (Becker, 2001; Chen, 2008; Conlon & Simpson, 2003; Drenoyianni, 2006; Levin & Wadmany, 2005; Underwood, 2004b). Cuban's study focused on 26 teachers and some of their students from two schools in Silicon Valley, USA: a global centre for technology innovation and use. Cuban sought to affirm whether teachers with abundant access to ICT, such as those in Silicon Valley, still represented the national patterns of teachers' occasional usage of computers. Cuban concluded that the national patterns were consistent, even in Silicon Valley. He concluded that the use of ICT by the teachers in the study was still neither widespread nor consistent. He proposed numerous factors as the reasons for infrequent use of ICT by teachers: for example, lack of reliable hardware, school timetabling and internet speed.

Becker's (2001) large scale quantitative study was informed by and built on Cuban's analysis. His large-scale survey of 4,100 teachers in the USA identified, like Cuban, minimal impact of ICT on teachers' practices in their classroom teaching. Similarly, Conlon and Simpson (2003) also built on Cuban's study. Their quantitative study surveyed Scottish teachers in primary and secondary schools over a period of two years to identify whether Scottish teachers were increasing the frequency of use of ICT in their classroom teaching. The findings of Conlon and Simpson's study were similar to those of Cuban and Becker. The teachers were found to use ICT only occasionally in both the first and second years of the study. A conclusion of the study was that the majority of teachers were not increasing their use of ICT in classroom teaching and therefore not changing in their practice.

Conlon and Simpson's study is one of the few longitudinal studies examining change in teachers' practices with ICT. A limitation of this study was that different groups of teachers participated in each survey. Consequently, the degree of change in frequency of each teacher's use was beyond the scope of the study.

Other studies (Gonzales, Oickett, Hupert, & Martin, 2002; Martin, et al., 2000; Mullis, et al., 2000; Parr; Rosaen, Hobson, & Khan, 2003), using frequency of use as an indicator of change, have presented inconsistent findings on whether teachers are increasing the frequency of their use of ICT. A limitation of many of these studies is that first, they rely on teachers' self-reporting survey data to ascertain increased frequency of use and second, they do not triangulate the data with other measures of pedagogical change. Consequently, many of these studies do not provide much information beyond identification of use. They therefore provide minimal information about why teachers increase or decrease their use of ICT.

Some variables directly related to ICT have been identified as hindering or assisting the frequency with which teachers use ICT in their practice (Chen, 2008; Drent & Meelissen, 2008; Guha, 2003; Haydn & Barton, 2007; Hennesy, et al., 2005; Loveless, 2001; Tondeur, et al., 2007; Turbill, 2001). These variables include: the explicitness and shared vision of the school ICT policy (Al-Fudail & Mellar, 2008; Tondeur, et al., 2007), technical errors with ICT resources (Al-Fudail & Mellar, 2008), the availability of in-school ICT support (Chen, 2008; Tondeur, et al., 2007), government policy documents concerning teaching and ICT (Haydn & Barton, 2007) and professional development (Matzen & Edmunds, 2007) have been identified as factors constraining the frequency teachers use ICT. The teachers in Haydn's (2003) study explained that a visit to the computer lab created classroom behaviour problems (such as students not paying attention to the teacher and being easily distracted), in relation to the teachers' choice not to ICT in their classroom teaching. Extra planning time needed for lessons using ICT, in a time-poor school environment, was also identified as contributing to teachers' avoidance of using ICT in their classroom teaching (Bauer & Kenton, 2005).

It was evident from my examination of these studies that the variables they identified as influencing teachers' practices with ICT were often identified as single factors and often examined independently of other aspects of the teachers' context. A reason for this is that often these studies are an intervention aimed at identifying whether one factor or a number of single factors can 'improve' a teacher's practice with ICT (Jang, 2008; Matzen & Edmunds, 2007). These factors and more, are simultaneously present in the teacher's context: however, little is known about how they fit together and influence teachers' practices with ICT. Many studies examining the influence of single factors on teachers' practice with ICT recommend the need for research to focus on detailing the interplay between these factors (Drent & Meelissen, 2008; Hermans, et al., 2008; Matzen & Edmunds, 2007; Ottensen, 2006b; Tondeur, et al., 2007). This they describe as important to understanding which variables have the most influence on teaching practice with ICT, the type of influence they have collectively, and also the long term effect of such variables. For example, Tondeur, et al. (2007) recommend that future research examine the interplay between school-related characteristics (such as school culture, conditions and readiness for change) with teacher-related characteristics such as teacher beliefs and frequency of use of ICT in teaching, as the relationship is not very clear.

Another standout aspect of a number of studies in the research literature is that the variables they identify as influencing teachers' practices with ICT are often primarily focused on school-related factors or ICT specific factors (Matzen & Edmunds, 2007). As stated in Chapter 1, my experience with teachers in the *e.ffects* study led to an appreciation of the importance of the broader context on teachers' practice with ICT. There is little understanding in the research literature of how contextual factors beyond school and ICT based variables are interpreted by teachers in relation to their practice with ICT. Given the broad social and cultural uses of ICT by students, adults and teachers themselves in their homes and in society, many researchers identify the need for more understanding of the influence of contexts outside of school, on teachers' practices with ICT (Loveless, 2003; Selwyn, 2008). Ottensen (2006b) for example, recommends the need to examine teachers' practices with ICT in relation to the varying personal and professional, social and cultural contexts and identities they participate in when using ICT.

Furthermore, some significant claims are made within these studies, based on frequency of use as a single variable: for example, the PISA study (OECD, 2006), which surveyed 15 year-old students' frequency of use of ICT at school in relation to their standardised test scores for mathematics and literacy. This type of relationship places a lot of importance on one single aspect of use—frequency. However, the survey data gives minimal information to detail this relationship.

The field of research on teachers' practices with ICT is dominated by quantitative studies or small cross-case analyses (Underwood, 2004; Webb & Cox, 2004) which, by nature of their approach, cannot provide rich detail about why teachers use ICT in the ways they do, or do not. If we are to understand why (or even just how frequently) teachers use ICT in the ways they do, methodologies are needed which take account of the many factors that can influence this practice (Kemmis, 2006; Selwyn, 2008; Watson, 2001). Qualitative studies can provide such information, as they focus on detailing how and why single factors influence a teacher's frequency of use of ICT. More importantly, qualitative studies can examine these factors in relation to each other and the influence they have together on ICT mediated practice.

There is an emerging body of qualitative research on teachers' practices with ICT, which is conceptualising contexts as multifaceted, rather than as singular factors (Goodson, Knobel & Lankshear, 2002; Schofield, 1995; Garrison & Bromley, 2004; Monahan, 2005). Such studies support examining how varying contextual factors influence each other and in turn, teachers' uses of ICT (Yates, 2001). For example how teachers interpret their use of technology in terms of the overwheleming instructional tasks teachers and students face (Garrison & Bromley, 2004) the relationship between globalisation, technology and practices in schools (Monahan, 2005), how the changing perceptions of good education contribute to what counts as good teaching (Apple & Jungck, 1998) and the growing influence of corporatisation (often facilitated by ICT) on education (Noble, 2002).

Additionally, contexts are dynamic, particularly in the situation of ICT, due to the constant stream of innovations and new technologies. As stated in Chapter 1, this is a pressure for teachers, as they are expected to keep up with ICT innovations brought into the school teaching and learning context. For example from a technological persepctive there continues to be changes in: the number of computers in classrooms and schools, the types of computers, the software used and its application in the classroom. Consequently there are a greater number of variables that are developing when assessing the influence of ICT on pedagogy and the curriculum.

The work by Schofield (1995) and Hodas (1996) emphasises schools and classrooms as social and technological organisations. Schofield argues computer usage is therefore constrained (simultaneously) by the context, its infrastructure and its history. Consequently a particular combination of hardware and software may be used in different ways in different contexts (different classrooms and different schools) with different results. Simarly, change is evident in the analytical enviornment and the types of questions researchers are asking (Goodson et al, 2002). Greater attention is being paid to power relations and ideological foorms that underlie cultural phenomenon. Consequently, two aspects of the changing contexts teachers practices with ICT are undertaken within include, what is being studied and how.

Studies are needed which focus on the ways these factors evolve and impact on each other over time, and consequently on teachers' practices with ICT. Underwood (2004) states that a much needed methodology in research on educational uses of ICT is the qualitative longitudinal study. This is because it facilitates focusing on changing practice within changing contexts. This methodology is one that was used in this study as it facilitates acknowledging both the multifaceted nature of the teachers' context and the fast paced changes in this context, particularly in terms of ICT innovations.

Furthermore, many studies focusing on teachers' frequency of use of ICT in their practice also indicate that teachers within the same school or same subject department, vary in the frequency of their use. This, combined with contextual factors that act as barriers for one teacher, is not necessarily interpreted in the same way by other teachers. It also resonates with my experiences of teachers in the *e.ffects* study, as described in Chapter 1, whose practices with ICT were changing in unique ways. Teachers responding in individual ways to aspects of their context, is reflective of work on teachers' professional identities, (Connelly & Clandinin, 1999; Kemmis, 2005) that identifies that teachers have unique and varying motivations which they draw on to make sense of their contexts. As explained in Chapter 1, this is an important concern of this study and consequently, theories have been used in this study that support examination of the individualistic nature of TICT mediated practices. The use of these theories in this study is explained in detail in Chapter 4. Furthermore, one can suggest that, as contextual factors continue to modify and shift, teachers' individual responses will also change in some way.

Many studies on change in teaching with ICT place ICT as the primary unit of analysis, limiting the depth of understanding of teachers' varying motivations in this practice (Underwood, 2004). Shifting the focus away from the technology to the teacher, as this study does, contributes to further understanding of this factor.

2.1.2 Teachers' intentions for using ICT

In addition to frequency of use, another characteristic consistently used in the research literature as evidence of change in teaching practice with ICT is the intentions or reasons teachers demonstrate for using ICT in their teaching (Watson, 2006a). Intentions are generally presented in this body of literature in terms of whether teachers use ICT in their teaching to develop ICT skills or to construct knowledge (for example, subject content knowledge). Teachers' demonstration of the latter intention is understood by many studies as indicative of 'changed' practice with ICT (Becker, 2000; Cuban, 2001b; Drenoyianni, 2006; Drenoyianni & Selwood, 1998; Warschauer, et al., 2004; Watson, 2006a).

An important finding presented in research of teachers' uses of ICT is that most teachers place more emphasis on teaching computer skills, which is often described as coming at the expense of using ICT for knowledge construction (Watson, 2006; Becker, 2000; Cuban, 2001b; OECD, 2006; Warschauer, et al., 2004; 2006a). Drenoyianni et al.'s (1998) quantitative study categorised teachers into two broad groupings: those who saw computer use as a means of facilitating and enhancing teaching and learning, thus making a valuable contribution to teaching and learning across the curriculum (the conceptions), and those teachers who adopted a computer awareness perspective (the misconceptions). The study indicated that 70% of participants' primary intention for using ICT was to develop students' ICT skills. Interestingly, 50% of participants considered their use of ICT as having a 'pedagogic rationale'; however, the researchers felt that 20% of these teachers did not have enough knowledge of how ICT could be used to enhance teaching and learning, and therefore could not be counted as having a pedagogic rationale. Watson (2006) also concludes with a similar focus:

> The goal may be integration, a seamless link between the technology and learning, understanding and applying, but the reality still falls far short. (p. 202)

A consequence of the approaches taken in these studies (Watson, 2006; Drenoyianni & Selwood, 1998) is that they affect the possibility of understanding these consistent findings more fully. The focus of the research is on the technology and what the technology can do, rather than on the user, the teacher, and why they are using ICT in the ways they are. An aim of this study, as described in Chapter 3, is to focus on teachers and their practice. This will facilitate a greater depth of understanding of why teachers use ICT in the ways they do, or alternatively, why they do not.

Studies by Baggott la Velle, McFarlane, John, & Brawn (2004) and Morgan and Tindmarsh (2004) argue that teachers often consider teaching ICT skills to be in opposition to using ICT to teach curriculum content. Both these studies identify numerous factors teachers think about in their choice of intention for incorporating ICT into their teaching. In the former study, the teachers expressed some concern about being obliged to teach ICT skills during what they described as valuable science curriculum time. This led to the erosion, in their view, of the learning of science knowledge and skills. Even when simulations for learning science content were used, they were seen by numerous teachers as adjuncts to, not replacements for, the 'practical'. Similarly, Morgan and Tindmarsh's (2004), expressed concern in their study about the 'double discourse' of technology and subject becoming blurred in the research and policy literature which advocates the benefits of ICT in teaching and learning. They state that an overemphasis on ICT might in turn lead to a derogation of the quality of geography teaching.

While studies have found that many teachers are not using ICT for knowledge construction, the studies by Baggott la Velle, et al. (2004) and Morgan and Tindmarsh (2004) and Garrison and Bromley (2004), suggest this can be related to tensions that exist in teachers' contexts. For example, they refer to tensions that may exist between: what teachers understand their role of teacher to be, the practices they understand as necessary for fulfilling this role, and the pressure on them to use ICT in their teaching (John & Sutherland, 2004; Garrison & Bromley, 2004). For example, teachers who in Hennessy's study (2005) primarily used ICT for the development of ICT skills, identified the value of using ICT to enhance knowledge, yet cited the constraints of high stakes testing and the associated expectation of traditional teaching methods as extinguishing opportunities for this. Some of these teachers felt that time spent using ICT in class, meant less time available for working on subject outcomes. They thus gave priority to subject knowledge. Furthermore, the ambiguity of policy documents as to which 'rationale' for ICT use should be prioritised (Watson, 2001; Mary Webb, 2002); and school ICT focus (Hayes, et al., 2005; Parr, 1999) has been identified in conflicting situations which teachers consider in their intentions when teaching with ICT. This suggests that for teachers, a tension exists between aspects of the established context and practice of teaching, and their teaching with ICT.

Furthermore, in a number of studies it is also difficult to differentiate teachers' use of ICT as having an ICT skills intention from a knowledge construction intention. For example, in the PISA 2003 results (OECD, 2006), the frequent use of computers among 15 year-olds was dedicated to electronic communication (56%), looking things up on the Internet (55%), playing games (53%) and word processing (48%). The use of educational software (13%) and the use of computers to help learn school material (30%) were less frequent. Notably enough, OECD quantitative data did not actually clarify which of these student uses took place at school, and did not refer to the nature of teachers' use of ICT at school. As a result, computer uses are presented in a decontextualised form that does not enable readers to judge whether their use was to develop ICT skills or alternatively, to support curriculum learning.

2.1.3 Constructivist practices when teaching with ICT

In addition to using ICT for knowledge construction and high frequency of use, evidence of change in teaching practice with ICT is also associated in the research literature with a teacher's' demonstration of 'constructivist' practices. There are however numerous variations on how constructivist practices in the research literature on teachers' practices with ICT are defined in relation to traditional practices (McCormick & Scrimshaw, 2001). Commonly, the research literature conceptualises constructivist practices as student-centred learning in which teachers guide students in their exploration of knowledge, rather than explicit instruction and knowledge transferral (Levin & Wadmany, 2005; McCormick & Scrimshaw, 2001).

Constructivist practices are a dominant concern in the literature and many studies have used these criteria to identify change in teaching with ICT (Chen, 2008; Conlon & Simpson, 2003; Cuban, 2001b; Drent & Meelissen, 2008; Hennesy, et al., 2005; Hermans, Tondeur, van Braak, Valcke, 2008; Levin & Wadmany, 2005; Warschauer, et al., 2004; Wong, Li, Choi, & Lee, 2008). Representative of the line of argument much of this research takes, a study by Herman et al. (2008) concluded that constructivist concerns have a positive and transformative effect on uses of ICT while traditional beliefs (non-constructivist) have a negative impact on classroom use of ICT.

Many studies have found teachers are not demonstrating constructivist practices in their uses of ICT in their teaching (Chen, 2008; Conlon & Simpson, 2003; Cuban, 2001b; Drent & Meelissen, 2008; Hennesy, et al., 2005; Hermans, et al., 2008; Matzen & Edmunds, 2007; Warschauer, et al., 2004; Wong, et al., 2008). These studies state that teachers are merely using ICT as an alternative way of undertaking the same learning tasks. Their findings indicate that teachers' lessons often just replicate the manual version of the task, just adding a minor, additional use of ICT (Kerawalla & Crook, 2002). They conclude that little attention is given to using ICT for learning anything other than ICT skills.

Additionally, a growing body of research focuses on identifying factors that hinder teachers' changing in this way (Chen, 2008; Levin & Wadmany, 2005; Matzen & Edmunds, 2007). Teacher-related variables such as teachers' willingness and commitment to experimenting with ICT in their teaching (Drent & Meelissen, 2008), teacher beliefs about ICT (Levin & Wadmany, 2005) and teachers trying to deal with the confronting and overwhelming instructional tasks required of them (Garrison & Bromley, 2004) have been identified as factors which hinder teachers using ICT in constructivist ways.

A continuing distinction of this body of research is the discourse of blaming teachers for not changing their teaching to more constructivist practices. The limitations of teachers are often given as the reason for lack of change in practice. In the research journal paper 'Why do teachers not practise what they believe regarding technology integration?', Chen (2008) argues that teachers have beliefs in constructivist practices but don't teach that way because they have limited knowledge of what constructivist practices are.

Parr's (1999) study is one of the few longitudinal qualitative studies focusing on change in teaching with ICT, and subsequently provides some insight into this issue from another perspective. This study focused on one school's five-year effort to increase the level and type of usage of ICT by teachers. After five years of professional development, which focused on developing teachers' knowledge, attitudes and resourcing of ICT, teachers were noted as having increased confidence and skill levels with ICT, and as using it more frequently. Teachers' uses of ICT however, continued within what was described by Parr as a traditional mode of teaching. To explain their lack of change to constructivist practices, some studies conclude that teachers' lack of ICT skills or confidence was a constraining force on how willing they were to use ICT with students (Dawes, 2001; Parr, 1999b; Selwyn, 2000). This is a plausible argument. From a different vantage point, Parr's findings examine change in teaching with ICT beyond skill level, to the culture and economic processes of the school and the ways teachers engage with these in their teaching with ICT. The teachers in this study continued with a strict adherence to the existing school curriculum, part of which was a program of regular testing. This made it difficult for teachers to prioritise the process of learning, as opposed to the acquisition of content knowledge as an end in itself.

What Parr's study indicates is that teachers may appreciate the potential that ICT offers for student learning, yet their practical experience of their role of teacher leads them to interpret ICT as not needed, or potentially a hindrance in fulfilling this role. Other practical choices teachers make regarding teaching with ICT, relate to the location of ICT resources (Cox, 1999; Webb, 2002), students' lack of English proficiency (Warschauer, et al., 2004) and students' lack of skills in interpreting internet information (Baggott la Velle, et al., 2004), matters which are perceived by some teachers as the difference between the 'dream and the reality' of integrating ICT into the curriculum. Becker (2000) placed the likelihood of teachers using ICT in intellectually powerful ways, as greatly dependent on their own level of ICT expertise and on how highly they valued its use in the educational process. Watson's (2001) observations indicate that syllabus outcomes mostly demand only lower order thinking tasks anyway, for the use of ICT.

Another alternative perspective on teachers' lack of change to constructivist practices is associated with the difficulty of changing one's own pedagogical beliefs when teaching with ICT (Ottensen, 2006b; Wong, et al., 2008). Levin and Wadmany (2005), conducted a three year longitudinal, mixed method study of six primary teachers in Israel which focused on pedagogical beliefs associated with teaching with ICT. Findings from this study indicate that pedagogical beliefs are individualised and multifaceted and they are generally slow to change. However, some aspects were found to change quicker than others. Additionally, the study also indicated that teachers often expressed alignment with aspects of various pedagogical beliefs at the same time. A limitation of this study is that it only focused on changes in beliefs. The study relied on data derived solely from teachers' statements recorded in a series of ICT-related professional development workshops; therefore, the ways these changes were reflected in participants' teaching with ICT and vice versa over time could not be ascertained.

An important association to be made is that while constructivist practices are often associated with school reform and 'ideal' change in teaching practice, teachers do not necessarily prioritise that type of pedagogy for their own teaching when teaching with ICT (Becker, 2000; Levin & Wadmany, 2005; Parr, 1999). A teacher's core approach to teaching is formed over time and influenced by a complex mesh of factors: for example, a teacher's own education and teacher training (Kemmis, 2005; Ottensen, 2006b; Renshaw, 1998). It is influenced by an intricate mesh of variables, not a singular entity (Alexander, 1992; Loveless, 2003; Mosely, et al., 1999; Shulman, 1986). Their core approach to teaching influences the types of teaching approaches they are willing to take on or not. If teachers are not easily shifting to a constructivist style of teaching, there is minimal information on the type of approach they may be shifting to and/or using when teaching with ICT. Simarly, the literature on teachers and teaching for example, Lortie (1975), Mclaughlin and Talbert (2001). Hall and Hord (1987) identify a number of factors that influence the ways teachers teach. Lortie found the historical actions of teachers, for example the experiences one had as students themselves as strong predictors of current teaching practice. This suggests that if one's former teachers did not use constructivist practices then this may contribute to a teacher not wanting to use that teaching approach in their own practices. Teacher commitment and engagement have also been identified as most critical factors in terms of teaching actions (Huberman, 1997, Nais, 1981). Similarly this litertaure has identified personal value systems of the teachers as significant to the teaching practice they adopt and develop.

It has been argued that reliance on constructivist practices in the place of theory has limited understanding change in teachers' practices with ICT outside this approach to teaching (Selwyn, 2008; Underwood, 2004). Selwyn (2008) states of research in this field:

> Though researched thoroughly, the predominance of these concerns has led education technology to become a rather uniform field of study—dominated by constructivist views of teaching and learning, and by a pronounced tendency to focus only on the positive aspects of education technology use. (p. 84)

> A contribution to this field of research is to examine questions of change and teaching with ICT as broadly as possible. This would facilitate examining the user's experience, with minimal limitation of analysis with pre-determined theory and expectations. (p. 83)

As stated in Chapter 1, understanding teachers' individualised choices in their ICT mediated practice is an important concern of this study. A review of the research in relation to their use of constructivist practices as a characteristic of change, indicates there is little information on why the majority of teachers are not changing in this way and also on what changes may be occurring in their practices outside constructivist practices.

Furthermore, identifying changes in singular factors such as pedagogical beliefs, gives some information about change in one aspect of teaching with ICT, but it cannot identify the various factors that are influencing this change and the ways this change is influencing other aspects of teaching with ICT. It is therefore unreasonable to expect a single factor, such as placing ICT in schools, to erase this history and the processes within these contexts. Parr's (1999) study suggests that if teachers see their current teaching strategies as successful or necessary, then the impetus for changing their core approach to teaching will be weak. It is reasonable to suggest however that as contexts change—for example, curriculum and or school demands—then the desire to change may be influenced. As stated in Chapter 1, there is a need for methodologies which are qualitative and longitudinal and which situate teaching with ICT within a multifaceted context. This should facilitate rich data that focuses and follows changes in contexts, as well as the ways teachers understand this change. It will also facilitate capturing a proportion of this complexity that influences and is influenced by change in teaching with ICT.

2.2 Tracking change: Use of continua and cross-sectional analysis

In addition to the use of the three characteristics discussed in Section 2.1 as evidence of change in teachers' practices with ICT, another noteworthy observation of the literature is the consistent use of continua, as well as the consistent lack of longitudinal studies, particularly qualitative longitudinal studies. It was evident that these approaches, which entailed limited tracing and examining of changes, were limiting in a number of studies.

Some of the literature on change in teaching with ICT uses continua to measure change in teachers' practices with ICT. These present a sequence of steps that teachers are expected to progress along as they move from novice teachers with ICT to proficient teachers with ICT. Continua often used in research include those based on teachers' levels of usage and stages of concern (ACOT, 1995; Clarkson & Oliver, 2002; Coughlin & Lemke, 1998; Marcinkiewicz, 1994; Trinidad, Newhouse, & Clarkson, 2004). A continuum often used in this body of research is the ACOT model (1995). Like other models, this model states that a teacher must progress through a series of stages: a) Entry, representing baseline exposure to technology, b) Adoption, occurring when teachers try the technology; c) Adaption, beginning the appropriate use of technology; d) Appropriation, where ICT becomes part of the learning context; and e) Invention, where there is a change in methods and media to facilitate learning. As with other continua, teachers must progress through all stages: otherwise it is expected the ICT will likely be misused or discarded (Marcinkiewicz, 1994).

While such frameworks are proposed as supporting the examining of change in teachers' practices with ICT, they present a clinical interpretation of change in this practice. Newhouse et al. (2004) state that such continua are often intended to provide indicators for policymakers to assess the status of schools in terms of their use of ICT to support learning. In terms of research, they place limitations however, on the type and paths of change teachers can be examined as progressing through. Literature on teachers' pedagogy and professional identity indicates that teachers are individualistic, and therefore no one model is going to describe perfectly the circumstances of all teachers' changing practice with ICT (Newhouse, Trinidad, & Clarkson, 2002). In order to examine other changes that may be occurring, less pre-emptive restrictions on the type of change and paths of change that are examined, are needed.

Additionally, it is evident that the majority of studies examining change in teachers' practices with ICT are not longitudinal studies. With the exception of a few longitudinal studies (Parr, 1999a; Pelgrum, 2001), much of the research examining change in teachers' practices with ICT was cross sectional analysis. The large scale surveys and small cross-sectional studies dominant in this field of research have given us snapshots of the scale of ICT use and the types of uses teachers are engaging students in at a single point in time. They have not however, presented detailed information about the individual teacher and how and why they make decisions about using ICT within the changing context of their own set of variables; the nuances of change in contexts and pedagogy over time. In her editorial evaluation of research on the educational usage of ICT in the journal *Technology, Pedagogy and Education*, Underwood (2004) recommends that developing a more complicated model of ICT related teaching practices and pedagogical understanding can be gained through longitudinal research.

A review of the literature on change in teachers' practices with ICT indicates that longitudinal studies are rare in the research on teachers' ICT pedagogies (Cox et al, 2003; Underwood, 2004), or for that matter in educational research as a whole (Thomson, Plumridge, Holland, 2003), and yet they are needed to enable a holistic understanding of the ways individual teachers use and think about ICT and the forces shaping change (Ruspini, 2002) if we are to have a more developed understanding of ICT pedagogy. Reflecting on future directions for this area of research Underwood (2004) states:

> There has been little longitudinal research … Yet such studies are vital. Although theory certainly can be suggestive of causality, it cannot carry the evidential weight of longitudinal empirical work, either experimental or post hoc through established data sets. Such work … could have a major part to play in developing a deeper understanding of ICT. (p.142)

The review has identified the need for longitudinal research on teachers' practices with ICT to build understanding of how TICT mediated practice changes within a changing context.

2.3 Addressing the gap: Fuller understanding of TICT mediated practice needed

The purpose of this literature review was to identify gaps between what is known about change in teaching practice with ICT and what is yet to be known, and relate this to the research questions of this study (Boote & Beile, 2005). Research Question 1 focuses on identifying if and how teachers' practices with ICT have changed. This review indicates that many teachers are not demonstrating the three characteristics that have been proposed as evidence of change in this practice (increased frequency of use, using ICT to construct knowledge and constructivist practices). This, Bigum (2001) states, may be because teaching with ICT does not take place upon a blank slate. The particular changes that researchers have been looking for and have built into their methodologies may not be the changes actually taking place once ICT merges with other established processes embedded in the practice of teaching in schools. It may also be because methodologies in this area often anticipate immediate change, and change in this practice is not immediate. As stated, much of the research in this area has looked for change over the short term, and change is not being identified in teachers' practices within a short time frame. Given the complexity of this practice and the context in which it is situated, expecting change to take place slowly over time is reasonable. This understanding is also supported by my experiences with teachers in the e.ffects study, as stated in Chapter 1. Changes in their practices with ICT were evident by the third year of the study.

This literature review also informs Research Question 2 which asks what influences change in teaching with ICT. This review indicates that the mere presence of ICT in schools is not having a significant influence on teaching with ICT. A number of factors within teachers' school contexts and their roles, which hinder their uses of ICT, have been identified. Little is known however about which factors support it and also which factors beyond the school context, influence this practice to change.

The literature on educational innovation and change, for example the work of Michael Fullan, is useful for reflecting on what we need to know in order to suppport meaningful and authentic change in schools. This body of literature focuses on large scale reform such as imporving every classroom, every school and the entire teaching profession. Fullan (2008) stresses the need to develop a new kind of leader who recognises what is needed to bring about deep and lasting change in living systems at all levels. He suggests leaders need a deep understanding of what motivates us as human beings and how we tap into and influence other people's self-motivation. This requires deep understanding of teachers as individuals. It is this knoweldge that this study aims to contribute to.

Watson (2001) states a lack of understanding of individual teachers' uses of ICT is a consequence of methodologies which have ignored the complexity of what informs and shapes ICT practices. Conceptually, ICT has been attributed to being a catalyst for changing teachers' pedagogy: however, looking beyond the educational technology literature to the literature on pedagogy supports the thesis that teaching is a complicated practice. Also, given the ubiquitous use of ICT in society, the factors influencing it would be expected to include those outside the school context, to include social and cultural uses of ICT by families and society. This is particularly pertinent to use of ICT which, as stated in Chapter 1, has had a considerable effect on many aspects of our daily lives.

Little insight is given in the literature regarding Research Question 3, which focuses on examining teachers' understandings of their changing practices with ICT. This is because the lived experiences of those using (and not using) ICT have not been a primary focus of research in this area. Some studies have identified tensions that teachers recognize between factors in their context and pressure to teach with ICT. However, this review of the literature indicates there is minimal insight into the ways teachers understand and engage with these tensions.

There continues to be an argument for the need for this field of research to focus more on contributing to knowledge about learning and teaching, and less on the seemingly widespread concern for demonstrating the benefits of ICT use in education so as to justify its cost (McDougall & Jones, 2006; Selwyn, 2008). In this chapter I have identified that the literature to date has aimed at providing information about general patterns of use of ICT and whether this use has influenced practice in particular ways. This information is well documented now, and there is now a need to move on to research that has a different focus. The aim of this study is not to replicate what we know about teachers' practices with ICT but to build on our knowledge of this practice by gaining detailed information about how and why teachers make the choices they do in their TICT mediated practice. Chapter 3 draws on this literature review and explains the methodology and methods used to address the methodological and data gaps identified in the literature, to deepen our understanding of TICT mediated practice.

Chapter 3: Methodology and Methods

They camped against a boulder and he made a shelter of poles with the tarp. He got a fire going and they set up by dragging up a great brushpile of wood to see them through the night. They piled a mat of dead hemlock boughs over the snow and they sat wrapped in their blankets watching the fire. (p.31, McCarthy, 2006)

This chapter explains the methodology and methods used in this study to support a deep understanding of change in Teachers' Information and Communication (TICT) mediated practice. The excerpt from *The Road* above, focuses on the characters in the novel bringing together relevant resources to build something of need. Similarly, this chapter presents the tools and resources that have been drawn together and used to facilitate an examination of the research questions.

The previous chapter presented a review of the research literature on change in teachers' practice with ICT. This review was important for clarifying current understandings of changes in TICT mediated practice, identifying what is yet to be known and developing this study in a way that addressed the methodological and data gaps identified in the literature. It was evident from reviewing the literature, that three characteristics have consistently been used as evidence for change in teachers' practices with ICT. These characteristics include: teachers' frequent use of ICT in their teaching, using ICT to construct knowledge (for example, curriculum content) and demonstrating constructivist practices when using ICT in their teaching. These three characteristics have been used as an organising principle in the literature review. From this process it was found that the current literature indicates many teachers are not demonstrating these changes in their teaching practice with ICT.

A key argument presented in this chapter is that consistent use of these characteristics has facilitated information gathering regarding broad patterns of use of ICT by teachers. The methodologies that have been used to examine these characteristics however, are unable to provide depth of understanding about teachers' practices with ICT. A reason for this is that ICT has been positioned as the primary focus of the study. Consequently, although the research literature indicates that most teachers are not changing according to these characteristics, there is however little detail of why teachers are not, and also of any change that may be occurring in their practice outside these expectations.

This chapter builds on the literature review by presenting the methodology and methods used in this study to address the Research Questions. As stated in Chapter 1 the Research Questions for this study are:

How does TICT mediated practice change over time?

What induces change or continuity in TICT mediated practice?

What ways do teachers think about and interpret their TICT mediated practice?

In Section 3.1 I present an explanation of the methodology used in this study. This explanation is given in relation to the dissonance I identified between my experiences with the changes I observed in the teachers participating in the *e.ffects* study and the findings the research literature was presenting regarding the lack of change in teachers' ICT mediated practice. A key point made in this section is that a qualitative, longitudinal methodology facilitated examining TICT mediated practice in a situated way. This, importantly, supported gaining detail about change in TICT mediated practice as well as change that developed in the context of this practice. This supported examining the ways context influences practice over time which, as stated, is a main concern of this study.

A second key point made in this chapter is that grounded theory methods supported opening up an examination of this practice in a way that stayed close to the data. Importantly, this supported moving away from imposing constructivist practices or other pre-determined theory in analysis which, as stated in Chapter 2, was a limitation evident in the research literature on change in teachers' practices with ICT. Additionally, this section explains that focusing on a small number of participants facilitated fine-grain, in-depth analysis and reporting. As stated in Chapter 2, the research to date has primarily given broad patterns of use and there is little research that provides rich detail about this practice. The explanation of the methodology used in this study also includes issues associated with the rigour of this study and the strategies that have been incorporated to address them.

An overview of the analysis related to the data collection is presented in Section 3.2. This section explains that the use of pre-existing data in this study required research methods that firstly reduced and organised the data into a manageable and useful form, that the pre-existing data organisation provided a useful basis for, and was necessary for, further longitudinal data collection, and that it was necessary to merge and analyse pre-existing data with the new data, to form an initial impression of the whole data set. A significant point made in this section is that matching an impression of the data against the research questions was useful for identifying the gaps in analysis. This section identifies questions significant to the research questions used as the basis for analysis of the data set. This is followed by Section 3.3, which documents the use of theory to deepen analysis of the data set. Detail is presented regarding the selection criteria used to identify aspects of theory relevant to the data and Research Questions, the systematic process of applying the theoretical aspects to the data set, and how this process contributed to analysis of the data in relation to each Research Question. A key point made in this section is that using theory in analysis of the data set facilitated building a complex structure around each Research Question that in turn facilitated an in-depth examination and subsequent reporting in Chapter 4.

3.1 Methodology

As stated in Chapters 1 and 2, an aim of this study was to build on what is known about change in TICT mediated practice. Integral to building knowledge was using a methodology and methods that supported new information about change in this practice. Table 3.1 below draws on the literature review presented in Chapter 2, lists and compares the methodological and knowledge limitations that have been identified in the literature (Orlando, 2009) and the methodology and knowledge focus of this study. The explanation that follows the table is organised around how this study addresses these limitations in relation to the Research Questions.

Table 3.1 Comparison between the methodologies used to research teachers' practices with ICT and the design of this study

Methodologies dominating current research	Important to this study	Methodological framework of this study
ICT as the central concern of study. ICT as the catalyst for change	The impact of technology on human endeavour as the central concern of study. Specifically how teachers' practice is mediated by ICT	Qualitative: teachers' practices as the primary unit of analysis. Small number of participants supporting fine-grain analysis
Constructivism used as the theoretical perspective	Using theoretical perspectives relevant to the data to analyse findings	Grounded theory strategies that support an iterative design and staying close to the data. Using theory relevant to data
Teaching methods and student organisation as the focus of study	Examining TICT mediated practices within the dynamic professional and personal worlds of the teacher, and the ways practice and context influence each other	Qualitative: examining teachers' practices in the context they are situated Longitudinal: examining changing teaching practices and/within changing contexts
Generic expectations for change in teachers' practices	Detailed, thick qualitative data on the TICT mediated practice of a small number of teachers over five years	Qualitative: various types of data collected over the long term Longitudinal (assorted analysis) Small number of participants: range of data and fine-grain analysis Grounded theory strategies that support an iterative design and staying close to the data
Unrelated cross sectional studies used for examining change	Examining individual teachers' ICT mediated practices over a long period of time	Longitudinal: Five year study. Small number of participants: teaching practices of five participants over five years

3.1.1 Longitudinal and Qualitative

As identified in Table 3.1, a core concern of this study is to understand the influence that teachers' engagement with their context has on the change that develops in their TICT mediated practice. Part of this understanding includes the ways that changes in a teacher's contexts influence their teaching, as well as the ways changes in a teacher's practice influence their context. I understand this reciprocal relationship to be a significant aspect of understanding change in TICT mediated practice.

Trying to examine and understand the situated and subjective nature of human action and why individuals change what they do is a complex task (Cohen, Manion, & Morrison, 2000; Flick, 2009). As identified in Chapter 2, answers to these types of questions are difficult to address in survey-based, longitudinal research or cross-sectional analysis. They have the limitations of focusing on single variables of change (Diggle, Heagerty, Liang, & Zeger, 2002; Flick, 2009) which cannot sufficiently take account of the complexity of changing teaching practice within a diverse and dynamic context such as school. As stated in Chapter 1, the complexity of schools is influenced by immediate and local people, situations and events, as well as more broadly by the society and culture in which they are situated.

Table 3.1 indicates that a longitudinal qualitative approach is used in this study as it provides a means for focusing on: the context in which TICT mediated practice takes place, change in the context and in practice, and the subjective meaning of change in TICT mediated practice for teachers (Flick, 2009; Ruspini, 2002). A longitudinal qualitative approach provided the opportunity to examine TICT mediated practice within the environments in which it was situated (Ruspini, 2002). Situating this practice heightened the complicated and unpredictable nature of change in practice, as well as the context and changes that develop in it. This was particularly important, given the change that I was examining is associated with using ICT. For example, the vast potential for using ICT is influenced by rapid information flow and the ways of communicating that ICT offers, combined with the continual state of innovation. This combination stimulates the uses that can be made of ICT, as well as the value that individuals and groups in our society place on ICT. Contextualising TICT mediated practice supported opportunities to reflect on factors such as the social experiences and needs of students and teachers. For exmaple, teachers' home uses of ICT, the individual learning styles of teachers, the ways the teachers used aspects of their context to assist them in their practices and the availability of ICT resources outside school.

Additionally, as Table 3.1 indicates, longitudinal research is suitable for this study as it provides the opportunity to foreground change as a unit of analysis, rather than singular variables of change (Diggle, et al., 2002; Ruspini, 2002; Thomson, Plumridge, & Holland, 2003). As stated, change in practice, and in contexts, and how they influence each other, is a core concern of this study. As noted in Chapters 1 and 2, there is little research in this area, or in fact in the discipline of Education, which positions change as the primary unit of analysis (Webb & Cox, 2004; Underwood, 2004). Focusing on change, in this study, provides the opportunity to sequence the teachers' practices and thinking, and to examine them in terms of the flows into and out of the situation. This opens up many paths for both causal analysis and inference (Ruspini, 2002; Underwood, 2004). A longitudinal approach supports a more reliable explanation regarding the change process of TICT mediated practice and the factors shaping that change.

A distinguishing feature of longitudinal research, important for the research questions, is that data is collected via repeated contact with individuals over time (Diggle, et al., 2002). As can be seen in Table 3.1, this strategy is consistent with the priority I have given to tracking TICT mediated practice over time. This study has a five year time span, which allows the opportunity to sort, synthesise and analyse a sequential collection of data over a long period of time (Charmaz, 2006). Five years is a significant amount of time, particularly in terms of ICT, given the dynamic state of innovation. For example, in a first observation, one participant in explained she knew very little about computers and therefore used an overhead projector in an observation lesson of her. She explained an overhead projector was a form of technology that she knew something abaout. Conversely, in a final observation of her teaching, five years later, her class were scattered throughout the classroom using laptops and a range of applications and internet sites. Contact with the participants over this period of time made possible tracking changes in the participants' uses of ICT and in their understandings, knowledge and beliefs in their practice, as new ICT resources and design features moved in and out of society and schools. Interestingly, the rapid state of innovation was evidenced in the succession of terms I had used in this study to refer to ICT. The term began as 'computers', then as ICT resources evolved during the course of the study, 'computers' was succeeded by terms reflecting the focus of the current resources, such as 'information technology', 'computer-based technology'. As stated in Chapter 2, the evidential weight of such a long data set of five years, as used in this study, forms a valuable contribution to the research literature focusing on educational use of ICT (Underwood, 2004).

Different types of qualitative data were collected from and about each participant's ICT mediated practice and context over the five years of the study. Teacher interviews and classroom observations were conducted over the long term, as well as focus groups with students and interviews with teaching colleagues and school executive and analsyis of relevant documents. This contributed to a rich data set, which provided the opportunity to secure a fuller understanding of the various aspects of each teacher's story (Bogden & Biklen, 2003; Flick, 2009). As stated in Chapters 1 and 2, developing a complex understanding of this practice was important in this study. The rich data set also facilitated reliability, and provided a valuable foundation for examining change in TICT mediated practice at the individual, micro level (Flick, 2009; Gershuny & Buck, 2000).

Another benefit of the repeated contact with participants over the long term in this study is that it assisted in addressing issues of accurately capturing the reality of an individual's experiences (Lather, 1991; Thomson, et al., 2003; Yates, 2001). Capturing another person's reality and getting at 'real' experiences and 'real' development of learning in research, is an enduring problem with both qualitative and quantitative research (Yates, 2001). As Yates (2003) indicates,

> Filling in a single answer on a survey might reflect a respondent's passing feelings on a particular day, or even be deliberately made up. Single interviews in small cross-sectional studies have some of the same problems, researchers run the risk of inflating the importance of particular responses, or not noticing them at all. (p. 14)

A benefit of qualitative longitudinal research is that a participant-researcher relationship may be established over time. While I did not develop a close relationship with the participants, repeated contact over a period of five years supported getting to know the participants and becoming more familiar with their way of thinking. I was able to revisit aspects of previous discussions with each teacher to clarify and/or build on existing information. The participants therefore had multiple opportunities to talk about and make sense of their experiences in regard to their ICT mediated practice (Yates, 2001; Flick, 2009; Ruspini, 2002).

Getting to know the participants through regular engagement with them, had the benefit of heightening my attention as a researcher to uncharacteristic remarks made by the participants and also to the possibility of undue emphasis being given to these remarks in analysis of the data (Bradburn, 1983). This was important for facilitating my ability to see change and continuities in a relatively 'close-up' way (Yates, 2003). As identified in Table 3.1, the development of rich, fine-grain analysis focusing on change was an important feature of this study. Engaging with the teachers over the long term facilitated this, as it supported a greater opportunity for discriminating 'actual' change from chance occurrences (Cohen, et al., 2000) in their ICT mediated practice.

Furthermore, in order to capture the multi-faceted and distinctive nature of each participant's story more accurately, I considered the construction of their reality from a dual perspective. It was not assumed that each interview was an 'unmediated confession' (McLeod, 2003, p. 201). While the details regarding the participants' practices and thinking are undoubtedly important, the sole purpose of the interviews was not just to check the consistency between what they say and what they do. The interviews were also approached with the understanding that the means by which an individual talks about, remembers and make sense of their realities 'highlights their subjective state' (Bruner, 1990, p. 54) and is equally as revealing of the person as the content itself.

It is also important to acknowledge that participating in the interviews over five years also influenced the TICT mediated practice of the participants. The interviews they participated in can be described as another aspect of their changing context. The conversations the participants had as part of this study, focused on a process where they articulated their experiences of ICT mediated practice. Finding the words to talk about their practice was a requirement of this. It also provided opportunities for them to think explicitly about their ICT mediated practice and to make connections between their practical knowledge and professional knowledge. This is a positive and influential process for teachers, as it provides them with resources they can use to develop their practice.

3.1.2 Assorted analysis

The longitudinal component of this study was made possible with the use of assorted analysis. Assorted analysis is the secondary analysis of pre-existing research data, combined with primary data collection and analysis (Heaton, 2004; Smith, 2008). Its use in this study was important for both methodological and practical reasons. As discussed in previous chapters, and identified in Table 3.1, an important feature of this study was to follow and compare the TICT mediated practice of individuals over an extended period of time. As explained, a longitudinal approach complements and supports this type of examination. There are, however, strict time constraints around the completion of a doctoral thesis. For this reason, a longitudinal study is not ordinarily possible for doctoral studies. This is a particularly pertinent issue, given the lack of longitudinal studies in education. As stated in Chapter 2, there is a need to build up this body of research and research expertise in this area (Underwood, 2004). Assorted analysis and the opportunity to re-use data allowed a longitudinal study to be possible. Assorted analysis supported collecting longitudinal data over time however it does not support analysing data in an iterative manner as it is collected. This had the benefit however of being able to analyse the data with this supported examining change from a distinctive position; one of hindsight. I was aware of the technological innovations that had occurred since the collection of the pre-existing data and also the changes that had occurred in school policies and practice regarding infrastructure and curriculum related to ICT. I was also aware of the significant social and cultural changes associated with ICT use outside school that had developed since the collection of the pre-existing data. This hindsight facilitated an informed understanding of the types of changes and trajectories of change that had occurred, and not occurred, since the pre-existing data had been collected time. It also can be interpreted as a limitation in that my own experiences and ensuing understandings that had formed during this time would influence my analysis of the data.

The pre-existing data used in this study was drawn from the *e.ffects* study, which was introduced in Chapter 1. Further details of the *e.ffects* study are presented in Section 3.3 of this chapter. As stated, my research in the *e.ffects* study contributed to the reasoning for this study. As a member of the *e.ffects* research team I was one of a number of people collecting data. Importantly, I was therefore familiar with the contexts and participants represented in this pre-existing data. Also built into the methods of this study were strategies that focused on continuity rather than disconnection and de-contextualisation of the pre-existing data. This study continued with some of the same participants and continued to focus teaching with ICT within the same school context. These strategies are discussed in detail later in this chapter. Importantly, the *e.ffects* data was part of data I was familiar with. Re-using one's own data alleviates epistemological issues about data being collected by other researchers, and therefore being removed from the contexts in which they were gathered and analysed (Gilles & Edwards, 2005; Heaton, 2004; James & Sorensen, 2000; Parry & Mauthner, 2004; Smith, 2008).

The use of pre-existing data also contributed to the rigour of this study as it brought into this study the field notes and memos of researchers who collected and analysed the pre-existing data. This collection of data contributed to a body of evidence from different perspectives accumulated over time (Flick, 2009; Merriam, 1998). The pre-existing data was also systematically collected and ordered, and the new data collected was systematically added to these records over the course of the study (Merriman, 1998). This had the benefit of supporting 'checking, reading and comparing the interviews and other qualitative data against each other, allowing patterns, themes and inconsistencies to emerge' (McLeod, 2003, p. 205). This strengthened the rigour of the study (Flick, 2009; Merriam, 1998).

3.1.3 Grounded theory methods

As identified in Table 3.1, a selection of tools drawn from interpretive grounded theory methods have been used in this study to open up new ways of thinking about TICT mediated practice and the type of theory that could assist in understanding this practice. As stated in Chapter 2 and in Table 3.1, moving away from constructivist practices as theory was identified as much needed in this area of research (Selwyn, 2008; Underwood, 2004).

Grounded theory is a systematic process by which the researcher becomes more and more embedded in the data. The aim is to develop increasingly richer concepts and models of how the phenomena being studied, works (Charmaz, 2001; Ryan & Bernerd, 2000).

The interpretive grounded theory methods I selected to use in this study were based on new interpretations of this methodology (Bryant, 2003; Charmaz, 2006; Ulle, 2005). These new interpretations are consistent with the epistemological underpinnings of earlier forms of grounded theory, in that they involve an iterative, systematic process of data collection and analysis which stays close to the data; theory is constructed from working with the data (Charmaz, 2006; Strauss & Corbin, 1998). The aim is to create abstract, interpretative understanding of the data.

A distinction of more recent interpretations of grounded theory is the assumptions made of the external world (Bryant, 2003; Hall & Callery, 2001b; Ulle, 2005). Earlier forms of grounded theory assume the researcher is a neutral observer and views categories developed during data analysis to be derived from data. More recent interpretations recognise the subjectivity of the role that the researcher plays in creating the data and the ensuing analysis through interaction with the data (Bryant, 2003; Charmaz, 2001, 2006; Hall & Callery, 2001b; Ulle, 2005).

I have made flexible use of grounded theory in this study by selecting those methods that facilitated addressing the research questions. These methods have included collecting data and coding it to develop themes to inform subsequent data collection and analysis, and using theory to build the categories of concepts developed in coding. This type of use is reflective of more recent interpretations of grounded theory which anticipate a freer use of the approach, rather than strict adherence to guidelines (Charmaz, 2006).

An advantage of using grounded theory methods in this study was that they require the researcher to stay close to the data, and theory is constructed from working with the data. As stated in Chapter 2, Underwood (2004) has critically observed, 'There are too many outputs in which this theoretical perspective (constructivist practices) appears as a mantra' (p. 139). As identified in Table 3.1, using grounded theory methods facilitated breaking away from using constructivist practice as theory. It made it possible to work with the data, particularly in the coding and comparison of data, without aligning to a particular pre-selected theory (Ulle, 2005). This facilitated opening up new ways of thinking about and understanding change in TICT mediated practice, and was an important contribution this study could make to research and practice.

Newer interpretations of interpretive grounded theory are consistent with the need to acknowledge the subjectivity of the researcher. This is an issue often associated with qualitative research (Bogden & Biklen, 2003; Flick, 2009; Miles & Huberman, 1984). It also reflects the aim of this study, as stated in previous chapters, of trying to come closer to an informed understanding of change in teachers' practices and contexts; to examine situations through the eyes of the teacher (Cohen, et al., 2000). McLeod (2003) argues that acknowledging one's subjectivity in research is not simply addressed by collecting more and more data over the long term. There was a need in this study to critically examine what I was seeing in the data and critique and appraise my own position and location (Charmaz, 2006; McLeod & Yates, 2006) regarding data collection, selection, interpretation and analysis. To do this, I have made, the participants' and my world, as transparent as possible to the reader (Merriman, 1998; Guba, Lincoln & Bryman, 2001; Flick, 2009). Also, to further assist in clarifying my subjectivity in my reading of the data, a strategy designed into this research was collaboration with the participants, where they had the opportunity to read summaries of their data and discuss and interpret their data with me. This strategy is discussed in more detail later in this chapter,

3.1.4 Small number of study participants

This study is a small-scale in-depth study constructed around a relatively small sample size of five participants. A small sample size is used for both theoretical and practical reasons. As stated in Chapter 2 and identified in Table 3.1, the research literature on teachers' practices with ICT has gathered a relatively small amount of data from a large number of teachers. The intention of this study was to contribute to this literature by investigating a small number of teachers across a wide range of dimensions, in considerable depth, over a period of time.

In terms of the practicalities of time, focusing on a small number of teachers supported finding out the particular and the in-depth, and developing thick descriptions around these (Merriman, 1998; Lincoln & Guba, 1985). In Chapter 4, I include detailed historical, contextualised narratives of the participants' practices, the changes that occurred and evidence supporting my analysis of the process of change. These narratives facilitated extending the broad patterns of usage that the current research literature provides (see Chapter 2) by enabling greater attention to the intricacies individual teachers work through in their TICT mediated practice.

Additionally, the five teachers participating in this study were representative of the situated nature of teaching. By paying attention to the particular and giving sufficient contextual details, the reader will be able to make judgements about the possible usefulness and transferability of my findings to other situations (Flick, 2009; Geertz, 1973; Lincoln & Guba, 1985).

One potential issue of dealing with a small number of participants is the possible over-reading I may bring to the analysis and interpretation. 'Over-reading' refers to over-emphasising claims and issues from the teachers' data. To address this, the design of this study is iterative. As identified in Table 3.1, this is made possible using grounded theory methods. The iterative design of this study included multiple acts of design, comparison, dialogue, reflexive critique and interpretation. It was characterised by a consistent cycle of data collection, analysis and reading. As stated in Chapters 1 and 2, a substantial body of research has sought to evaluate whether teachers are living up to expectations for change. I identified this as deterring in-depth understanding of this practice. The iterative design addressed this limitation in the literature as it facilitated using theory in ways which helped to understand and explain the teachers' ICT mediated practice, rather than to evaluate their actions against firm criteria.

Also, in small-number research, issues of selection are important (Yates, 2003). A selection process based on criteria reflective of the Research Questions and the issues associated with assorted analysis was used for the selection of the participants. These are detailed later in this chapter.

3.1.5 Rigour of this study

It was important to present this study as one that would be valuable in all areas of educational use of ICT, and in educational research generally. As stated in Chapter 2, research in educational uses of ICT is often disconnected with educational research, and addressing this lack of connection was important in this study. To facilitate this, it was necessary to take account of issues that impact on the usefulness and appropriateness of the research for its stated purpose. This is particularly important, as I am charged with the responsibility for collecting, interpreting and drawing conclusions from a collection of subjective experiences (observations of classroom teaching and discussion with teachers and students). It is important that the conclusions I make are plausible and credible. This is an issue relevant to all research, but particularly to qualitative research and especially to research that uses grounded theory methods (Bogden & Biklen, 2003; Flick, 2009; Hall & Callery, 2001a). Issues regarding the rigour of qualitative (and grounded theory), studies make it essential that I demonstrate that appropriate measures have been taken throughout the research to ensure that a rigorous and useful study is presented.

Reflecting the four criteria for rigour in qualitative research (dependability, credibility, transferability and confirmability) I have focused on presetning presenting transparency in the research process to ensure the reader can check the conclusions that have been drawn in the study. I have used a range of strategies to ensure this, which include: transparency around the methods and theories used in the study and why they have been used; the participants and their distinctiveness; clearly acknowledging data from inferences about the data and my reflexivity. Some strategies addressing rigour of this study have already been included in my explanation of methodology in Section 3.1. They include the gathering of multiple data sources for each participant from different perspectives over a period of time (Flick, 2009). I also provide sufficient thick description grounded in contextual experience so that readers can decide what is relevant to them (Geertz, 1973; Lincoln & Guba, 1985; Merriman, 1998). These are detailed later in this chapter, as well as in Chapters 3 and 4. The use of collaborative analysis techniques with the participants, as described in Section 3.2, was undertaken to ensure that the descriptions reflect the participant's experiences (Lincoln & Guba, 1985).

Peer examination, member checks and peer auditing (Flick, 2009; Merriam, 1998) have been used extensively throughout this study to further support its rigour. Peer and supervisor comment, critique and debate were consistent parts of the research process. This study used more than one investigator for part of the data gathering (Guba, Lincoln & Bryman, 2001). Additionally, my audio recordings ensure referential adequacy (Lincoln & Guba, 1985), and an audit trail to track the research process is available (Lincoln & Guba, 1985). The research design and initial findings have also been published in two international research journals: *Pedagogy, Education and Society* (Orlando, 2009) and the *Asia Pacific Journal of Teacher Education* (Orlando, 2007). This ongoing peer examination has assisted with clarifying and testing my assumptions and theoretical orientations. These are key aspects related to addressing issues of researcher bias.

Additionally, this study uses grounded theory methods. However, this approach is often criticised for its lack of rigour (Hall & Callery, 2001). These arguments centre on the lack of transparency of the effects of interactions amongst investigators and participants during data collection and analysis. In addition to the strategies described, the explanation of the methodology and methods used in this study is comprehensive and explicit. This further assists in clarifying the rigour of this study (Lincoln & Guba, 1985; Merriam, 1998; Yates, 2004) by ensuring the reader has sufficient information to understand and evaluate the findings presented in Chapter 4.

In this section I have explained this study as a qualitative, longitudinal study, using grounded theory strategies and focusing on a small number of participants. As stated, assorted analysis has been used to contribute to the longitudinal component. It has been discussed that this methodology was used in this study as a way of producing detailed and varied evidence of the ways TICT mediated practice changes and why. Section 3.2, which follows, explains the particular research methods used in this study to support the methodology.

3.2 Research methods

A number of research methods were used to systematically and meaningfully reduce, organise and analyse the data in relation to the Research Questions. These methods reflected the methodology of this study, as explained in Section 3.1. Table 3.2 below gives an overview of the methods. As can be seen from the table, the research process began with analysis related to the collection of data. This process focused on reducing and organising the pre-existing data, collecting new data and combining, shaping and organising the data set into a workable form. Key word analysis (Flick, 2009; Lincoln & Guba, 1985) was undertaken data to identify themes relevant to examining teachers' ICT mediated practice. These themes were used to inform further data gathering and analysis during this first stage of analysis.

The research process then focused on using aspects of theory to deepen analysis of the data set, in the next stage of the research process. The aspects of theories selected for use stemmed from the work undertaken in the analysis related to the data collection and the themes that emerged as part of that analysis. The use of theory facilitated deepening my understanding of the themes in relation to the Research Questions, as well as identifying other themes pertinent to the data.

A matrix was developed around broad themes and sub-categories identified from the keyword analysis. Samples of the matrixes are presnted in the Appendix of this thesis. The matrix was used throughout the research process and supported a systemic organisation and documentation of the data into a longitudinal format. Importantly, this supported the rigour of this study (Flick, 2009). A detailed explanation of each aspect of the research process follows in Table 3.2.

Table 3.2 Overview of research methods used in this study

Purpose	Goal	Description	Research Methods
Analysis related to data collection	Identify appropriate participants from *e.ffects* study pre-existing data Reduce, manage and organise participants' pre-existing data	Three layers: 1.1) Analysis of pre-existing data 1.2) Continuous movement between past and present data: Collection of new data and analysis of pre-existing and new data 1.3) Retrospective analysis of data by participants.	1.1a) Key word analysis 1.1b) Matrix to organise data into themes 1.2a) New data collection: observations, interviews 1.2b) Keyword analysis 1.2c) Continuation of matrix to organise data into themes 1.3a) Retrospective interviews specifically related to teachers' data collected over five years 1.3b) Keyword analysis 1.3c) Continuation of matrix to organise data into themes 1.3d) Development of impression of data 1.3e) Refinement of research questions directly related to the data
Analysis of the data set	Apply theoretical perspectives to deepen analysis of data	Application of theoretical perspectives to data analysis	2.1 Selection and application of theoretical perspectives to deepen analysis of data and address new research questions 2.2 Further refinement of research questions to reflect analysis in terms of data and theories

Table 3.2 indicates that the first stage of the research process was to organise the data into a manageable form so that deep analysis could be undertaken in relation to the research questions. As stated, this study uses assorted analysis to contribute to the longitudinal component of the study. Assorted analysis is the reworking of pre-existing data together with new data collection and analysis (Heaton, 2004). Data from the *e.ffects* study formed the pre-existing data used in this study. Additionally, this stage included new data collection. Consequently there was a substantial amount of data that needed to be organised in order for this study to progress. A systematic three-layer process was undertaken to achieve this: analysis of the pre-existing data, continuous movement between past and present data, and retrospective analysis of data by participants. An explanation of each layer of this process follows.

3.2.1 Analysis of pre-existing *e.ffects* data

As Table 3.2 identifies, the first layer of analysis related to collection of the data centred on analysis of the participants' pre-existing data. The pre-existing data used in this study was from the *e.ffects* study. This data was collected while I was a member of a research team for the study *Enhancing Learning Using New Technologies*; otherwise known as the *e.ffects* study (Hayes, 2007; Hayes, et al., 2005). This study was an Australian Research Council Strategic Partnerships with Industry— Research and Training (SPIRT) Scheme between the Faculty of Education, University of Technology in Sydney and the Curriculum Support Directorate, NSW Department of Education and Training. The *e.ffects study* was a longitudinal, qualitative study that examined the impact of ICT on learning and teaching in schools. It focused on examining how teachers integrate ICT into the classroom, the impact ICT was having on teachers' pedagogical, curriculum and assessment practices, how ICT was mediating student learning, how different groups of students (in terms of class and gender) were being addressed with ICT and the ICT-related resources schools had available to them, and how they were located and allocated.

Seven case study schools participated in the *e.ffects* study. Data was collected from 2001 to 2003. The case study schools included four secondary schools and three primary schools. All seven schools were working within the normal and general context of the New South Wales (NSW) curriculum. They were not 'lighthouse' schools or classes working with special conditions, support and opportunities. The schools were located across regional and urban NSW. They joined the study cumulatively and were visited accordingly over the three-year period. Two secondary schools and two primary schools were visited in late 2001. The following year, these four schools were revisited twice, and an additional secondary school was included. Finally, in 2003, the five schools already participating and an additional primary school and secondary school were visited once.

A large amount of data on teachers' practices with ICT was collected during the three years of the *e.ffects* study. Forty teachers participated in the study and 110 teacher interviews and 71 classroom observations were conducted in total. Interviews were also conducted with principals, school executive members and key ICT people in the school. Focus groups and informal discussions were also conducted with students. Additionally, relevant documents were collected from each school, for example, school technology plans.

From the data collected for the *e.ffects* study, five teacher participants were selected to be focused on in this study. A number of factors were considered in the selection of the participants. As stated in Chapter 2, the research literature indicates that the majority of teachers have not demonstrated the expected change in practices mediated by ICT. For example, they are not using constructivist practices when teaching with ICT. I am interested in examining the change in TICT mediated practice that has occurred and why it has occurred. Interestingly, in the sorting of the *e.ffects* data, no teachers were identified as demonstrating constructivist practices in their classroom observations.

A number of professional and personal characteristics, and combinations of these characteristics, were considered in selecting and omitting teachers for this study. Eventually, a distinguishing feature that I used for selection of participants was the quality of the data set available for each (Hinds, Vogel, & Clarke-Steffen, 1997). In line with Hind et al.'s framework, five participants were selected. Each partciant seelected has partcanated in ecah of the e.ffects field visits to their school. A varied amount of data available including a interviews and classroom observations was available to be used. Overall the data set of ecah of the five participants gave a clear representative picture of their practices with ICT over the period 2001-2003. Data collected consistently over time was important for this study, as the focus was on examining paths of change, rather than before and after scenarios. Additionally, the transcriptions and field notes were clear and legible so that they could be read in their complete form, rather than just using legible sections. The availability of empirical data of this kind is important for contributing to the depth of data and the development of thick descriptions (Geertz, 1973) and is needed for careful study of the practices of teachers and how they change.

Table 3.3 that follows, presents a summary of the *e.ffects* data that was available for the five participants. This is denoted in the 2001-2003 columns. The table also includes the data collected from each participant for this study, and this is indicated in the 2005 columns. The table includes the name of the participant, the type of data collected of that participant, and the year it was collected. To maintain the anonymity of the participants and schools, pseudonyms have been used for the participants' names, and the schools have been allocated a letter to identify them, for example, school A, where both Vanessa and Beth taught. The use of these pseudonyms is continued throughout this thesis.

Table 3.3 The e.ffects study and new data collected for the five participants

Teacher	Data	School A Primary School					School B Primary School					School C Secondary School					School D Secondary School				
		2001	2002a	2002b	2003	2005	2001	2002a	2002b	2003	2005	2001	2002a	2002b	2003	2005	2001	2002a	2002b	2003	2005
Vanessa	Classroom obs.	X		X	X	X															
	Teacher int.	X	X	X	X	X															
	Student f.group	X				X															
	Colleague int.	X	X	X	X	X															
Beth	Classroom obs.	X	X		X	X															
	Teacher int.	X	X		X	X															
	Student f.group	X	X	X	X	X															
	Colleague int.	X	X	X	X	X															
Lisa	Classroom obs.						X	X		X	X										
	Teacher int.						X	X	X	X	X										
	Student f.group						X				X										
	Colleague int.						X	X	X	X	X										
Philip	Classroom obs.											X	X			X					
	Teacher int.											X	X		X	X					
	Student f.group											X	X			X					
	Colleague int.											X	X		X	X					
Fran	Classroom obs.																X	X			X
	Teacher int.																X	X		X	X
	Student f.group																X				X
	Colleague int.																X	X		X	X

The five participants selected for this study were chosen on the basis of the data available for them. Their selection can be described as random. They were not chosen on the basis of a particular characteristic. Two teachers selected were teaching in the same school. This assisted a more complex analsyis of the data however it was not a strategic move when deciding on the participants.

The participants had some features in common, which were associated with their workplace. All five participants worked in schools where the educational use of ICT was valued and encouraged by the school principal. This meant that all participants in this study worked within a context in which the school executive prioritised and strategised integrating ICT into the school teaching and learning context. This included, for example, access to ICT resources for staff and students, and prioritising professional development that focused on using ICT for teachers.

Each of the schools the participants worked in was well regarded by the NSW Department of Education and Training (DET), for its efforts in using ICT in teaching and learning. The ICT Technical Support Advisors appointed to each school by DET, considered these schools successful in terms of the school executive and staff's commitment to integrating ICT into teaching and learning and their progress in this area. This was the reason they had been selected to be part of the *e.ffects* study. It must be noted however, that the NSW DET had not developed formal criteria for determining which schools were successful in this area and which were not.

The participants were all experienced teachers. Their years of teaching ranged from Philip, who had been teaching 15 years, to Lisa who had been teaching 26 years. They were all teaching in a government school in the outer suburbs of Sydney (NSW) during the three-year period of the *e.ffects* study. Each of the participants continued in their positions at the same school during the three years of the *e.ffects* study. Since that time only one participant, Philip, transferred to another school.

The data indicated that the participants also have a number of distinctive and differentiating professional and personal characteristics. Differences were evident in various workplace situations; they worked in schools of varying sizes, locations and socioeconomic levels. They taught a variety of subjects and year levels. Furthermore, each participant had their own distinct core approach to teaching and learning. There were differences evident in how they understood the process of teaching and learning and the goals they prioritised in this process. The participants used ICT in their own particular ways in their teaching and learning and discussed and justified their uses in different ways. Furthermore, each participant had different personal and social situations. Various models of adult education and learning share the understanding that biographical factors such as the differences identified between teachers are important for understanding how adults learn and change (see Kemmis, 2006; Lea & Nicholl, 2002).

Below is a profile describing the five participants in this study. The profiles include brief biographical data of the participants and also an overview of each participant's core approaches to teaching which describes the way they understood learning to occur. In many ways their core approaches to teaching can be considered the base upon which they built their teaching practice. The core approaches to teaching described are based on data collected as part of the *e.ffects* study. It can be seen from these overviews that the some of the participants were technology enthusiasts, but most were novices in this area. The partcipants represented a range of understandings of how learning develops, also they all taught in different subject areas or year levels.

Beth

For the five years of this study, Beth taught Year 4 at a primary school in a low socioeconomic area on the outskirts of Sydney. Beth lives in a very small regional town approximately 45 minutes drive from the school she teaches at. She has adult children and lives alone.

Beth describes her priority as teaching the prescribed syllabus content associated with the year level she is teaching. Beth uses highly structured teaching methods to teach the syllabus.

The routines of her lesson include Beth giving information about the focus of the lesson and students completing a closed-questioned worksheet or activity independently. The worksheets are marked by Beth either during or after the lesson. Teaching the basics is a philosophical priority of her teaching. Beth's students are rarely permitted to talk in class.

Phillip

At the commencement of the *e.ffects* study, Philip had been a secondary school teacher for approximately eight years. He was previously a secondary school art teacher and had taken up an opportunity provided by the Department of Education NSW that involved retraining teachers for new computer studies syllabuses.

During the *e.ffects* study Philip taught in a secondary school in a low socioeconomic area in Sydney's western suburbs. In the final year of this study he moved house and also transferred to a secondary school is a mid socioeconomic area in Sydney's north-western suburbs.

Philip's priority is to teach the syllabus but he explains he is also committed to preparing his students to work in the Information Technology industry.

Philip spends a large part of the lesson moving around the class to different students. This movement is characterised by informal talk and discussion between teacher and student, addressing individual students' needs and helping students to understand the content.

Lessons have an informal atmosphere and students are encouraged to talk to each other on task. Philip refers to motivating students is his discussions and includes theory on student-centred learning in his discussion about teaching and learning.

Lisa

At the beginning of the *e.ffects* study Lisa had been a primary school teacher for approximately 30 years. The school Lisa worked at was on the outskirts of western Sydney in a low socioeconomic area. Lisa lived in the same suburb as the school.

During the five years of this study, Lisa was a computer studies teacher teaching all classes in the school each week. Lisa was previously a primary school teacher and was transferred to another school and, unknowingly, to the position of computer teacher instead of classroom teacher.

Lisa's teaching was characterised by well-established, teacher-centred routines focusing on explicit instruction and leaving nothing to chance. She describes her philosophical understanding as, students need teachers in order to learn.

Lisa's teaching followed an explicit, well-established, linear path. She began each lesson with 10-15 minutes of practising basic ICT skills such as saving files and knowing the correct names for ICT hardware such as monitor, mouse. Lisa believes that a core component of successful learning is to practise. She then divides the class in half. One half of the class play computer games unassisted in the computer lab. The other half work with Lisa on the computer skill she had planned for the lesson. Lisa stated she can only give half the class the one on one attention she considers important for learning. Lisa's lessons are designed (for the half she works with) to include a substantial amount of instruction from her at the whole class level and one-on-one time with students during the course of the lesson.

Lesson content is sequential from year Kindergarten to Year 6, with students working on progressive skills throughout these year levels.

Vanessa

At the beginning of the *e.ffects* study Vanessa had been teaching for approximately 30 years. She taught at the same school as Beth. The school was located in a low-socioeconomic suburb on the outskirts of Sydney, NSW. She has two adult children who live with her.

Vanessa is committed to teaching the syllabus. She stated her priority was also to develop her students' collaborative skills. These, she stated, were skills they all needed 'for life'.

Her lessons were characterised by students working in groups. Vanessa rarely moved round the room during lessons; students asked for the teacher's help on an 'as needed' basis.

Vanessa is an Assistant Principal at the school and she is committed to following the principal's vision in the school.

Fran

Fran is a female secondary school English teacher. At the beginning of the *e.ffects* study she was aged in her late forties. Fran had been a teacher for approximately twenty years. She is married with two school-aged children.

During the five years of the study, Fran taught in a large secondary school on the outskirts of Sydney in an area of low socioeconomic status.

She stated that her priority is teaching the syllabus. Fran's teaching is characterised by teacher instruction followed by group work or time for students to share knowledge and help each other with lesson activities.

The selection of these five participants proved to be an important part of examining the process of change in TICT mediated practice. For example, it was evident in their data that their decisions on how to use ICT in their teaching emerged from their personal histories, the distinctive ways in which they understood and applied institutional expectations, their beliefs about students and learning and the educational use of ICT. This allowed their paths of change, the nuances of that change and the various factors shaping that change to stand out. This allowed me to research in uncharted territories and go beyond generalised approaches to researching TICT mediated practice. A limitation of the selecting these five partcipants is that they all taught in similar locations and schools from similar socio-economic areas. This reflects the limitations of assorted analsyis as these particular aspects were important in the *e.ffects* study. Additionally the participants were all willing to participate in educational research. This is of course is important for educational research but an obvious limitation is that this study cannot represent a true, varied sample but can only be undertaken with those willing to take part.

Once the participants were selected, an important beginning strategy for analysis was secondary analysis of the pre-existing data. It is argued that the domain of research in educational uses of ICT in education is fast moving, at least in terms of technical development. Underwood (2004) states, 'in the excitement of the new we appear not to want to look back and learn from the lessons of the past'. The data from the *e.ffects* study represented a valuable historical record of ICT mediated practice (Gilles & Edwards, 2005). Analysis of this data supported building a picture of the past for these participants in terms of how they engaged in the educational use of ICT (Gilles & Edwards, 2005).

The aim of the secondary analysis of the participants' pre-existing data was to build a rich historical picture of their ICT mediated practice for the period 2001-2003 (the period of data collection for the *e.ffects* study). Analysis techniques began with line by line reading of each participant's data (Miles & Huberman, 1984) in order to identify themes pertinent to the data. The data was then coded and categorised into the themes that emerged as important to the data (Charmaz, 2006; Strauss & Corbin, 1990). Examples of initial codes used include: 'School leadership of ICT', 'Home', 'ICT-related demands on teachers', 'Valuing of educational use of ICT'. At this stage of analysis, three key themes emerged for grouping the coded data. They included: 'Practices', 'Contexts' and 'Teachers' understandings of their contexts'.

The strategies used to analyse the participants' ICT mediated practices were also used to analyse the data associated with their contexts. The available data of the participants' context included interviews undertaken with their principal and other teachers in the school, and focus groups with a random selection of the teacher's students. This data was used to give other information about the teachers: for example, their contexts, and ways they engaged with their contexts. This information was coded, building on the themes initially developed with the teacher's own data. The data extracted was important, as it supplemented the participants' data on their practices and contexts. For example, interviews with the participant's principal often included the principal's vision for the school for teaching and learning with ICT. At times it was evident in the participant's data that they interpreted this vision differently, or they may not have been aware of it. This data, or lack of data, gave further detail about the participants' context and how they engaged with it.

As I was particularly interested in how teachers' ICT mediated practice changed over time, a second aspect of the analysis of each teacher's pre-existing data included organising each teacher's coded data onto a matrix, because it supported understanding the data in terms of time and space. A sample of this matrix is included in Appendix 1 of this thesis. The matrix is organised around the themes that emerged from analysis of the data, and also chronologically. Each participant's milestones, and significant situations of their ICT mediated practices were plotted onto the matrix longitudinally. The coding next to each entry identifies each participant, the time the event took place and the particular date the entry refers to. The matrix established for data at this stage of analysis, continued to be built on throughout each stage of analysis.

The analysis of each participant's pre-existing data enabled the identification of a starting point for each participant in terms of their practice and their context. This, importantly, gave a point against which each participant's ICT mediated practice could be compared, and change could be traced. As stated in Chapters 1 and 2, constructivist practices have been used as a criterion for evidence of change in teachers' practices with ICT. The identification of a starting point for each participant based on their own practice, importantly, meant that the study was not reliant on a predetermined benchmark of constructivist practices in order to identify change.

From the analysis of the pre-existing data, it was evident that the ways the participants used ICT in their teaching were individualised and intertwined with their own contexts and identity. The ICT mediated practice of the participants was influenced by the established meanings and ways of working around pedagogy, curriculum and assessment practices (Bernstein, 1975; Bruner, 1990; Kemmis, 2006). These influences included, for example, valued subject knowledge, the boundaries of school learning and curriculum, teacher roles and hierarchical relationships between teachers and school administrators, ICT in society (Maclure, 1993). For example, one participant's use of an overhead projector rather than a computer in the first classroom observation of her in 2001. The participant explained she used an overhead projector instead of a computer in the lesson because she was very unfamiliar with computers and moreover how to teach with them. Her ICT mediated practice was strongly linked to her context and her identity; this participant had used a computer for the first time that year. She also had just transferred to the school, so had not yet established a network for support in using ICT. However the emphasis on computer use in the school by the new principal had encouraged her to buy a home computer to teach herself how to use one. This participant referred to established understandings and ways of working as well as changes that were happening around her, when explaining the decisions she made in her ICT mediated practice.

Analysis of the pre-existing data facilitated identifying interplay between the variables influencing teachers' ICT mediated practice (Alexander, 1992; Loveless, 2003; Mosely, et al., 1999; Shulman, 1986). For example, Vanessa's ICT mediated practice was significantly influenced by her new principal's vision for teaching with ICT in the school and the various contextual changes he made, reflecting his vision. Vanessa's teaching was also influenced by her daughters' uses of ICT at university and the need for using ICT that this stimulated for Vanessa, as well as the learning about ICT that her daughters supported her in. This complexity between the variables that influenced each participant could be traced over the course of the study, which supported, for example, examining both these variables (principal and daughters) and the many others that Vanessa engaged with at one time. This supported moving away from 'techno-centric' assumptions for change (Selfe & Hawisher, 2004) such as ICT being the sole factor influencing change in teachers' ICT mediated practice, often presented in the literature (see Chapter 2). Data available on the participants' context was useful when examining a practice such as teaching, which is considerably grounded in its location.

Contextualising teachers' ICT mediated practice was particularly useful for gaining further insight into the importance of identity for this practice. For example, extensive ICT-related professional development had been undertaken in Beth's school during the period 2001-2002. There was no evdience in Beth's data of the professional development undertaken in the school. It was evident however, in other data collected at the school during this time; for example, other teachers in the school (including Vanessa, who was also a teacher at Beth's school) discussed the value of this professional development during their interviews. From the data of other teachers interviewed in the school, I was able to develop an understanding that students across the school became involved in the professional development—some of them from my participant's class. These were formed into 'experts', who assisted classes across the school in their ICT use. As part of this professional development process, external consultants worked with the staff. The school in many ways had been re-arranged to work with this ICT-related professional development focus. Having this kind of information, that the participant did not mention in her interviews, raised questions for follow-up interviews about her teaching role, what she valued in her own learning, and the role of others in that learning.

The analysis of the pre-existing data provided a meaningful foundation for examining teachers' ICT mediated practice in terms of time. The methods contributed to tracing the paths of change of the participants' ICT mediated practice, and the nuances in their change, over a period of time. This method also enabled making connections between the participants' ICT mediated practice and factors influencing them over time. These techniques, importantly, contributed to examination of change in ICT mediated practice as non-linear and inconsistent and reflecting lived experience.

Analysis of the participants' pre-existing data also raised a number of questions to be pursued in new data collection, regarding examining and understanding teachers' ICT mediated practice. For example, Beth was discussed earlier in terms of not acknowledging professional development in her school. A question raised from the analysis of her pre-existing data was, when she developed computer skills using her home computer, would school professional development focusing on ICT be more important to her? Also, in what ways would her students' developing ICT skills influence Beth's own ICT skills/practices? Interestingly, as the research process progressed it became evident that the student's developing ICT skills had a significant influence on Beth's ICT mediated practice. This is discussed in detail in Chapter 4. However, at this stage in the process, the answers were uncertain. At this stage the data indicated that practices were not a direct reaction to contexts; the ways teachers addressed changes in their contexts were not predictable. For this reason, teachers' thinking about their contexts, and the ways they decided to address this in their practice, required further clarification. New data collection was also influenced by this emerging area of significance (Geertz, 1973).

3.2.2 Movement between pre-existing and new data: Data collection and analysis

The focus of the second layer of the analysis related to the data collected was the collection of new data on the ICT mediated practice of the participants, and the building on and extending of the questions and themes developed in the analysis of the pre-existing data. This layer of analysis was distinguished by the continuous movement between pre-existing data and new data.

New qualitative data on the ICT mediated practice of all five participants was collected in 2005. Given my desire to capture the context in which the participants' ICT mediated practices took place, classroom observations were essential. Two classroom observations were conducted of each participant teaching with ICT, and these took place on two separate days. Each observation encompassed 2-3 consecutive lessons. The observation took place at a time and day of the participant's choice. Field notes were hand written during the observation and included details regarding the teaching strategies, content, classroom environment and relationships that were evident in the lesson. More detailed field notes were written as soon as possible after the observation. Field notes were guided by the themes developed in the analysis of the pre-existing data.

Two semi-structured interviews were also conducted, one after each classroom observation. Questions posed during the interviews following the first observation focused on the participants describing the ways they used ICT in their teaching, how it had changed since 2003 (when the last *e.ffects* data had been collected of them), what they identified as significant aspects of their ICT mediated practice and why. The aim of this line of questioning was to identify changes in both their practice and context, and how these contributed to each other. Analysis of the data from the first interview raised questions which were incorporated into the second interview and also guided the field notes taken during the second classroom observation. The aim of this interview was to identify how the participants understood the use of ICT in the lesson, how this lesson fitted into their overall approach to ICT mediated practice and also to follow up on questions that arose from analysis of the first interview.

Interviews were also undertaken with a colleague with whom the participants collaborated with in their ICT mediated practice. As stated, this was an important focus of this study. The colleagues that were interviewed were selected by the participant or, in some situations, if a participant had referred to the actions of a colleague as significant to their own ICT mediated practices, I raised the possibility of interviewing that colleague with the participant. All participants were happy for me to conduct interviews with their colleague. I conducted an interview with one or two colleagues of each participant. All colleagues interviewed were teachers in the same subject area or year level whom the participant planned and/or team taught with. The data collected from these interviews were used to supplement the information about the participants' practice and context provided by the participants, as well as to identify aspects of their practice and context not evident in the participants' data.

In addition to observations and interviews, documents such as the participants' planning notes, students' work samples, and the school's ICT policy were collected as further representations of the participants' ICT mediated practice and their context.

The observations and interviews that took place were preceded by one or two telephone conversations, as well as a preliminary brief visit to each teacher at their school to re-acquaint myself with them and organise the data collection. The participants were aware I was coming to see them teach with ICT, so it can be assumed that I observed the 'best' lessons they considered they could give at that time. These observations were still of value because I did not rely on them alone but constructed the fieldwork to gather a range of data about the participants' ICT mediated practice.

The aim of the 2005 data collection was to continue the longitudinal component of the study and collect data on the participants' ICT mediated practice that spanned a period of five years. As stated in Chapter 2, little longitudinal research had been conducted on the educational use of ICT; contributing to longitudinal research was a priority of this study. A second aim of the collection of new data was to address the questions which arose during analysis of the pre-existing data. For example, Lisa stated in the first interview in 2005 that she was bored teaching the same way over and over again and was experimenting with teaching in new ways. Questions about this comment and others made by Lisa during that interview, facilitated developing questions around the types of teaching she was experimenting with, what initiated her new ideas, how she evaluated the success of lessons, which ones she had decided to continue with and why. Addressing these questions facilitated meaningfully contributing to continuity in the longitudinal data, with connections from one data collection period to the next.

A distinct characteristic of the second layer of the analysis related to the data collected was the simultaneous collection of new data, analysis of pre-existing data and analysis of new data. There was a continuous shuttling backwards and forwards between old data and new data collection, analysis and coding to trace and examine change in the participants' ICT mediated practice (Connelly & Clandinin, 1999). The movement backwards and forwards between past and present supported examining and presenting change more accurately in its authentic, non-linear form (McLeod, 2003). Examining change in this way supported moving away from the simplified and pre-determined steps for change that the current research literature often uses in relation to teachers' practices with ICT (see Chapter 2).

Analysis of the pre-existing and new data continued to use the research strategies that were used in the analysis of the pre-existing data as discussed earlier. Analysis included key word analysis to organise the participant's data around the themes. This method facilitated adding data to themes developed in analysis of the pre-existing data, refining themes in the light of the analysis undertaken during that first layer, and adding new themes that emerged from analysis of new data. I continued to use the matrix developed in the first layer of analysis to organise the participants' data.

3.2.3 Participants' retrospective analysis of own data set

The matrix developed of each participant's data set (2001-2005) formed the basis of the participants' retrospective analysis of their own data set. This strategy formed the third layer of the analysis related to the data collected. A semi-structured interview was undertaken with each participant, to review and discuss their data set. Some questions common to each interview were prepared, for example: 'What are your initial thoughts of your data?' 'What aspects do you think were significant for you in terms of the ways you use ICT as part of your teaching practice now?' Each retrospective interview followed highly individualised paths of questioning dependent on each participant's data and their interpretation and discussion of it. I found that for the most part participants continued to initiate and expand on their own discussion points throughout the interview. A distinction of these interviews is that each participant spent a substantial amount of time enthusiastically reading their matrix, making comments on sections they had forgotten about or were surprised by, or that were important for them. The time frame for this interview was approximately two hours for each participant.

The benefit of this retrospective interview was that it provided the opportunity for each participant to talk about events and situations they considered relevant to their ICT mediated practice. Each interview was recorded and transcribed. Additionally, I kept a diary to record my impressions immediately post interview. I added notes to the diary over time, where I was able to make connections with other data collected.

The participants' retrospective analysis of their data set was valuable for contributing to the depth of the data. The participants had experienced some emotional distance from their ICT mediated practice and ways of thinking, represented in the *e.ffects* study data, and they were able to have a sense of themselves in the long view (McLeod, 2003). The long view they presented during these interviews affirmed the strong link I was seeing in my analysis between practices, context and identity. The participants explained why they made the decisions they did in their teaching at that time, and also dispelled some of the connections I was making about the data.

The retrospective interview gave further detail of context but mostly, it gave more insight into the teachers' thinking behind their ICT mediated practice. Of particular note was the inclusion of personal details of their lives that had not come out in the previous data collected about them. This supported gaining data about how their life outisde school contributed to their ICT mediated practice. For example, as one participant read over the summary of her data from 2003 she noted the numerous negative comments she had made regarding her class and the educational use of ICT. These included her reference at that time to students' lack of ability to work co-operatively, and what she described as 'arrogant gender issues' when students worked on the computers together, and her resentment of ICT being imposed on her as a teacher. In retrospect this participant discussed this negativity in terms of her personal life: she had separated from her husband during that time and was dealing with a challenging personal life. Other participants' personal lives were also brought into their retrospective discussion of their data: for example, details of why they relocated to another school, relationships with other teachers and future plans.

This retrospective strategy also supported moving away from longitudinal analysis that simplified change in terms of chronological order. As stated in the previous chapter, presenting changing teaching practice as something that can be predicted, was contributing to limitations in research of change in teachers' practices with ICT. Supporting the opportunity for the participants to look back over their ICT mediated practice supported understanding change in teaching practice as recursive and shifting. It highlighted the uneven ways in which a teacher thinks about, decides on and undertakes their teaching over time (McLeod, 2003).

Furthermore, the use of this retrospective strategy allowed contextualising the participants' own data in the broader data set, as discussed earlier. This enabled me, to some extent, to contextualise the 'teacher' within the person and to contextualise the school contexts within the participants' broader 'life' context. In their own ways, the participants described the retrospective analysis of their data as a unique and valuable reflective opportunity to look over what they have done. For me, it was important for reflexively thinking about the way I was attempting to interpret, construct and represent (Geertz, 1973) the practices and paths of change of other individuals.

3.2.4 Development of themes: Value of analysis related to the data collected

The analysis that took place as part of the data collection was crucial to the progression of this study in terms of addressing the research questions. This process facilitated systematically reducing and organising the data into one data set which supported the identification of three themes important to change in the ICT mediated practice of the participants. These themes included: Practice, Context and, Own Understandings. The theme 'Practice' centred on the participants' classroom teaching with ICT and included the teaching strategies, teaching content, resources, assessment, relationships with students and classroom environment. The theme 'Context' focused on the environment the participants' ICT mediated practice took place within. It included social and material structures and conditions evident in the participants' classroom, school personal life and in society. For example, school policies for teaching with ICT, the syllabus, and home uses of ICT by students. The theme of 'Own Understandings' referred to the participants' distinct ways of interpreting their ICT mediated practice and the resources they drew on to inform this practice.

Categories and subcategories relevant to the Research Questions were developed for the three themes. The categorisations were important for the development of thick descriptions that spanned across time and space about the ICT mediated practices of the participants. These thick descriptions have been used to present the findings in Chapter 4.

Significant conceptual understandings developed as part of the three layers of analysis of the data include:

- Centering broadly on TICT mediated practice as a multidimensional practice;
- Identifying and describing the contexts in which teachers' ICT mediated practice is situated;
- Identifying aspects of the participants' context particularly important to their ICT mediated practice and;
- The ways individual participants understand the context that shapes their ICT mediated practice.

An important aspect of the analysis undertaken to this point is that it was data-driven and was facilitating new knowledge about change in teachers' ICT mediated practices. As stated in the previous chapters, this was an important aim of this study. Chapter 2 presented three criteria (frequency of use, intention for use of ICT and constructivist practices when using ICT) that are often used as evidence of change in teachers' practices with ICT. Interestingly, these three criteria were not evident in the conceptualisations developed during the analysis to date as important to change in the ICT mediated practices of the participants; nor in fact were they evident as important at the completion of analysis of the data set.

The data-driven nature of the analysis up to now provides the grounding which Strauss and Corbin (1998) identify as necessary to build the density and develop the sensitivity and integration needed to develop a complicated explanation of change in teachers' ICT mediated practice. This was integral to the deep analysis of the data which followed.

The completion of the analysis in relation to the collected data was used as a natural point of reflection in which an impression of the data was developed and matched against the Research Questions to identify where further analysis was needed. This point of the study can be understood in the same way that an artist stands back from the easel at a significant point in creation to reflect on their visual creation; whether they are on their way to achieving their goal, what to develop further and the types of effects that might support further enhancing their creation. With the intention of generating new knowledge around change in teachers' ICT mediated practice, the structure that was now in place around the data gave me the opportunity to stand back and reflect on the Research Questions, and prompted me to further explicate and improve on my Research Questions. This was a necessary step in the research process as it provoked greater clarity around why the participants' ICT mediated practice changed in the ways they did or did not (Benoliel, 1996; Melia, 1996).

On my easel I had formulated an impression of the data (Strauss & Corbin, 1990) developed from the analysis. The impression comprised descriptions of how the participants changed in their ICT mediated practice and identified some contextual factors important to the changes. There were also first sketches of a process I was beginning to see from the analysis, in the ways the participants engaged with aspects of their contexts as part of the change in their ICT mediated practice. What follows in this section is what I observed on my easel at this point of the study. I use a different font to present this impression, to emphasise it as a 'work in progress'. At this stage the analysis was superficial; however, this impression was integral to the analysis that followed.

What I could gather was that five participants prioritised student learning as part of their ICT mediated practice. They focused on students achieving the syllabus outcomes and preparing them for their future: for example, future schooling and jobs. These priorities guided the way the participants undertook their ICT mediated practice.

It was also apparent from the data at this point that change in the ICT mediated practice of the participants was influenced by aspects of their personal, professional and broader societal contexts. The participants actively drew on, as well as contributing to, the discourses in these contexts. This influenced shifts in these contexts, opening up new and different ways to think about and undertake their ICT mediated practice. Of particular significance for the participants were the gaps and inconsistencies between the syllabus documents, school ICT policies and uses of ICT outside these. These gaps and inconsistencies raised issues associated with fulfilling their roles as teachers as well as providing meaningful learning for their students (Orlando, 2009). The participants resolved these issues by discerning and analysing these communications and their underlying messages and by applying them to the ways they considered ICT educationally valuable. Hand in hand with this, I could see the central role of decision making for participants (Kemmis, 2006).

It was evident from the organisation of the data at this point that the participants' decisions in their ICT mediated practice were influenced by what may be referred to as their 'stories to live by' (Connelly & Clandinin, 1999; Kemmis, 2005; Maclure, 1993). They made decisions as individuals; however, the process of discerning and analysing was similar for each of them. This suggested a collective sense of teachers' ICT mediated practice.

Furthermore, the situated nature of the ICT mediated practice within personal, professional and societal contexts meant that participants needed to make compromise in this practice. They acknowledged compromise between their own understandings of learning and children and the expectations for teaching with the syllabus, which they considered as a constraint on their teaching (Polkinghorne, 1997). Depending on their understandings of children and of earning, the degree and frequency for compromise differed for each participant.

The impression of the ICT mediated practice of the participants developed in and because of the analysis of the data, afforded direction for further analysis of the data in terms of the Research Questions. A systematic process of plotting the impression against the Research Questions was undertaken. This matching process facilitated identifying where gaps were present in the analysis, was structured as a framework for each Research Question and was prioritised for the next stage of analysis. A summary of this process is presented below in Table 3.4. A detailed explanation of the table then follows.

Table 3.4 Summary of analysis of data collected and the direction it provided for analysis of the data set

Research Question	Aim of Research Question	Concepts/descriptions developed in analysis related to data collection	Gaps to be addressed in next stage of analysis
1. In what ways does the ICT mediated practice change over time?	To identify what TICT mediated practice is and where change in TICT mediated practice occurred for participants.	TICT mediated practice has observable aspects and changes occur in these. TICT mediated practice has some less observable aspects and changes occur in these. Changes in less observable aspects of TICT mediated practice appear to be significant in terms of the observable aspects of this practice we might see in a classroom.	What are the less observable aspects of TICT mediated practice? How are the less observable aspects of this TICT mediated practice related to the observable aspects of this practice and the changes that develop in these?
2. What induces change or continuity in TICT mediated practice?	To identify contextual aspects important to TICT mediated practice. To understand how teachers mediate their contexts as part of their TICT mediated practice and how this influences change in this practice.	Identified a wide range of contextual factors important to teachers' practices mediated by ICT. Some evidence of a process where teachers engaged with their contexts and as part of their practices mediated by ICT and discerned and positioned against discourses they considered relevant to their teaching mediated by ICT. This process contributed to their learning.	In what ways do teachers engage with their contexts as part of their teaching with ICT? In what ways do changes in their process of engagement influence teachers' learning? What influences changes in their engagement with their context as part of their TICT mediated practice?
3. What ways do teachers think about and interpret their TICT mediated practice?	To identify teachers' dispositions for developing themselves as professionals and how this influences their TICT mediated practice. Identifying how teachers see change through their own narrative.	Descriptive understanding of differences between the participants in terms of wanting to change their TICT mediated practice.	How do teachers arrive at wanting to change their TICT mediated practice? What is the process teachers undertake when they want to change their TICT mediated practice? What is the significance of context on teachers wanting to change their TICT mediated practice?

As can be seen from Table 3.4, Research Question 1 focuses on defining TICT mediated practice and identifying where change develops in it. Stage 1 of the research process facilitated identifying observable and less observable aspects of TICT mediated practice. Observable aspects of this practice included for example, goals for teaching with ICT, ICT resources used, and relationships with students when teaching with ICT. Less-observable aspects of the participants' ICT mediated practice included, for example, teachers' beliefs about school, learning and the educational value of ICT.

Changes were identified in both observable and less observable aspects of the participants' ICT mediated practice. Change in the less observable aspects appeared to be significant in terms of the change we see in observable classroom teaching practices with ICT. An important aspect of my reading of the literature at this time was that beliefs are one of the many aspects of less observable practices that a teacher brings to their teaching practice (Kemmis, 2006; Windschitl & Sahl, 2002). With this understanding, I prioritised analysis in defining and explaining these less-observable aspects of TICT mediated practice, examining this change and its relationship to change that develops in observable practices.

Another aspect which stood out at the completion of analysis related to the data collection was that, while the participants changed in their TICT mediated practice, the change they demonstrated was consistent with their understanding of the teaching and learning process. No participant identified themself as a constructivist teacher at the beginning or the end of data collection. No participant demonstrated a wholly student-centred approach in their teaching during the study. As stated in Chapter 2, this is an expectation for change in teachers' uses of ICT. Analysis of the data at this point also indicated that change for these teachers was a continuous merging and expansion of new and established understandings and practices. A phrase I used to describe this shifting was 'changing inside the box'. Nielsen (1996) writes of the self as a 'magic writing pad', a kind of palimpsest, which 'all the time receives new inscriptions upon it without having the old ones erased' (p. 7). I could see this was the situation with the participants and their ICT mediated practice. Understanding the ways individual participants added layers to their TICT mediated practice and built on established ways of thinking and acting, was an important aspect to examine so as to understand changes in this practice.

Research Question 2 was concerned with understanding what induces change or continuity in TICT mediated practice. This question primarily focused on the process of change. At the end of Stage 1 there was more cloud than clarity in relation to this question. I had identified a wide range of contextual factors outside ICT resources themselves, that were important to TICT mediated practice. These included for example, personal factors including the social networks the participants used to develop their ICT skills, and professional factors such as school syllabi. Identifying these factors was important, in that it contributed to counter-balancing ICT as the sole catalyst for change that is often presented in the research literature (see Chapter 2).

The analysis related to the collection of the data also signalled a process where the participants engaged with their contexts as part of their TICT mediated practice. I identified three elements of this process from the analysis: a) teachers engage with their context as part of their TICT mediated practice; b) teachers discern aspects of their context which they consider to be important for their TICT mediated practice: for example, social uses of ICT and; c) teachers position themselves against understandings and beliefs embedded in their context that they consider relevant to their TICT mediated practice. It was evident that their engagement with their context contributed to their learning. As stated in Chapters 1 and 2, identifying this was important to this study. My understanding of how the participants engaged in, discerned and positioned themselves against the information present in their context, and how change in their TICT mediated practice occurred as a result, was at this point descriptive and superficial. My reading of authors such as Renshaw (1998), Bruner (1990), and Wells (2007) referred to a similar process and its influence on practices, as well as on factors such as professional identity. I prioritised a greater depth of understanding of this process and its influence on observable and less-observable aspects of TICT mediated practice, so as to address Research Question 2.

Research Question 3 focuses on the ways teachers think about and interpret their TICT mediated practice. From the analysis related to the collection of data, I developed a descriptive understanding of the participants' varying motivations to change their TICT mediated practice and the types of change they valued. This understanding was important for gaining depth of understanding around change or consistency that occurs in TICT mediated practice. At this point I had minimal understanding of how different motivations for change were arrived at, or how they were mediated by the participants. My reading at this time of authors that focus on the narratives of the individual (Connelly & Clandinin, 1999) signalled that teachers may have particular priorities which they brought to their practice, which influenced how they thought and what they wanted to achieve. More understanding of the narratives of the five teachers and gaining clarity in what was important to them, was prioritised.

In this section I have explained the analysis of the data collected for this study. As stated, this process included: analysis of pre-existing data, the collection of new data, analysis of pre-existing and new data and retrospective analysis of data by participants. The emphasis of these three layers was to reduce and organise the data into a manageable form for the purposes of this study. The completion of the three layers of analysis facilitated identifying themes and an impression of the data. Additionally, the questions raised as part of the analysis of the collected data, and presented in Table 3.4, formed the basis for analysis of the data set. A detailed explanation of this process follows in Section 3.3.

3.3 Application of Professional Practice theory and Socio-cultural theory

I identified both Professional Practice theory and Socio-cultural theory as useful in analysis of the data set because they centre on the core concern of the Research Questions; understanding the relationship between context and how people act. As stated in Chapter 1, understanding the relationship between context and practice was important to this study from its inception. Additionally, analysis undertaken during the collection of the data supported identifying particular aspects of this relationship as important to TICT mediated practice and worthy of further exploration: for example, the contribution of established practices and the ways participants engage with their context as part of their ICT mediated practice.

A distinction of Professional Practice theory is that it identifies a symbiotic relationship between practice and context; it perceives context to be enfolded into practice (Green, 2009; Kemmis, 2009; Schon, 1983). This theory foregrounds the ways that particular social and material structures and conditions characterise the context in which the practice is situated. Additionally, Professional Practice theory focuses on the relationships between the ways these structures and conditions contribute to people's knowledge and professional identity, the ways they perform within that practice, and vice versa. I identified the use of this theory as particularly useful for the in-depth conceptualisation of established practices and other aspects of context, and how they are important to the TICT mediated practice I prioritised pursuing (see Section 3.2).

In my use of Professional Practice theory, I have drawn principally from authors theorising practice in terms of teaching, for example Kemmis (2008, 2005) and Green (2008). I have also, in less depth, drawn on work related to some other professional setting—for example, Schon (1983) and Schatzki, (2001). Concepts embedded in this theory that are particularly useful for this study include: that practice is situated in social and material space and time; that there are individual and extra-individual features of practice, dispositions, and the symbiotic relationship between practice and context.

Socio-cultural theory was useful for the Research Questions because it focuses on the co-construction of knowledge. It identifies that learners create a body of knowledge from their experiences and that their learning is shaped by tools used in the learning (Bruner, 1990; Lave & Wenger, 1991; Vygotsky, 1978; Wells, 1999). Socio-cultural theory was useful as it focuses on the complexity of people interacting with tools such as ICT (Facer, et al., 2003) and the development in thinking and action it influences. This resonated with understanding the process of change that was embedded in the Research Questions, with examining how teachers engaged with their context and how this influenced their ICT mediated practice. The writings of Vygotsky (1978, 1981), Wells (1999; 2007), Bruner (1990), and Lave and Wenger (1991) were particularly useful for this. Theoretical concepts used from this theory which resonated with the Research Questions included: the mediation of physical tools, the zone of proximal development (in learning and identity), affordances, and communities of practice.

Additionally, both Socio-cultural theory and Professional Practice theory identify that practice is a constant and iterative engagement with context in constructing and reconstructing understandings about one's practice, with the aim of addressing problems that manifest in it. Together, these two theories supported a suitable and complex foundation for conceptualising the relationship between practice (professional knowledge/actions and identity) and context; central concepts for exploring participants' practices mediated by ICT (Tusting & Barton, 2003; Ulle, 2005).

Using two theories supported analysis of the participants' experiences in their ICT mediated practice in a way different to using just one theory, or grounded theory alone. The use of multiple theoretical perspectives is often necessary in working with longitudinal and qualitative research, and particularly with interviews (McLeod, 2003). This is because this type of data resists assimilation to one theoretical perspective; it requires multiple lenses. The benefits gained were in reading the different theories against each other, and the differences and tensions between them enabled new insights into the data. McLeod argues that approaches to qualitative longitudinal research which are 'either this approach or the other—seem inadequate and reductive' (p. 202).

Similarly, the use of multiple theories supports researching 'users' of ICT. The research questions for this study centre on the participants' actions in their use of ICT and in their engagement with their context as part of this use. As stated in Chapter 1, the debates surrounding the educational use of ICT take diverse forms. For example, there are articles in newspapers about the safety of children on the internet and about political initiatives concerning education, as well as highly theoretical discussions on the changing nature of life (and work) within a digital society. Some of these debates have a psychological focus, such as how learning may change through interaction with these new tools. Others are more sociological, such as looking at the use of ICT in relation to social inequality. Fitting analysis neatly into one theoretical box is therefore difficult, and consequently there is a need to call upon existing research from a range of perspectives to enable asking the right questions about what I was seeing in the data (Facer, et al., 2003).

Furthermore, the relationship between contexts and practice emerged from the analysis as related to the collection of the data, as a focal point for understanding change in TICT mediated practice. Green (2008) argues that theorising the relationship between practice and context is intensely problematic, especially in terms of scope. This is particularly problematic in the situation of TICT mediated practice, due to the extensive social, cultural and economic reliance on ICT. The theoretical framework using aspects of the two theories I have developed for analysis of the data set, was beneficial, as it brought in a team of theoretical perspectives, to identify and learn from the differences.

3.3.1 Process of using theory for analysis of data set

The process of using aspects of Socio-cultural theory and Professional Practice theory began with selection of the aspects of both theories that were useful for analysing the research questions. Subjective and practical factors were considered in the selection process. First, the aspects selected were those I found plausible and that complemented and enhanced my worldview of the situated, individualised and subjective nature of TICT mediated practice. Additionally, the field of educational research is not simply characterised by the search for knowledge, but is a field of practice with different players and different audiences, who each have a sense of what is useful knowledge (Yates, 2004). As stated in Chapter 1, an intention of this study was to develop findings that will assist policymakers and managers of TICT mediated practice in understanding the bigger phenomenon of ICT in schools. Examining for example the psychological make-up of teachers, would limit my contribution to this. It was necessary that the theoretical standpoints I selected would support the opportunity to draw some conclusions about how to support teachers and their ICT mediated practice.

Following the selection of theoretical standpoints, an analysis framework was developed to systematically match aspects of the theories to the Research Questions that they facilitated analysing. A sample focusing on Research Question 3 is illustrated below, in Figure 3.3. Research Question 3 focuses on examining the ways the participants engage with their contexts in their TICT mediated practice. Professional Practice theorisation of the purposive nature of practice was also useful for examining this question. Additionally, a number of aspects from Socio-cultural theory, focusing on the concept of mediation were also useful. As can be seen, the analysis of this Research Question 3 relied substantially on aspects of Socio-cultural theory. Each question drew on each theory in ways that most usefully addressed analysis of that individual question.

A useful organisational strategy was to make key theory points, which were simple statements based on and representing aspects of theory, and then to use them in analysis. As can be seen from Figure 3.3, several key theory points were matched to Research Question 3. A primary strategy and focus of the matching was whether the key theory point assisted in understanding the data related to that Research Question. Data and key theory points that centred on the same or related concepts were matched together. For example, Research Question 3c asked: *What is the significance of context on teachers wanting to, and changing their TICT mediated practice?* The key theory points matched to this related to contexts, and engagement of context. One of the key theory points matched to Research Question 3c therefore included: *Contexts are used as resources to scaffold learning. Knowledge is constructed from mediation* (Vygotsky, 1978; Wells 1995).

The key theory points (and the understandings embedded within them) were used as a springboard for developing questions of the data, conducive to the research question. The questions developed, focused on gaining more depth of understanding of the dimensions and properties of each question, and the relationship between these and the theory (Strauss & Corbin, 1998; Ulle, 2005). Continuing to use Research Question 3c as an example, the matching of the key theory point *Contexts are used as resources to scaffold learning. Knowledge is constructed from mediation* (Vygotsky, 1978; Wells 1995) to this question stimulated me to ask which resources did the participants draw on from their contexts to inform their TICT mediated practice, which resources did they prioritise, how did they use the resources in their context? This is represented in Figure 3.3 as '*What aspects of their context do teachers mediate as part of their TICT mediated practice? Which dimensions of this practice does this mediation relate to?* This process did not focus on developing questions that related to individual aspects of theory. Rather, the aspects were read against each other and the similarities and tensions between them were drawn on to develop the questions (McLeod, 2003). The use of two theories facilitated focusing on the learning process of 'individual' participants within the context of a 'professional practice'.

Table 3.5 Sample of framework developed for analysis of data set

<table>
<tr><td>Research Question 3: In what ways do teachers think about and interpret their ICT mediated practice?</td><td colspan="2">Gaps to be addressed for Research Question 3a) How do teachers arrive at wanting to change their TICT mediated practice? 3b) What is the process teachers undertake when they want to change their TICT mediated practice? 3c) What is the significance of context on teachers wanting to, and changing their TICT mediated practice?</td></tr>
<tr><td colspan="2">Socio-cultural theory
Mediation is an interpretation and negotiation of what one's a context means for their practice. It provides a basis for making sense- making decision about teaching. It is part of tool use (Wells, 2001; Ruthglen, 2008).
Adding something new to the context (a new tool) opens the opportunity to think and act differently (affordances) (Vygotsky, 1978)
Contexts are used as resources to scaffold learning. Knowledge is constructed from mediation (Vygotsky, 1978; Wells 1995).
Mediation often occurs in the context of a significant problem (Wells 1995)
Person acting-with- meditational-means could be person, person-acting with another person, person-acting-with-ICT, or person-acting-with-particular knowledge (Sutherland, et, al 2004)
The physical tool (computer) can be seen as an instrument of labour, a thing that is interposed between a person and the object of their labour which serves as a 'conductor' of their activity (Verenikina & Gould, 1998)
Although objects can expand our possibilities to manipulate and transform different objects, they also have a limiting effect in that the object can only be manipulated within the limitation of that tool (Verenikina & Gould, 1998)
When ICT is integrated into the school curriculum it becomes a tool that mediates teaching and learning activities to develop higher order thinking skills (Lim & Hang, 2003)</td><td>Professional Practice theory
Practice is purposive not random. Not necessarily planned but our intentions are part of this purposiveness (Green, 2008).</td></tr>
<tr><td colspan="3">Key theory points: People have different needs and readiness in their learning. Teachers reflect on change in their TICT mediated practice. Teachers develop solutions to changing contexts.</td></tr>
<tr><td colspan="3">Questions developed to ask of the data
1) What problems/opportunities open up for teachers in their ICT mediated practice?
2) In what ways are problems that open up, important to/ purposive for teachers?
3) What aspects of their context do teachers mediate as part of their TICT mediated practice? Which dimensions of this practice does this mediation relate to?
4) How do the issues/opportunities ICT open up relate to the established meanings in which teachers' TICT mediated were situated?
5) What learning is evident from teachers' mediations with their context? In what ways does it scaffold their development in their ICT mediated practice?
6) How do teachers' engagement with their context as part of their TICT mediated practice change over time?</td></tr>
</table>

What follows is a summary of the thinking and the questions I developed from the application of aspects of Professional Practice Theory and Socio-cultural theory to each Research Question. Table 3.6 below gives an overview of the key theory points developed for each Research Question. The discussion that follows the table explains each Research Question in relation to its associated key theory points and the structure this supported developing for each Research Question.

Table 3.6 Key theory points drawn from aspects of theory used in analysis, were matched to each Research Question

Research Questions before analysis of data set	Generalisations developed from grouping similar or associated aspects of theory	Research Questions after analysis of data set
Research Question 1: In what ways do TICT mediated practice change over time? 1a) What are the less observable aspects of TICT mediated practice? 1b) How are the less observable aspects of this TICT mediated practice related to the observable aspects of this practice, and the changes that develops in both?	TICT mediated practice are undertaken and influenced by (mediated by) existing social and materials structures and conditions associated with a practice. Symbiotic relationship between context and practices. Change in one contributes to change in the other Contexts are dynamic	**Research Question 1:** In what ways are established contexts important to TICT mediated practice?
Research Question 2: What induces change or continuity in TICT mediated practice? 2a) In what ways to teachers engage with their contexts as part of TICT mediated practice? 2b) In what ways do changes in their process of engagement influence teachers' learning? 2c) What influences changes in their engagement with their context as part of their TICT mediated practice?	TICT mediated practice are undertaken and influenced by (mediated by) existing social and materials structures and conditions associated with a context in which a practice is situated. Engagement with context is contributed to by the context as well as individual characteristics of the person. Engagement with contexts enables individualised meaning about one's practice. Engagement with context is often initiated by a problem that manifests as relevant to their practice.	Research Question 2: How do teachers engage with their context and how does their engagement contribute to their TICT mediated practice?
Research Question 3: What ways do teachers think about and interpret their TICT mediated practice? 3a) How do teachers arrive at wanting to change their TICT mediated practice? 3b) What is the process teachers undertake when they want to change their TICT mediated practice? 3c) What is the significance of context on teachers wanting to, and changing their TICT mediated practice?	People have different needs and readiness in their learning. Teachers reflect on change in their TICT mediated practice. Teachers develop solutions to changing contexts.	Research Question 3: In what ways do changes in the context in which is their teaching is situated, influence TICT mediated practice?

A central understanding of the key theory points used in analysis of Research Question 1 is that teaching is an already established and defined practice. Kemmis (2009) refers to this as 'practice architecture'. The professional practice of teaching is understood to have individual features that characterize it. These include the cognitive understandings, language, values, actions and material features associated with teachers and teaching (Wells, 1995; Shatzki, 2001; Kemmis, 2006; Green 2008). Individual features include, for example, knowledge of pedagogy, the expected actions teachers use in relation to students, and the professional language and jargon used by teachers. The individual features of the practice of teaching include established social and material structures and conditions that have been developed over time. Kemmis' multidimensional framework for individual features of practice was useful for examining established meanings of individual features of practice. For the purposes of my analysis I simplified this framework to examine the individual features in terms of: ways of acting, knowledge and intentions.

Socio-cultural theory also alerts us that within these established meanings there are also parallel understandings that indicate variations around the ways people understand the established meanings within their practice (Ruthglen, 2008). I had begun to see these parallel meanings in terms of what the participants understood a 'good teacher' to be, and also the 'future' they were preparing students for.

Socio-cultural theory also identifies teachers' context as dynamic, and a new resource in the context, such as ICT, can challenge existing, established meanings of teaching practice (Lea & Nicholl, 2002; Renshaw, 1998).

The application of these theoretical understandings inspired questions for Research Question 1, which centred on established meanings and the ways teachers worked with them as part of their TICT mediated practice. Specifically, this process raised questions which focused on: identifying the established meanings important to TICT mediated practice, the parallel meanings which exist within them, what contributed to maintaining these established meanings, and the practices within TICT mediated practice they privileged (and problematised). Additionally, what are the ways teachers worked with the established meanings in their TICT mediated practice? Also, the influence of TICT mediated practice on established meanings of teaching practice, and the ways these changes then in turn influence changes in TICT mediated practice.

As Table 3.3 indicates, the key theory points used in the analysis of Research Question 2 focused on the situated nature of TICT mediated practice and the importance of context for practice. As stated in Section 3.2, from the analysis of the data in relation to collection of data, I categorised the data associated with context in terms of physical spaces and relationships. Perspectives from Professional Practice theory and Socio-cultural theory supported expanding my analysis of contexts to discursive, abstract processes at play that form existing meanings associated with contexts (Kemmis, 2005, Wells, 1995, Schatzki, 2001; Renshaw, 1998). These include, for example, asking how established meanings around the role of a school, or the community's valuing of ICT (for example) influence TICT mediated practice. Kemmis's framework of contexts, what he identifies as 'extra-individual' features of practice, was useful for organising my analysis around these ideas. For the purposes of my study I simplified his multidimensional framework of extra-individual features to: social, cultural and economic aspects of context. Green's (2008) work in Professional Practice theory also drew my attention to context in terms of scale: that there is a local context within a broader context. Understanding scale in terms of social, cultural and economic features of contexts, assisted with examining the ways that existing meanings in the broader context influenced practice in the local context: in this case for example, teaching in schools with ICT.

The theoretical understandings regarding contexts stimulated further questions for Research Question 2, around the influence of context on TICT mediated practice. For example, identifying the existing understandings and parallel meanings associated with the contexts significant to TICT mediated practice, what contributed to these established meanings and the practices they privileged and problematised. What was the influence of ICT on established meanings of context, on the ways teachers worked with ICT with these established meanings and understandings, on changes evident in their TICT mediated practice?

Key theory points used in the analysis of Research Question 2 also drew on the understandings from Professional Practice theory of the symbiotic relationship between practice and context (Kemmis, 2005, 2006; Green, 2008). That is, the individual practitioner and context are folded into practice. This understanding is important for understanding changing practice. Kemmis (2005) states: 'understanding changing practices requires work outside the head of practitioners as well as inside their heads'. My questions in this heading aimed at conceptualising TICT mediated practice by tying together understandings around established meanings of practices and contexts previously discussed, to identify relationships between the two, points of intersection and points of change.

A core understanding drawn from the two theories that is important to Research Question 2 is that teachers engage with their contexts as part of their professional practice. They also engage with their context to develop their practice. Important to this understanding are the choices teachers make as part of their practice. The focus of choices was one I identified to pursue further in analysis in relation to the data collection, as documented in Section 3.2.

I identified a tension between the way Socio-cultural theory and Professional Practice theory conceptualised choices, which stimulated my thinking about Research Question 2, around the influence of context on practice. Sociocultural theory highlights the understanding that in activity (practice), resources in our context, such as ICT, are resources which act as a 'middleman' or conductor in an activity (Verenikina, 1998). They influence the activity that can take place when using that resource. Characteristic of Vygotsky's work, resources from our context expand possibilities to manipulate and transform different objects. The resources also have limiting effects in that they can only be manipulated within the limitations of the tool. Second, this theory argues that adding a new tool to the context such as ICT, opens up the opportunities to think and act differently—it offers affordances—new knowledge (Renshaw, 1998). What this theory foregrounded for me was the secondary or more passive role on the part of the teacher, compared to the resource.

An understanding taken from Professional Practice theory, relevant to Research Question 2 is that practice is purposive, not random (Kemmis, 2005, Green, 2008) and that a teacher's intentions are part of this purpose. While ICT has been integrated into teachers' contexts (which include established meanings and established resources that can be used), teachers are not necessarily passive in the ways these resources, including ICT, act as a conductor in their teaching. My focus in this study is on the teacher, and the process of their developing practical understanding of their ICT mediated practice. Important to this study is examining the choices teachers make with ICT when this resource is part of their practice, and the other resources they draw on to facilitate this practice. The questions developed from this thinking focus on examining the situations that arose for teachers associated with ICT in teaching practices: for example, problems or opportunities in relation to established and parallel meanings. They also focused on the choices teachers made in their uses of ICT in their teaching, and what influenced their choices.

Key theory points applied to Research Question 2 also focused on teachers' learning in their use of ICT in their teaching over time. In particular, changes in patterns of choices teachers make in their practice can represent a teacher's learning (Vygotsky 1981). Two aspects of theory were useful for thinking about such changing patterns. First, from Socio-cultural theory, is the concept of the Zone of Proximal Development (ZPD): a co-constructed interactive space of knowledge construction and identity formation (Renshaw, 1998). Second, common to thinking in both Socio-cultural and Professional Practice theory is that affordances, or new learning, are socially constructed and strongly influenced by the person's knowledge and whole life experience (Kelly, 2006; Kemmis, 2005). This drew my attention to the individual nature of teachers' engagement with and learning from, using ICT in their teaching. These perspectives informed questions around the relationship between a teacher's use of ICT in their teaching, the teacher's ZPD in terms of their level of knowledge and professional identity and the co-constructed space their learning was situated in. Continuing to focus on the teacher and choices they made, individuality was examined in terms of differing levels of ZPD as well as the teacher's contribution to the co-constructed space: for example, identifying or setting up opportunities for learning for themselves.

The key theory points applied to Research Question 3 centred on 'individualised' choices teachers made in their practice and what contributed to their individuality. The concept of 'dispositions' was useful for this (Kemmis, 2006; Hillier, 2005). Dispositions refer to an individual's learned capacity to participate appropriately in a practice (Kemmis, 2006). In terms of the teachers in this study dispositions refers to how well they are able to participate in the practice of teaching within their own classroom, school and more broadly within the community. Kemmis's (2006) use of the metaphor of a practitioner as a diver in the ocean was useful for foregrounding the very real presence of many social, cultural and economic established meanings for teachers, and the ways they swim around and against them in their practice; searching for meaning. Due to their equipment, divers have limited ability to communicate: this metaphor highlights the actions of the individual and the necessity ultimately that they rely on their own store of knowledge, understandings, beliefs, goals and values in the decisions they make in their practice. As a way of identifying and categorising the 'lived logic' of teachers, I used the concept of 'dispositions' in combination with the various senses of being a professional (Green, 2008): practising as a professional, working in a professional manner, possessing moral-ethical qualities, and professionalism as opposed to amateurism. These were useful for framing reasoning for teachers' choices and examining changes in these.

The questions these key theory points stimulated, in relation to Research Question 3, centred on teachers' individualised meaning making in terms of their TICT mediated practices. Questions focused on identifying difference in the choices teachers make in their TICT mediated practice and what contributed to their making different or similar choices. Additionally, the different ways they engaged with problems that arose in their practice and how they each engaged with these problems were a point of focus.

The matrix begun in the analysis related to the collection of the data, was built on during analysis of the data set. The analysis documented in this chapter has supported identifying further themes important to each research question, examining and identifying relationships within the themes (including the properties and the conditions that influence them) and between themes. Consistent with Strauss and Corbin's (1990) argument, the making of connections in this way supports developing a complicated understanding of the nature of each theme and the relationships between them. This was necessary for examining the Research Questions. The analysis of the data set was crucial for examining the dual relationship between practices and context and examining change within this framework.

The next chapter presents the findings for all three Research Questions. The questions that arose from analysis of the data set are an important element of this discussion, because they facilitated a complex structure to be addressed in each Research Question.

Chapter 4: Findings and Discussion

Why don't you tell me a story?
I don't want to.
Okay.
You could tell me about yourself.
You already know all the stories about me. You were there.
You have stories inside that I don't know about.
You mean like dreams?
Like dreams. Or just the things you think about.
(McCarthy, 2006, p. 287)

This chapter presents detailed pictures of five teachers and their Information and Communication Technology (ICT) mediated practice over a period of five years. As the above excerpt from *The Road* suggests, the detailed pictures are my interpretations of the teachers' ICT mediated practice paths of change that have been developed from my analysis of the data. The presentation of these detailed pictures is an important stage of this study as they clarify how I have interpreted the data; this is a necessary step for understanding and valuing the contributions I claim this study to make.

As discussed in Chapter 3, the design of this study has been an iterative process. It involved a cumulative series of data collection and analysis which aimed at gaining an increasingly deeper understanding of the TICT mediated practice of the participants. As explained, this process included identifying relevant themes and reducing and organising the data around the themes, from which an impression of the data was developed. This was followed by analysis of the data, which drew on elements from Socio-cultural theory and Professional Practice theory. The application of these elements involved drawing on the theories to identify questions and themes relevant to the research questions and the data, to guide further analysis. Analysis undertaken as part of this process showed the importance of the context in which TICT mediated practice of the participants was situated, and the ways participants engaged with their context as part of this practice. This included the information, values and beliefs they drew from various aspects of their context. Also part of their practice were the contributions they made to their context in terms of knowledge, beliefs and values about the educational use and value of ICT.

The methodological process undertaken in this study (themes, impression, and application of elements of theory) generated a structure of three research questions. The research questions were developed through the analysis related to the data collection. They are different to the research questions presented in Chapter 1 of this thesis. Analysis of the data set contributed to structuring new research questions pertinent to the theory and the TICT mediated practice of the participants. This chapter presents the findings and discussion for these research questions. The research questions include:

1. In what ways are established contexts important to TICT mediated practice? Established contexts refer to the social and material spaces and time in which participants situate their ICT mediated practice as well as structures and conditions which characterise it. As stated in Chapter 3, the participants situated their ICT mediated practice within a broad context associated with teachers, teaching, learning, schools, education, school and non-school uses of ICT. Of importance to TICT mediated practice is that much of this context was established well before ICT was integrated into school teaching and learning. This question aims at identifying which aspects of this broad context supported and hindered their ICT mediated practice and why.

2. How do teachers engage with their context and how does their engagement contribute to their TICT mediated practice? As explained in Chapter 3, from the analysis related to the collection of the data, two factors were identified as important to how the participants engaged with their context as part of their ICT mediated practice. These included individual factors and context. Individual factors include two elements: the participants' understanding of the teaching and learning process (their core approach to teaching), and the participants' ability to develop and motivation for developing their professional practice. In this research question, the participants' engagement with their context as part of their TICT mediated practice is examined via individual factors and contexts. The aim of this research question is to identify similarities and differences in the participants' process of engagement with their context as part of their TICT mediated practice, and also how this process contributed to the participants' learning.

3. In what ways do changes in the context in which their teaching is situated, influence TICT mediated practice? From the analysis of the data, as discussed in Chapter 3, it was evident that some changes in their context were important to the participants' ICT mediated practice. Importantly, different changes in their context were important to different teachers. This question builds on Research Question 1 and 2 and examines 'change' by focusing on the relationship between change in TICT mediated practice and changes in context. It examines which changes in their context were critical to changes in each participant's ICT mediated practice, and how they each engaged with these critical moments. Also, given the symbiotic relationship between context and practice, how changes in one participant's TICT mediated practice contributed to further or other changes in their context.

This chapter presents the findings and discussion pertinent to all three research questions. This begins with Section 4.1, which presents a theoretical model for addressing three research questions, both individually and in relation to each other. This model was developed through the grounded theory strategies used in this study, as discussed in Chapter 3. Three key findings are presented in the explanation of this model. One key finding is that there is a process which explains the ways participants engaged with their context as part of their ICT mediated practice. Second, some contextual and individual resources were particularly important resources that the participants drew on to inform their TICT mediated practice. As stated in the explanation of the research questions, contextual resources refer to the social and material spaces and time in which participants situated their ICT mediated practice, and the structures and condition which characterised it. Individual resources refer to the participants' core approaches to teaching, as well as their motivations for developing themselves within their practice. A third key finding presented in the model is that some changes in the participants' context (critical moments) were important to the participants as they catalysed reflection on their ICT mediated practice and initiated changes in this practice. The model of change in TICT mediated practice that is presented, facilitates explaining why some changes in their context were more important to the participants than others, and why they engaged with these changes in their context in the ways they did. The theoretical model presented was developed from the findings however it has been positoned first in this chapter. Given the length of this chapter and the amount and complexity of the data it deals with, this stratgey was used to assist the reader in understanding the findings and supporting data that follows the model.

Section 4.2 builds on the model of change in TICT mediated practice illustrated in Section 4.1 by presenting a detailed explanation of the resources identified in the model of change and the ways the participants engaged with them in their critical moments. A distinction of this section is that it uses the participants' voices drawn from analysis to illustrate the explanation. Three key findings are presented in this section. First, the participants prioritised particular contextual and individual resources to inform their ICT mediated practice. Related to this, a second finding indicates that key resources the participants drew on prioritised, privileged and hindered particular types of TICT mediated practice. A third finding was that critical moments (significant changes in their context) experienced by the participants in their ICT mediated practice, were primarily manifested from within their school, and were associated with change in their teaching practice and/or change in their professional identity. These findings assist in identifying the 'frame of reference': that is the particular setting and belief system, the participants' ICT mediated practice was situated within. This assists a deeper understanding of the TICT mediated practice of the participants by explaining why their practice changed in the ways it did, and why.

4.1 Model of factors determining change in TICT mediated practice

An important finding of this study is that contextual resources, individual resources and critical moments were significant to changes that developed in the TICT mediated practice of the participants. As stated in the introduction to this chapter, contextual resources are the social and material structures and conditions in place, associated with teaching in school and non-school uses of ICT. Individual factors are psychologically-based, and centre on the participant's individual interpretations of core approaches to teaching and learning, as well as their individual dispositions for developing themselves within their practice. Critical moments are events that manifested in the participant's context which initiated a process of reflection and change in their ICT mediated practice. Context, individual factors and critical moments are used in this section to present a model for explaining the participants' engagement with their context as part of their ICT mediated practice, and the resources important to participants as they engaged with their context. Additionally, the model identifies the influence that some changes in their context (critical comments) had on their development of their ICT mediated practice. This model provides a theoretical response to the three research questions.

The process of change in TICT mediated practice can be understood as an interplay between three factors: context, individual factors and critical moments. Figure 4.1 below summarises this interplay. The figure also identifies key elements of each factor. These elements are described in detail in Section 4.2 but are used here to facilitate introducing this process of change in TICT mediated practice.

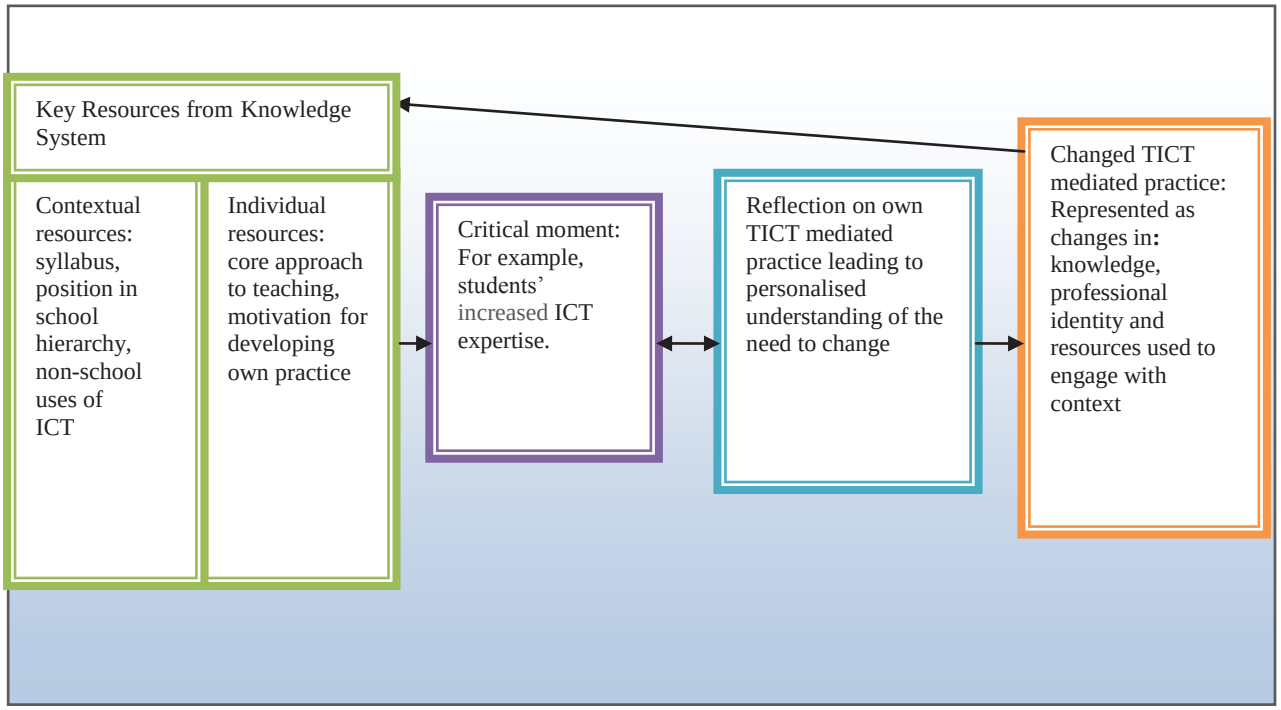

Figure 4.1: Determining factors for change in TICT mediated practice

A critical moment began the process of change in TICT mediated practice. The concept of a critical moment has been used in research to focus on an event or incident, planned or unplanned, that has significance for an individual's learning and actions (Sikes, Measor, & Woods, 1985; Woods, 1993). This concept has been used in research to describe incidents that make one stop and think, or one that raise questions for an individual about an aspect of their beliefs, values, attitude or behaviour (see Denscomber, 2007; Irvine, Roberts, Tranter, Williams, & Jones, 2008; Victoroff & Hogan, 2006). A critical moment is an incident which is not necessarily dramatic, yet in some way has had a significant impact on one's personal and professional learning. Importantly focusing on critical moments in this study contributed to understanding the characteristics of the learning process and context of the participant's that were associated with their ICT mediated practice over time. Also in identifying their interpretations of their learning and actions as part of this practice.

Of the many problems which arose for the participants in terms of their ICT mediated practice, critical moments were situations not planned by the participants which related to the use of ICT and that also applied pressure on them to change their knowledge, identity and/or actions (Ottensen, 2006a).

Given the situated nature of TICT mediated practice, critical moments were never isolated events (Green, 2009; Kemmis, 2009). As can be seen in Figure 4.1, they were embedded in and contributed to by key contextual and individual factors (Wells, 1999). Similarly, it was evident that contextual and individual factors to them being a critical moment. Importantly, critical moments were a change in their context (often with a series of other related situations leading up to them) that matched the participants' individual factors. Consequently, they struck a chord for the participants, who identified them as important to their practice and consequently perceived the need to respond to them, even unwillingly initially, for some participants (Carr, 2009; Renshaw, 1998; Vygotsky, 1981). Critical moments stimulated participants to reflect on their ICT mediated practice and began a process of change that responded to the particular demands of the situation (Wells, 1999). The term 'lift-off' moments has been described as a particular positive experience where one makes sense of change in one's personal life in relation to a change one needs to bring into their professional practice (Grant & Knowles, 2000). A distinction of critical moments for these participants is that they are not necessarily based on personal experiences. Their personal experiences did however contribute to their critical moments being critical moments. Additionally, a fundamental characteristic of critical moments is that they were followed by the participants taking action to make change. This action was not necessarily interpreted as a positive experience but primarily as a necessary action.

Critical moments changed participants' ICT mediated practice because they were not isolated events. There were lead-up 'clues' for the participants, which were minor changes in their context leading up to the critical moment. These clues, for each participant, were interpreted by them in individual ways. For example, in the situation of Philip, they were a series of clues which he interpreted in terms of the limitations of the syllabus in preparing students to work in the IT industry. Another participant may have interpreted these clues another way. However, Philip interpreted them in this way because they were interpreted via his Individual factors and what was important to him. This contributed to a building up of importance for changing ICT mediated practice in a particular way. The critical moment was related to these clues but was comparatively a bigger, more significant change in their context. In many ways the critical moment was a critical moment because of the building up in importance by these clues.

An outcome of the participants' reflection that took place as part of their engagement with a critical moment was that they identified the need to take action to develop their knowledge, so as to change what they were identifying in themselves asinadequate. If this cycle did not occur, it was not a critical moment for the participant. This reflection-learning-action-change cycle was associated with teaching practice and professional identity. An observable outcome after time, was changes in the participants' ICT mediated practice. These changes included, for example, new or modified classroom teaching strategies and changed relationships with students and other staff. As Figure 4.1 indicates, changes in the TICT mediated practice of the participants contributed to further changes to their context and Individual factors. For example, changes to their context included the ways that non-school uses of ICT were brought into classroom teaching with ICT and, in terms of their individual factors, new knowledge contributed to the ways participants valued ICT as part of teaching and learning.

As identified in Figure 4.1, participants drew on two sets of resources, to interpret the pressure they associated with a critical moment. Each set of resources provided them with knowledge, values and motivations that they identified as useful for addressing the critical moment. Both sets of resources were contributed to by the participant's prior experiences (Polkinghorne, 1997). One set of resources centred around contextual social and material structures and conditions (Green, 2009; Kemmis, 2009). Participants consistently referred to two systemic structures: the syllabus (documents specifying the teaching and learning to take place in schools) and the impacts of hierarchical structures on teachers. It also included, to a lesser extent, non-school uses of ICT. In their explanation of their ICT mediated practice, participants consistently referred to the various structures that have been developed for using ICT across a broad range of social settings outside school. For example, the processes in place for communicating via email, or those in place for using ICT in business transactions or community service transactions. While these were not school-based structures, the participants identified them as relevant sources of information to inform their ICT mediated practice.

Participants used the information from the syllabus, school hierarchy structures and non-school uses of ICT to guide the practical aspects of their ICT mediated practice. Their use of this information focused on their role, what they needed to do and how they used ICT. Their use of information in this way suggests they addressed critical moments from practical aspects of their teaching, rather than the theoretical or technical aspect (Carr, 2009; Kemmis, 2006).

A second set of resources the participants drew on to interpret the critical moments was their individual factors. Participants consistently referred to their interpretations of the practice and profession of teaching. As identified in Figure 4.1, this included their core approaches to teaching and learning, which involved how they understood this process and what they prioritised as part of it. It also included their ability and motivation for developing themselves within their profession. This was associated with what was important to the participants to develop in their TICT mediated practice, the actions they undertook associated with this and the skills they brought to these actions (Kemmis, 2005). For example, their motivation and ability to develop themselves as leaders in the school, or the importance they placed on student-teacher relationships and their motivation to develop this aspect of their practice. Individual factors contributed to their individual understandings of knowledge and professional identity associated with TICT mediated practice, which informed the actions they took in response to critical moments.

The critical moments they identified, and the ways they addressed the critical moment, was different for each participant. This is because the contextual and individual resources they drew on to assist them to interpret changes in their context had their own developmental trajectory (Vygotsky, 1981; Wells, 2007). Each of these sets of resources is influenced by social and material conditions that the individual has experienced over time (Ottensen, 2006a; Vygotsky, 1981). The individual draws on the knowledge, values and motivations they developed from past experiences, to address the current situation. Consequently, the combination of contextual resources and Individual factors the individual brings to bear when engaging with changes in their context varies for each person. This also indicates the historical dimension of their ICT mediated practice (Kemmis, 2006, 2009; Ottensen, 2006a; Vygotsky, 1981). The data indicated that while ICT is a recent inclusion in schools, it has not simply moved into and occupied empty slots in the participants' practice (Ottensen, 2006a; Ruthven, 2008). The ways the participants used ICT and the ways their TICT mediated practice evolved over time were contributed to and re-constructed by knowledge and values they have built up over time about concepts such as teaching, schools, student learning.

Contextual and individual resources were constantly (and automatically and often unconsciously) invoked and used by the participants as a sounding board to reflect on and make decisions about the pressure that critical moments placed on them. A generalised explanation of this mechanism follows: A significant change manifests in a teacher's context, which disrupts the normal flow of things and makes it difficult for him or her to keep teaching in the same way. For example, a new class of Year 1 students with high motivation for using ICT in their learning, makes it difficult to continue not using the computers in the classroom. This critical moment brings about pressure to change. The change travels through two sets of resources: the formal structures associated with teaching with and using of ICT (context is resource set A), as well as the teacher's individual interpretations of the practice and profession of teaching (individual factors as resource set B). The individual draws on aspects of these resources that they identify as relevant to the problem. For example, they might reflect on the resources the syllabus requires them to use in teaching, whether their principal expects them to use computers in their teaching, whether they see computers as an important part of a six year-old's education, that their retirement is getting close. The interplay between these two sets of resources provides a space for the teacher to make sense of the critical moment and negotiate what is important about the practice and profession of teaching and how they could and should teach with ICT. The pressure to change their ICT mediated practice is confirmed or denied, accepted or rejected, adjusted and shaped to fit in with the teacher's previous conceptions of the practice and profession of teaching inside the particular context of the moment. The result is a personalised understanding of the critical moment—a uniquely constructed piece of knowledge. Importantly, critical moments impelled the teacher to actively change their ICT mediated practice. This process of engagement facilitated their acting in ways they considered wise, prudent or strategic in their ICT mediated practice (Carr, 2009; Kemmis, 2009; Wells, 1999). This does not mean that they were model ways of addressing the problem, but they were ways that fitted in with the teachers' understandings of the issue (Polkinghorne, 1997). For example, if the teacher considered the issue only needed a superficial change in their ICT mediated practice, then their actions reflected this. Teachers identify a practical solution to their problem. This influences how they approach their own professional learning and the changes they bring or do not bring into their ICT mediated practice. Additionally, over time, the participants stated their engagement with the critical

moments was an empowering element and an increased confidence in their ICT mediated practice was evident.

The resources the participants drew on to address critical moments also influenced the range of choices they could make regarding their ICT mediated practice. This is because the knowledge, values, and intentions embedded within the contextual resources are laden with a subjective background of meanings, therefore privileging particular kinds of practices (Kemmis, 2006). For example, the participants consistently drew on the syllabus, and the constructions it explicitly and implicitly communicated about teachers and teaching, to inform their ICT mediated practice. Additionally, the individual factors the individual brings to the process are not limitless, but are dependent on the knowledge the individual has, as well as the passions and goals they have. These factors also privilege particular kinds of practices and therefore contribute to the ways they interpret changes in their context (Connelly & Clandinin, 1999).

4.2 Resources and critical moments

This section elaborates on the model *Determining Factors for Change in TICT Mediated Practice* as illustrated in Figure 4.1 by using data to address the three research questions. Research Question 1 is addressed by detailing the particular contextual and individual resources the participants used to inform their ICT mediated practice. This section also addresses Research Questions 2 and 3 by identifying where critical moments manifested within and because of these resources, and chronicling individual participants' engagement with critical moments and the influence this had on their TICT mediated practice over time. The main argument presented in this section is that there was inconsistent and challenging information within the resources the participants used to inform their ICT mediated practice. For this reason, some events were interpreted as critical moments by some participants while for others they were much less relevant or were even dismissed. Also the participants' engagement with these critical moments influenced further changes in their context as well as some changes in their individual resources.

4.2.1 Key contextual resources

A key finding of this study is that three contextual resources were important to the participants in terms of their ICT mediated practice: the syllabus, school hierarchy and non-school uses of ICT. The syllabus developed by the NSW Government's Board of Studies, sets the core curriculum for all primary and secondary schools in NSW for each discipline area. The school hierarchy refers to the organisation of power and status the participants experienced to be present in schools and the school system. Of particular importance to the participants was their own status and agency within this system. Non-school use of ICT refers to the formal and informal processes in place for using ICT across a wide range of settings. In their explanations of their ICT mediated practice, participants consistently referred to structures they participated in or were aware of for using ICT outside school. For example, Lisa referred to structures and processes in place for online banking and Beth referred to informal arrangements within her social group to organise outings via email. While many other factors may be associated with TICT mediated practice, the participants kept emphasising these three in their explanations of their practice.

An interesting finding was that even though the participants were located in different locations, they referred to these three contextual resources in similar ways in terms of their ICT mediated practice. This indicates that they identified dominant and consistent meanings and intentions (Bruner, 1990; Kemmis, 2006) embedded within these structures that they considered to be relevant to their ICT mediated practice. In some situations this was influenced by the historical nature of these structures, such as the syllabus and the school hierarchy, which have been part of school education and have evolved to their present form over a long period of time (Wells, 2007). Moreover, this suggests that the meanings and intentions communicated by these structures were prioritised by the participants, possibly at the expense of communications from other aspects of their context. Details of the significance of these three contextual structures for the participants follow, beginning with the syllabus, then their status within the school hierarchy, and finishing with non-school uses of ICT.

An important finding was that the participants experienced an incompatibility between teaching the syllabus and their ICT mediated practice. This stemmed from how they interpreted ICT was included, or not included, in the syllabus and also differences in the ways the syllabus organised knowledge and the ways the internet organised knowledge.

Significant to TICT mediated practice of three of the five participants was their perception that ICT was not needed to fulfil syllabus outcomes. This was pertinent for Beth and Vanessa, who were primary school teachers, and Fran, a secondary school English teacher. The following quote from Vanessa indicates that the content of these syllabi was their priority and she did not perceive that she needed to use ICT in her teaching for students to achieve the syllabus outcomes.

> ICT is not an important part of the syllabus … even though I teach with ICT I still need to rely heavily on traditional teaching aspects (to cover syllabus content) … Getting through (syllabus) content is first. (Vanessa, 2001, interview data)

In the early stage of the study Beth and Fran made similar evaluations to Vanessa. They explained that while teachers were being pressured by principals and DET to use ICT in their teaching, the syllabus did not communicate this to them. This indicates that from their insider's perspective of the practice of teaching (Kemmis, 2009), ICT was perceived as unnecessary for the day to day requirements of their practice. A consequence of this is that their established ways of teaching were being reinforced and maintained.

A close examination of the syllabi these three participants worked with indicated minimal reference to ICT in the outcomes. For example, there was little acknowledgment of ICT in the Mathematics and English syllabi Beth and Vanessa used. When ICT was mentioned in these syllabi, the language used was generalised and non-committal. The following outcome drawn from the Mathematics syllabus (Stage 2) Beth worked with, exemplifies this: 'Uses objects, actions, imagery, technology or trial and error to explore maths problems.' The wording of this outcome suggests ICT as a possibility, not a necessity, for addressing this outcome. The outcome also does not specify digital technology, but more broadly uses the term 'technology'. Only one outcome was found to acknowledge ICT in the English syllabus (Stage 3), which Vanessa worked with. This stated: 'Produces texts in a fluent and legible style and uses computer technology to present these effectively in a variety of ways.' Given the lack of ICT in the syllabus, teachers may have found it viable to not consider ICT essential for teaching the outcomes.

The participants positioned TICT mediated practice as outside the syllabus, which led to them perceiving it as a lower priority in their practice. Classroom observations and interviews indicated that they organised their planning, teaching strategies and assessment around the syllabus requirements. Compared to other contextual and individual resources, the syllabus was referred to most often in their explanations of their TICT mediated practice. While ICT has had a presence in schools since the mid 1980s, and there were school policies that positioned it as an important part of teaching and learning, it was the syllabus that the participants focused on and consistently referred to, to justify their ICT mediated practice, despite these other influences. They were focused on the practicalities of their day to day work, and they identified the syllabus as defining this for them.

Participants explained that the pressure to teach content they perceived as outside the syllabus exacerbated an already stressful and overloaded teaching situation. The participants consistently experienced covering the syllabus content as a stressful experience, leaving them feeling as though they were always behind in the fundamental aspect of their work—teaching the syllabus. They explained this left little time and motivation to develop their ICT mediated practice. The time they had to address the syllabus outcomes was of prime importance to the participants. As the following quotes indicate, the expectation of them that they perceived, to cover all syllabus content in time, was a source of stress for them.

> Learning at school is not free-range learning. It is bounded by expectations that we teach them (students) within a required time. (Lisa, 2002, interview data)

> Teachers have a lot of work to get through, they need to work quickly to get it all done … It takes a lot longer in class when children are using computers … using ICT is a really slow process. (Fran, 2001, interview data).

Part of the participants' stress in covering the syllabus content can be attributed to the busy life of a school in which the teaching was situated. All participants referred to the overload of school activities which didn't directly involve syllabus outcomes, such as assembly and school choir, which constantly cut into their time to teach. As Fran's quote above indicates, activities outside the syllabus were considered as interruptions to their teaching. The participants explained that the syllabus content they were required to cover, the time structures around this and the busy school life, all constrained the time they had available to develop other aspects of their teaching such as using ICT. As stated, they perceived ICT was not considered a necessary part of the syllabus and therefore it was perceived as another interruption to the little time they already had. As Fran experienced, it slowed down the momentum and reduced her opportunities to cover all the required content. Conversely, Philip, a secondary school computer-studies teacher, did not experience an overload of syllabus content to deal with. Philip did not refer to the busy school context or feel stressed. Interestingly, a consistent theme in his data was the opportunities he took to develop himself within his practice. This is explained in greater detail in Section 4.2.2.

The stress the participants referred to, indicated a routine of juggling the various interruptions in their day with the priority of spending time on teaching the syllabus content. The participants perceived the stress of addressing daily activity in a school to negatively influence their willingness to develop their ICT MP. For example, early in the study, Vanessa questioned the value of spending time trying new things in her teaching. She stated,

> There is limited time to do everything, you can waste too much time trying new things—you need to draw on success and experience. (Vanessa, 2002, interview data).

A pattern of 'always feeling behind in their teaching' appeared to hinder the development of their ICT mediated practice. A consequence of this is that the pattern can form a routine that is difficult to break into or out of. Over the course of the study, Vanessa increasingly valued ICT as part of teaching and learning at school and referred less to it as being outside her priorities. Interestingly she continued to refer to juggling her work and, as the quote that follows indicates, identified other, more recent initiatives outside her priorities which she interpretted as stressful to fit into her teaching.

> Oh, the stuff at the moment with OH & S … but then they (DET) sit there and so oh, your reading is going down, well yeah takes away time. (Vanessa, 2005, interview data)

A consequence of teaching the syllabus within a busy school life is that contexts promoting and supporting the participants' ICT mediated practice were being overshadowed by the stress of covering the syllabus content in time. As stated in Chapter 3, all the participants were teaching in schools in which TICT mediated practice was being promoted by the principal. This took the form of professional development, establishment of computer labs, increased access to ICT and the promotion of a culture of teaching with ICT. As Fran's following quote suggests, this support was being overshadowed by the stress.

> Last staff development day we were asked to nominate as a faculty which type of computer level we wanted to work at. We said we weren't right at beginners, we knew how to turn one on. So we chose one and I don't know what happened but it didn't actually come to pass. Other people had so much work to do they just didn't go to that session of the staff development day … We don't have staff development day next term. There's just no time. (Fran 2003, interview data)

> Interviewer: Are there other things in the school that would give you the support to try new things?
> Fran: I think nobody's got time … Oh look they try, I mean it's all pretty tokenistic. You know, they're paying lip service. (Fran 2003, interview data)

The participants' prioritising of covering the syllabus, raises issues about developing TICT mediated practice, and where change, ideally, can be initiated to support school reform. A common discussion point throughout this chapter is the practical, 'day to day' focus of the participants. Reflecting this, the issues participants pointed out as important, related to the syllabus and/or the busy school life. These aspects are in their range of vision: therefore, introducing ICT via changes in syllabus content or by alleviating other activities that teachers are involved with may be a useful strategy they would respond to.

A second key finding of this study was the difference of importance for their TICT mediated practice that the participants identified, between the organisation of knowledge in the syllabus compared with the organisation of knowledge on the internet. The internet makes available information in a non-sequential, asynchronous and self-directed format. In contrast, the participants perceived that the syllabus conceptualised knowledge in sequential, time-directed and teacher-directed ways. This contradiction was problematic for the participants.

The nature of the internet is that ideas are linked together in terms of associations, reflective of natural thought patterns, rather than in the sequential ideas often used in print-based resources (Orlando, 2007). Users can move freely between ideas in ways that reflect their thinking and also which guide their thinking. Some participants experienced this at being at odds with the syllabus, which organises information into disciplines and then into discrete bodies of knowledge within each discipline. In 2002, Beth referred to students ' … going off on a tangent' in their learning. She stated this made it difficult for her to contain the students' learning to her lesson planning. Similarly, Philip explained that using the internet with students, necessitated teaching content outside the syllabus. In the early stage of the study he explained that when he used the internet to teach the school subject Design and Technology, this necessitated teaching the students critical literacy. He stated, 'Critical literacy should be the role of the English teacher' (Philip, 2001, interview data). All participants referred to similar understandings over the course of the study.

The participants perceived that the syllabus expected teaching to be sequential and teacher-directed. The majority of lessons observed of the participants in this study can be described in this way. The participants grouped knowledge into disciplines, teaching particular content at particular times, and sequencing learning into pre-determined steps. This can be explained as a consequence of how the syllabus is structured, as much as a choice by the participants.

In addition to the syllabus, there were many other aspects of their professional context that also interpreted sequential, teacher-directed approaches as characteristic of teaching. Participants referred to school reports and student assessment tasks from their school, and standardised tests which were institutionally based, as all requiring teachers to delineate and separate disciplinary content.

Professional practice has social and economic structures and conditions that characterise it and distinguish it from other professional practices (Kemmis, 2006). Sequential teaching was perceived by the participants and also by the school and DET (for example, via policy documents and syllabus), to characterise teaching practice. Similarly, the majority of classroom observations of the participants over the five years were sequential and teacher-directed in nature, suggesting that this type of teaching is an ordinary and expected way of acting within this practice (Bruner, 1990). The participants' negative response to the internet can be interpreted in terms of the internet disturbing the type of teacher direction they understood their practice to require/expect. Also, referring back to the stress the participants referred to when activities took them away from the syllabus, the internet was experienced as stressful by some participants as it did not 'fit' linear teaching easily.

There is a basis for changing the organisation of knowledge in the syllabus, as well as for maintaining, it if we are to capitalise on the potential ICT holds for future school learning. Realising the potential the internet holds for learning in schools might require significant reconceptualising of the way knowledge is organised in schools. For example, reshaping the syllabus in ways which reflect a less linear approach to teaching may be more conducive (CERI, 2002). This would be represented by a syllabus with less focus on disciplinary knowledge and more emphasis on strategies for working with vast amounts of information and processes. A syllabus of this kind gives explicit attention to non-cognitive outcomes, values and citizenship, as well as a strong emphasis on non-formal learning (CERI, 2002). This could possibly create a frame for teachers which resonates more with ICT and indeed with the world beyond the classroom, and also one which has been described as supporting 'widespread recognition for schools and their achievements, including towards the professionals with a high priority accorded to quality and equity' (CERI, 2002, p. 2).

Conversely, organising teaching and learning content into disciplines is not necessarily at odds with the knowledge society and the ways it requires working with knowledge. Skills identified as necessary for the knowledge society include: accessing knowledge, interpreting and applying it, generating products based on it, communicating and presenting these (Partnership for 21st Century Skills, 2004). This is what the syllabus also identifies as important. The difference is that the syllabus focuses this knowledge-work around a particular discipline. Working with the knowledge of one discipline can be considered valuable groundwork for working across disciplines with vast amounts of information to discern, apply and develop. Additionally, a gap widens between the syllabus and 21st Century skills when people reify disciplinary knowledge, viewing it as static and different from the knowledge gained through and for daily living. If disciplinary knowledge is interpreted as representing the ongoing processes of a community of inquiry, then the conflict between the developing knowledge prioritised by society and 'school' education would become a matter of integrating perspectives and not of choosing one over the other (Peterson, et al., 2004).

Lisa referred to feeling unstuck at times when teaching with the internet, as she now had to deal with students' engagement with crude and inappropriate internet images or texts in class. There is an increasing number of sites that pose issues around inaccurate, bias or outdated information. Wikipedia is one such example. There is also the high level of advertising on sites often accessed by children. While exposure to advertising may previously have been an issue in teaching, the potential for this to occur when students use the internet in class is increased dramatically. As stated, Lisa did not have a syllabus, whereas a syllabus potentially could offer guidance in dealing with this issue herself and/or teaching students how to deal with this issue.

Lisa's issue with the internet content relates to how schools manage the dynamic and vast amount of text and images accessible on the internet. This issue has been identified as a peril of using the internet with students, and which requires teachers to consistently check sites before the lesson and talk with students about inappropriate content (Bolick & Cooper, 2006). This is how Lisa tried to address this issue. However, she referred to it as an onerous and time-consuming task. Consequently, this is problematic for teachers, particularly given their perceptions of being time poor, as noted earlier. It raises systemic issues around the ways that knowledge is managed in schools and the ways this influences teachers' ICT mediated practice. For example, in Lisa's situation it appears that a content management process was not in place in the school to identify, audit and store appropriate internet content in a way that it could be easily accessed by students and teachers (Rosenblatt & Dykstra, 2003). Such systems can be developed by schools informally—for example, a staff member leading the organising of internet use in the school, or using commercial software packages available for such processes. Using a content management system would alleviate the time burden on individual teachers of organising the vast amount of internet information in preparation for their ICT mediated practice.

Philip taught an ICT-focused subject, Information Processes and Technologies (IPT) and identified a lack of relevant content in the syllabus. The IPT subject is for senior secondary school students and Philip understood his aim in this role as to prepare his students to work in the IT industry. Increasingly over the course of the study he experienced the syllabi he worked with as frustrating for both himself and his students. He was of the opinion that the rapidly innovative state of ICT and the IT industry did not fit with the lengthy process of developing a syllabus. He experienced that by the time a new syllabus got into schools, it was out of date, or quickly became out of date. He described this as the limitations of a paper-based syllabus for computer studies subjects: that the time usually attributed to developing a new syllabus, often between 5 and 10 years, is too slow in a field such as ICT, which is highly innovative. Interestingly, the IPT syllabus that Philip explained was lagging behind the IT industry was redeveloped in 2008, three years after the data collection had finished.

Over time, Philip increasingly questioned the suitability of the IPT syllabus to guide his ICT mediated practice. His questioning was related to the moral-ethical aspect of his ICT mediated practice and to doing the right thing by his students (Green, 2009). This influenced him to develop this practice in ways that reflected outside school uses of ICT more. The change that developed in his ICT mediated practice was within and against the structures for teaching that had been established in schools (Stronach, Corbin, McNamara, Stark, & Warne, 2002). Changes in Philip's ICT mediated practice, raises issues regarding the value of his teaching within the school system. Philip's IPT subject prepares students for the Higher School Certificate, an exam that all students undertaking this subject across NSW schools sit for. Philip, moving along his own trajectory of teaching, raises issues regarding whether his students will be advantaged or disadvantaged by his teaching in this exam. Philip's trajectory of change is also an interesting finding as it works against some earlier discussion, that explained the constraining nature of the syllabus. The three other teachers who used a syllabus all referred to the stress of covering the syllabus content. Philip on the other hand made space available for more content in his teaching.

Lisa had been employed as a primary school computer-studies teacher, yet no syllabus had been developed for her area of teaching. To address this issue, Lisa drew on her network of local secondary students and their perceptions of the secondary school curriculum as her main source of information to guide her teaching. She relied on anecdotal information about the way that schools used ICT in their teaching and shaped her teaching around the skills she considered the students would need to be able to use ICT at that school. Lisa had no direct contact with the local secondary school. She relied on ex-students visiting her to tell her the ways they used ICT at school. Substituting the perceptions of ex-students now attending the local secondary school for a syllabus, was Lisa's situation for much of the study. Interestingly, Lisa's teaching was observed to be repetitive across the classes and she took very few risks in her teaching over the five years.

Lisa's reliance on students' perceptions of the secondary school curriculum provides some insight into her approach to problem-solving. She did not use the internet or other means to supplement the students' perceptions about the curriculum at the local secondary school or any other secondary schools. Additionally, there was no evidence of her drawing on theory or any systematic research process to develop her ICT mediated practice. Lisa's approach to solving the problem of developing her teaching may be described as weak and haphazard.

Lisa's approach to problem-solving relates to lack of time, expertise or motivation to develop her ICT mediated practice in a more systematic way. Lisa's example can also be extended to questioning how knowledge is accessed and shared by teachers. Is knowledge of the curriculum outside one's own local school easily accessed, is knowledge sharing across schools something that is encouraged, discouraged or is it not an issue? Additionally, how is self-reflection and development of one's own practice promoted within such documentation?

Lisa's situation of not having a syllabus provides some insight into the way that schools and school systems have understood and responded to the place of ICT in school learning and teaching. The development of Lisa's position as a computer-studies teacher was her school's response to the issue of developing students' ICT expertise. Her principal considered it an important enough issue to dedicate a full-time teaching position to it. Lisa stated however that she did not have any ICT expertise before this position and also she did not know she was being transferred to a dedicated 'ICT' teaching position. She also was given the role of maintaining and administering all the computers within the school, upon being appointed to the role. This situation continued over much of the study with minimal direct measures to improve the support given to her position. She had some ad hoc support from her principal in the first year of the study in developing content for her teaching. This principal left the school at the end of the first year of the study and was replaced by an acting principal for the next two years. When interviewed in the mid stage of the study, the acting principal stated: 'To be honest, I'm not exactly sure what Lisa does in the computer lab but I'm sure she is doing a good job.' Similarly, DET were aware of Lisa's position within the school, yet there was no evidence of support being provided for her at this level either. The lack of support mediated a situation which left Lisa feeling isolated. She considered herself to be the only member on staff with ICT expertise: therefore, she felt she had no peers to support her in her teaching and felt no support from the system either.

Lisa's situation suggests that the structural impediments surrounding practice mediated by ICT were not given the same status as other practices within her school or the schooling system. Lisa's teaching was not being supported by a syllabus or other similar documents to guide it, as was the case for other content being taught within the school. The response of Lisa's acting principal, described above, represents a lack of status attributed to Lisa's position within the school and system. In his acting role, his intention was to ensure that the school stayed in order. He did not prioritise her teaching as an aspect of the teaching and learning he was expected to oversee.

Interestingly, a critical moment that manifested for Lisa was when she was expected to work closely with a teacher new to her school, who had a high level of ICT expertise. This change in her context caused considerable personal stress for Lisa, as the new teacher now contributed to her planning and teaching and she no longer had complete control over her ICT mediated practice. The change also contributed to a sense of relief for Lisa as it provided her with the support she had been craving. This critical moment involved organisational change in which Lisa moved from working in an isolated way to working in partnership with the new teacher. Pedagogical change was evident where Lisa took more risks in her teaching, introducing new content and teaching strategies in her ICT mediated practice. This critical moment also influenced a shift in her core approach to teaching, related to the capability she attributed to children as learners. An account of Lisa's engagement with this critical moment follows.

An up-close, mini-narrative device is used to present Lisa's engagement with a critical moment. Similarly, this device is used to present an account of each participant's engagement with their critical moment throughout the remainder of this chapter. Each mini-narrative includes: identification and recognition of the factors leading up to the critical moment being critical for that participant, how the participant engaged with the critical moment at the time and also, the changes in their ICT mediated practice that were influenced by the critical moment over time. The mini-narratives supplement and stand apart from the explanation of the participant's ICT mediated practice. For this reason they have been written in a different font is to differentiate them from the body of the text.

Lisa's critical moment: Working with a teacher new to her school who had a high level of ICT expertise

Damien's move to Lisa's school was initiated by the new principal, who had worked with Damien in their previous school and wanted to use his ICT expertise at this school. Damien was asked by the principal to share Lisa's technical administration of computers in the school. Additionally, Damien was appointed as a Deputy Principal and Lisa was required to teach his class for half a day each week during his executive release; this was in addition to the weekly computer skills class she taught this class.

Lisa experienced working with Damien to be personally stressful, as he expected her to teach in any way he needed her to. In one observation of Lisa in 2005, Damien had planned for Lisa to continue working with webquests with his class. Webquests are structured investigations available on the internet where learners work through a series of activities to investigate a particular topic. The field notes that follow indicate she was clearly uncomfortable teaching this lesson.

> Lisa seemed quite stressed in the introduction of this lesson. Didn't have the usual control I have seen at the beginning of lessons. She acknowledged to me this lessened control, stating a number of times aside to me, 'This is really going to be one of those days' (Lisa, 2005, field notes)

In an interview following this lesson Lisa clearly looked stressed, and showed her shaking hand as an indication of her physical reaction: this lesson had clearly placed her out of her comfort zone in teaching.

Lisa's tension was associated with Damien's expecting her to teach in ways compatible with his own core approach to teach yet outside Lisa's. The following quotes indicate that Lisa's core approach to teaching centred on the importance of explicit teaching and repetition. This was also evident in her teaching.

> Children need repetitious practice, just drill it and drill it. (Lisa, 2001, interview data)
>
> Teaching needs to be thoroughly planned for. (Lisa, 2003, interview data)
>
> Each lesson begins and ends with a set routine which focuses on practising and remembering. (Lisa, 2005, interview data).
>
> I can only teach well if I am in control of the learning environment. (Lisa, 2005, interview data).

Lisa described Damien's teaching/planning (core approach to teaching) as emphasising peer learning, and moving through content much quicker than Lisa did. This was affirmed in an interview with Damien. Damien's planning shifted Lisa's control of the teaching and learning in the classroom, which she expressed to be stressful.

Interestingly, a factor that contributed to this situation being a critical moment for Lisa was that she respected Damien's ICT expertise. Up until this time, she stated, she felt isolated from the teachers on staff because they didn't have much ICT expertise. She felt she didn't have any peers. Additionally, she did not have a dedicated syllabus to guide her teaching. As stated, she used students' perceptions of the curriculum at the local high school as a substitute. She appreciated and was relieved by the direction Damien gave her. Lisa identified that Damien provided a bridge for her to have a greater sense of belonging with her school staff (Lave, 1996). Additionally, while Damien put pressure on her pedagogically, he took off the pressure of leading ICT learning within her school. Lisa felt she didn't have adequate ICT knowledge to have this position in the school and she didn't aspire to be a leader within the school. However, she felt there was no one else to take the role. She was acting in a way that didn't fit with her disposition for developing herself within her practice. Damien relieved her of this ethico-moral conflict she was experiencing, between expectations for her to lead ICT in the school and acting within low motivation and low confidence in her ability to be a leader within her professional practice (Wells, 1999).

In the final year of the study, pedagogical change was evident in Lisa's ICT mediated practice. She changed two very longstanding practice. Interview and observation data indicated that in the previous four years of the study, Lisa always divided the class into two groups and taught ICT skills to only half the class; the other half played computer games without her assistance. In the final stage of the study, Lisa for the first time taught the whole class, with the older classes. She stated she now felt confident in her ICT skills to do so. Second, Lisa started using the internet with Year 1 classes in the schools. As the following quote suggests, her critical moment was an empowering element for her.

> I feel more confident with my ICT skills now so I am more willing to take risks in my teaching and change the ways I do things in class. … I would never have done that with the littlies a couple of years ago' (2005)
> 'Whoever said you can't do internet searching with Year 1 is wrong! (Lisa, 2005, interview data)

It is interesting to note that Lisa expressed a deficit view of children as learners earlier in the study. It may be suggested that the risk taking that led to pedagogical changes also contributed to changes in her core approach to teaching—in particular, the ways she understood children as learners.

Interestingly, over the course of the five years, a relationship between syllabus and long-term school-based planning was evident. Only one out of the nine syllabi the participants worked with, was rewritten and available for use by teachers during the study. Since completion of the study, three more have been redeveloped. The oldest syllabus still in use is the primary school English syllabus, which was published in 1998. The long-term use of syllabi in schools suggests that the issues these participants experienced are potentially long-standing issues for teachers in schools.

Fran was the only participant in the study whose syllabus was redeveloped during the study. A difference Fran identified in the new syllabus was that it made explicit reference to teaching with and about ICT to fulfil outcomes. This change personally distressed Fran. She perceived that her ICT skills were inadequate for such teaching, and this was confronting for her as she considered herself an experienced and capable English teacher. This critical moment began a process of cognitive change for Fran. She sought new information and initiated her own learning to develop her ICT skills. This involved organisational change where she identified staff who could assist her learning and arranged them to provide professional development for herself. An account of her engagement with this critical moment follows.

Fran's critical moment: ICT-related changes to the syllabus

A critical moment that developed for Fran was the implementation of a new secondary school English syllabus which included explicit reference to ICT in some outcomes. The draft of this syllabus was sent to schools in 2003 and the finalised syllabus was to be mandated in schools the year following the completion of data collection for this study. Some ICT-related outcomes included in the new syllabus were:

> Stage 4: 3.3 use the features of information and communication technologies including word processing, importing and manipulating of graphics, and formatting to compose a variety of texts for different purposes and audiences (B.O.S., 2005).
> Stage 5: 3.3 use advanced word processing tools including formatting of references and bibliographies, formatting multiple page documents including weblinks, importing data from internet and manipulating images to compose and format texts for different purposes, audiences and contexts, including the workplace (B.O.S., 2005).

As the following quote indicates, Fran experienced this change as personally stressful, since she perceived she would now need to use ICT in her teaching, whereas in the previous syllabus she did not.

> We're meant to look at word processing, at internet searches, email, language forms and features appropriate to those kinds of texts. … So we are now starting to stress out about how we are going to do this. Many of us don't feel comfortable taking a class into the computer room.'(Fran, 2003, interview data)

A consistent theme in Fran's data was her lack of motivation for using ICT in her teaching. Until this point Fran had consistently explained her ICT mediated practice in relation to the syllabus stating, 'Computers need to be used to address to syllabus' (2003), and 'Computer use needs to be for KLA learning (2005). She justified her lack of use of ICT by explaining she perceived the syllabus did not require her to use it much. In an interview following a lesson observation Fran was asked for her reasoning for using *Microsoft Word* in the lesson. She stated,

> Because that is what I can do … they can do it and it satisfies syllabus requirements … .I know you are supposed to do you know basic word processing and they need to be able to find something you know, go to the internet, but other than that I'm not really sure. (Fran, 2005, interview data)

Fran was also aware of her limited ICT skills. However, it wasn't until the new syllabus was mandated that it became a concern for her. Changes to the syllabus made limitations in her own ICT knowledge important to Fran. Fran's primary aim in her teaching was to teach the syllabus. From the changes to the syllabus Fran reconceptualised who and what an English teacher is and does (Wells, 1999). The inclusion of ICT affirmed to her that English teachers are expected to have, and need to have ,ICT expertise. This made learning about ICT important to her. Fran now referred to the need to use PowerPoint and the internet in her teaching, as she perceived them now as necessary for fulfilling some outcomes. This change in her content contributed to Fran realising that she was no longer able to teach the syllabus; there were parts of it she didn't have the knowledge to be able to teach.

This critical moment contributed to Fran initiating organisational change to facilitate her learning about ICT. Fran had stated, on a number of occasions, words to the affect that 'Teachers can't keep not knowing about ICT!'. However, this was the first instance of her initiating any action to improve her ICT expertise. Fran approached the head of her English faculty about the possibility of having a workshop on using *PowerPoint* for the English staff. Additionally, Fran had booked the computer lab once or twice a week for the term (wherever there was a vacancy in the lab) to support her using ICT more in her teaching. At the time of my final interview with Fran, one workshop had been undertaken, with another to soon follow. The organisation of her professional learning contributed to cognitive change and she stated she was starting to learn how to use *PowerPoint*.

In addition to the syllabus, the participant's status within the school hierarchy was a contextual factor also important to the TICT mediated practice of the participants. The participants consistently conceptualised the school hierarchy in this way: DET makes decisions regarding teaching practice in schools, the school principal and executive lead in localising the decisions made by DET, teachers follow the executive's lead and also provide the teaching expertise for teaching students and, at the lower end of the hierarchy, students are the learners. The participants associated their status within this hierarchy with their professional identity. There was a rhythm between their status and identity; a change in one influenced a change in the other.

Interestingly, the participants over-extended their use of the term DET and used it when referring to other educational executive bodies as well. For example, the Board of Studies is the organisation which develops the syllabus and, while the participants expressed frustration with the syllabus, they did not express frustration with the Board of Studies. Instead they used the term DET when explaining their frustration of the inadequacy of the syllabus content as well as when they referred to their frustration around DET-based initiatives in schools, such as ICT in schools. Generalising the term DET in this way indicates a lack of understanding of the distinctions between these two organisations. It also suggests that the participants' priorities are school-centred. They are not system centred or even more broadly, education centred. The participants' world is situated in their work, their field of operation is local and their language is local. DET and BOS may be considered the one entity by the participants because they are both outside their local world.

There were many instances which indicated that the TICT mediated practice of the participants was associated with their struggle to gain greater recognition within the school/DET hierarchy. This was in addition to the syllabus issues associated with their TICT mediated practice, as discussed. This struggle for recognition for some participants, was in relation to their place within this hierarchy now that ICT was valued in the education context. As the findings that follow indicate, recognition was understood by participants as improvement in their respect, legitimacy and agency as teachers within the hierarchy.

Of significance to most participants was the minimal recognition they perceived that DET gave to their professional expertise. Lisa, Beth, Fran and Vanessa all conveyed frustration about the regular process of DET making decisions for them in terms of what they will teach, when and for what reason. They referred to this structure as disregarding their teaching expertise. Midway in the study, Lisa explained at times she felt pressured into teaching in ways that did not fit with her core approaches to teaching. She referred to the consistent need to make a compromise between her own core approaches to teaching and what she perceived to be the constraints of the ethos and policies of DET (Polkinghorne, 1997).

Compromise between their own core approaches to teaching and DET policy was evident in the ICT mediated practice of all participants. Their compromise was a way of making sense of the rules they perceived as constraining the practice of teaching (Polkinghorne, 1997). Their perceptions and actions suggest that they experienced the top-down decision-making within this hierarchy as constraining. Their 'compromise' represented a creative, subjective response within these limits. As is described in Figure 4.1 their individual factors were important to the personalised understanding they developed of the school hierarchy and how to act within it.

A lack of recognition was particularly evident for the participants when DET initiated a new policy for teaching in schools. The participants referred to the lack of consultation in this process. They stated they knew what worked at the 'coalface' and yet they were never, or at best minimally, consulted in DET's change processes. The development of new syllabus by the BOS follows a similar pattern: however, participants only referred to DET in their explanations. They also referred to the lack of support and recognition for putting DET's projects into practice. The participants' perceptions indicate a struggle for voice in the process of new policy development. Their perceptions also suggest a lack of understanding of how DET works: the complexity of policy development.

Data from Vanessa's early and mid stage, is useful for explaining her perception of DET's policy implementation and how it influenced her ICT mediated practice. Vanessa consistently referred to DET's approach to initiating new projects into schools. She identified many previous DET-led initiatives into schools which, she explained, required substantial effort by herself as a teacher to carry out. She talked about all the effort she had put into putting such initiatives into practice. A pattern she had identified in such initiatives was: DET had a good idea—she worked hard to implement it for them yet she was never supported in or acknowledged for her efforts. Similarly, when responding to an interview question on where Fran might get help to learn PowerPoint, which she perceived she needed to fulfil requirements of her new syllabus, she answered,

> Oh who knows? I think there's a book I can. I don't know. … It will probably be a case of, you know we all sit around and work it out ourselves. We're not going to get it from you know who [DET]… just teach ourselves. (Fran, 2003, interview data)

Vanessa explained DET's initiation of new projects into schools as a disempowering process. She experienced this to be the situation with DET's bringing ICT into schools. In the first interview with Vanessa, the first question asked of her was 'What are some important things happening in the schools with ICT?' Her reply was:

> You know the department (DET) sends along a couple of computers per classroom and says we've done our bit. And that's where it stands and it's left to schools to network and pay for extras, to buy software they want and to do the training and development …, Robert [the principal] has a vision with technology, so I'm comfortable with that. (Vanessa, 2001, interview data)

In the mid stage of the study, about 18 months later, in the first question in the interview she was asked about highlights and issues since last the interview.

> The lows and frustrations are basically hardware. I think it's always going to be an issue. And I really don't know how it's going to be addressed without funding. We're not technology trained, so when things go wrong we don't have people here who can fix them. So that's always going to be an issue that needs to be addressed over time. Not at a school level, I don't think it's the school's responsibility. If the department wants to bring in computers then, you know, they're so used to just throwing things at us and it's another thing we have to learn and budget for.' (Vanessa, 2003, interview data)

Vanessa's explanation indicates that the new policy for using ICT in teaching was experienced by her as stressful, as she felt she had little agency in the process (Stronach, et al., 2002). The other participants similarly made reference to having little say in new initiatives. Interestingly, school principals take a leadership role in localising DET policy, and the principals of the participant schools all did this in regard to DET's policies for developing ICT as part of teaching and learning in schools. Participants however did not indicate similar negative feelings about their principal or school executive. For example, both Vanessa and Beth consistently referred to DET imposing ICT on them, yet both communicated appreciatively the ways their principal supported using ICT in their teaching. What these findings indicate is the influence of the uneven communication between what the participants explained as the stratified levels of the school hierarchy on their practice. Where there was recognition and communication, for example between participants and principals, bringing in new initiatives did not hold the same level of stress for them as when there was little communication between the levels, for example between teachers and DET. Furthermore, the participants referred to a history of lack of communication by DET, which influenced them to generalise DET negatively as an authoritative body (Bruner, 1990).

Interestingly, the changes that developed in the participants' ICT mediated practice during the study primarily stemmed from the actions they initiated rather than changes initiated for them. Strategies by DET to initiate change—for example, the introduction of the computer skills assessment to test students' ICT skills, and systemic professional development, were only of marginal importance to changes that developed in the participants' ICT mediated practice.

Participants referred to creating a space for regaining some control of their practice. Vanessa drew on her prior experiences with DET to help her interpret what to do (Ottensen, 2006a). It influenced her negotiating a compromise of the best way to approach the situation (Polkinghorne, 1997). For example, midway in the study, Vanessa described her ICT mediated practice as only superficially addressing initiatives for teaching with ICT. She stated that at times, she addressed them in ways that looked like she was doing what she was supposed to do.

When observed in her teaching, Vanessa used ICT as an add-on to her teaching. The lesson observed was a research lesson about rainforests. Students were researching with books, and when they finished they played a game about rainforests on the computer. They could also do more searching about rainforests on internet sites but she didn't give any guidance for this, it was just something extra they could do if they wanted to.

On the surface, Vanessa's tokenistic use of ICT might look like she simply does not want to change her ICT mediated practice. Rather, for Vanessa, past experiences of DET bringing in other such initiatives were evoked at this time. She used her interpretations of these past events to legitimise and retain her belief that she was once again experienced this process to be a disempowering element. Kemmis (2005) theorises practitioners as 'searching for saliences'. They set out a course of action for their practices reached on: a) the basis of their diagnosis of the subjective and objective conditions in which they are working and b) their understandings of the relationship between these subjective and objective conditions. Vanessa was experiencing a situation in which she identified conflicting values and self-interest by DET and her decision to only superficially use ICT reflects her negotiation of this conflict and her compromise (Carr, 2009; Polkinghorne, 1997).

A critical moment that manifested for Vanessa was her new principal's vision for ICT, which included the provision of resources and support to assist the development of TICT mediated practice of his teaching staff. This critical moment was personally inspirational for Vanessa. She happily perceived her principal as acknowledging the complexity of implementing new policy and her perception of the need to support teachers in this. This was in direct contrast to the lack of support she had experienced with DET, discussed earlier. This critical moment began a process of pedagogical change for Vanessa. She sought new information by using her home resources to develop her ICT expertise. Vanessa also brought new ICT related strategies and content into her teaching. Additionally, it initiated organisational change in which Vanessa's 'teaching team' became important to her continuing learning and pedagogical development. An account of Vanessa's engagement with this critical moment follows. Vanessa's account also includes a comparison with the way Beth, who taught at the same school, experienced this same change in a very different way. It was not a critical moment for Beth.

Vanessa's critical moment: New principal's vision for ICT

Robert, Vanessa and Beth's new principal was appointed to the school eight weeks before this study began. Approximately six months later he began initiating changes that aimed at shifting what he perceived to be traditional teaching, which dominated the school, to what he described as more 'constructivist', 'student-centred' practice. Robert stated that his vision was to use ICT as the vehicle for supporting this shift in practice. In the early stage of the study Robert initiated a series of changes to increase teachers' access to ICT resources, to improve their skills in using these resources and to provide continuous support they could access outside these sessions. As part of this, in the mid stage of the study, Robert established three teaching teams, which centred on teachers teaching the same stage, planning the use of ICT in their teaching together. Robert appointed Vanessa as leader of her teaching team.

The support and resources Robert implemented were particularly significant for Vanessa in terms of her understandings of her status in the school hierarchy. First, Vanessa was an Assistant Principal, and referred to the importance of this role for her on numerous occasions. She perceived her role as team leader as an extension of her role as Assistant Principal.

Additionally, Vanessa felt supported in her ICT mediated practice by Robert. She compared this to the perceived lack of support from DET. Vanessa also respected the success he had with developing his previous staff's ICT mediated practice. Robert was highly recognised within the school community for his success in integrating ICT into his previous school. That school had been awarded with the title Apple Distinguished School by Apple Computers.

This critical moment was experienced by Vanessa as personally stressful, as well as inspirational. She perceived that her appointment as team leader expected her to value ICT, to be a capable user of ICT, to motivate other teachers in her team to want to use ICT and to support them to develop expertise in using it in their teaching. As stated earlier, up until this point Vanessa's use of ICT may be described as superficial. This critical moment related to Vanessa acting in what she perceived to be a professional manner (Green, 2009). She appreciated Robert's professionalism in supporting teachers and with her role as Assistant Principal considered that 'changing' was the most appropriate action.

This critical moment contributed to Vanessa making organisational change to facilitate her learning. She primarily used her home ICT resources and network to develop her ICT expertise. Additionally, Vanessa made organisational changes to facilitate pedagogical change in her ICT mediated practice. She planned a regular use of ICT in which she combined the computer lab computers with her own class computers and the pod of laptops available for use to team teach with two other classes. This was a unique use of ICT in her school. Vanessa explained this supported her combining team teaching (which she was an advocate for) and using ICT. She also developed new content and teaching strategies for using ICT in her teaching.

Vanessa's leadership of her teaching team demonstrated and contributed to further organisational and pedagogical change associated with her ICT mediated practice. Vanessa explained she promoted team meetings as a time and space for sharing ideas, resources, and working collaboratively to plan for teaching with ICT. She referred to pooling the strengths of team members to plan collaboratively and support each other's teaching with ICT. Vanessa spoke very positively of how useful the teaching team was for her own ICT mediated practice. A significant cognitive change for Vanessa was the value she increasingly attributed to the educational use of ICT.

Interestingly, Beth felt let down by her teaching team. She stated that her team struggled to commit to meeting times. She had also found the teaching ideas the team members brought to the meeting were ideas she was already familiar with, and so it was unhelpful to her. After experiencing teaching teams, she concluded she would rather do her planning independently.

The different responses of Beth and Vanessa to teaching teams can be explained in terms of the compatibility of this initiative with their own learning styles and thus their core approach to teaching. Beth's core approach to teaching focused on independent learning and she also described this as her own learning style. Teaching teams do not reflect this: therefore, it wasn't a meaningful learning space for Beth as there was not a shared understanding of the process of learning in that space (Wertsch, 2000). This incompatibility did not contribute to change for Beth but rather to a sense of feeling marginalised and disadvantaged.

ICT was perceived by participants, to influence who and what was valued within the school hierarchy. A consequence of this is, is that it was experienced as a pressure for some participants in terms of their professional identity within the school hierarchy. What stood out for them was the changing status of others who had ICT expertise within the school (this included other teachers, and students), and the way this influenced their own rank in the system as well as their respect and legitimacy as teachers.

Participants stated that experienced teachers with ICT expertise were privileged in the school hierarchy in terms of promotion positions and access to ICT. They identified the status of individuals with ICT expertise to be enhanced within the school hierarchy. In the mid stage of the study, Beth and Fran referred to the new promotion positions that had been developed in their schools around ICT. This was explained by Beth in terms of the privileged positions that teachers with expertise in ICT were given in her primary school. This, she continued, was at the expense of teachers such as her, without ICT expertise, who were expected to take on extra/different duties to compensate for these roles. Similarly, Fran, a secondary school English teacher, perceived that staff with ICT expertise, who weren't teachers, moved up in the school hierarchy over teachers without ICT expertise. Beth and Fran described feeling a loss of status within the school as they didn't have the expertise with ICT that was now valued within this system.

In some circumstances, participants perceived access to ICT as a privileged position in the school hierarchy. Fran referred to this in terms of opportunities to use the computer lab in teaching. She stated that some classes had priority over others. Interestingly, these classes she referred to were subjects which focused on teaching computers, such as IPT. However, Fran referred to this as a privilege that she did not have access to. Philip made similar evaluations. As an IPT teacher he acknowledged that his classes were always timetabled in the computer lab, and that this didn't leave much opportunity for other classes to use the labs. The research participants who were primary school teachers referred to quantity of ICT resources and ease of access in a similar way. In the early stage of the study, both primary schools participating in the study stored ICT resources in the Year 6 classrooms. A consequence of this is that it communicated the message that ICT is necessary for students learning in Year 6 classes, but not for other year levels. It also communicated to teachers that knowledge of ICT is needed by Year 6 but not necessary for younger year levels (Orlando, 2007).

All participants perceived their students' increasing ICT expertise as a substantial change to the school hierarchy. Of significance to them was that students were developing much of their ICT knowledge independent of school. The students relied heavily on personal networks to guide them in their use of ICT and consequently were developing different types of ICT knowledge from each other which were idiosyncratic to their interests and home environment.

Students' increasing ICT expertise emerged as an important new situation for all participants. One reason for its importance was associated with the value of the knowledge they were developing. All participants observed that their students were developing knowledge highly valued by society, yet learning it without the support of teachers. The participants' reflections on this indicated this challenged their perceptions of the syllabus and contributed to them identifying gaps in ways the syllabus incorporated ICT knowledge into student learning.

The findings indicate that students' increasing ICT expertise challenged the participants' identity within this changed hierarchical structure. All participants experienced at some stage in the study that many of their students had more ICT knowledge than they did; even those participants who were computer studies teachers, such as Philip and Lisa. Participants referred to feeling inadequate in teaching with ICT, as they didn't have the level of ICT expertise necessary to support their students' use of it in their learning.

The perception of students' increased knowledge of ICT extended to a sense of inadequacy as a professional teacher. An understanding held by most participants was that what differentiated students and teachers was that teachers had a greater body of knowledge than students. Students having more knowledge than they did, challenged their conceptualisation of school hierarchy.

For Beth, a new class questioning her lack of ICT use in her teaching, was a critical moment. Beth found this to be personally stressful, as she perceived it challenged her identity as leader of her class. This critical moment began a process of cognitive change for Beth. She sought new information and initiated her own learning, relying on her home computer. This also involved organisational change, where Beth identified staff members who could be key informants to support her learning, and collaborated with them to assist her in her learning. This critical moment also resulted in pedagogical change. Beth brought new content and resources into her teaching. An account of her engagement with this critical moment follows.

Beth's critical moment: Pressure from a new class to use ICT in their learning

Midway in the study, Beth described her new class as avid ICT users. Many of them initiated completing their homework and class projects using their home computer. She stated that they were also consistently learning new ICT skills with the school computer coordinator during library lesson. This class was enthusiastic about ICT and put pressure on Beth to include it as part of their learning in class. In retrospect, later in the study, Beth spoke proudly of this class, describing them as particularly talented with ICT, more so than any class she had experienced.

Beth experienced this situation to be personally stressful because she experienced the class's demands to use ICT as an inadequacy in her day-to-day practice. She perceived that her lack of ICT knowledge was very visible with this class. Importantly, she found her confidence as a leader in the classroom faltering because she was aware the students had greater knowledge than she did.

The significance of her class's ICT expertise and demands was exacerbated for Beth by the ICT-related culture that was developing in the school. One change, Beth explained, was the privileged position that she perceived teachers with ICT expertise were given, at the expense of teachers without ICT expertise, such as herself, who were expected to take on extra/different duties to compensate for these roles. Beth also stated that the ICT-related changes in her school fostered a lot of professional talk about ICT. She found that her lack of ICT knowledge contributed to her withdrawing from such discussions.

Beth perceived that the ICT-related culture her principal, Robert was fostering challenged her professional identity. She explained it made visible to the other staff and her principal, her lack of ICT knowledge. Beth felt her lack of knowledge contributed to staff having a lesser opinion of her expertise as a teacher, particularly as she was new to the school and had not established a reputation as an experienced, accomplished teacher. Her reflections on this indicated that this was a disempowering element for her and contributed to her feeling marginalised and suffering a loss of status within the hierarchy of her school.

Students' ICT expertise, together with a developing ICT culture within the school, placed pressure on Beth to be a different type of teacher (Renshaw, 1998), one who is informed about ICT and uses it skilfully in their teaching. Beth felt she didn't have the knowledge to do this, and this challenged her identity as an experienced, accomplished teacher who could lead learning and teaching in the school.

Beth's reflection on this situation contributed to her making organisational change to develop her ICT mediated practice. Her decision to do this can be understood as her acceptance of and support for her students' enthusiasm for including ICT in their learning at school (Robertson, p. 407) and as addressing her desire for a greater sense of belonging in her new school (Lave, 1996; Renshaw, 1998). Beth combined resources from her personal and professional content to facilitate her learning. She explained that she learnt most of her ICT skills at home. However, the changes her principal had made in her school content supported her learning at home.

Beth stated that she consistently drew on the expertise of teachers at her school to support her home computing and ideas for ICT mediated practice. She explained, 'I volunteer to do things at home … if I have a problem, I come in and I'll talk to people [staff[here that are familiar with it' (2002, interview data). Beth also engaged in the professional development that was being offered in the school. She stated that she tried to quickly put into practice what she learnt, and ensured she acted on it quickly. She explained, 'I didn't want to waste the course seeing as I did it' (2003, interview data). She found the organisation developed in the school, of teaching particular ICT programs to staff and students, supportive. 'We've had an inservice on KidPix … it's also helpful that the children are learning it in the library [with the computer co-ordinator]. So I'm actually not teaching the program. I know they are familiar with it.' Someone else teaching the students how to use ICT program in the library alleviated Beth's lack of confidence in teaching the program herself to her students. It suggests that this organisation gave her a sense of security because using ICT didn't rely entirely on her expertise to teach the students.

Beth also made pedagogical changes in her ICT MP, introducing new content, outside the syllabus, which she considered to be important uses of ICT that her students should learn. This change was facilitated by the cognitive changes: by the final stage of the study, Beth demonstrated well-developed ICT expertise and an enthusiasm personally and professionally.

ICT and the professional knowledge of teachers was also a significant issue for Philip. The year prior to this study Philip had retrained as a computing teacher and a Design and Technology teacher. He explained he did this to ensure he was valuable as a teacher in contemporary society. Previously an art teacher, he stated:

> I didn't want to be a dinosaur, it was all happening around me and I wasn't sort of keeping pace and I thought the best way to redo it is throw yourself in it. (Philip, 2001, interview data)

The ICT-related changes the participants identified in the school hierarchy foreground the important place of ICT knowledge within this hierarchy, and how it influenced the TICT mediated practice of the participants. The participants observed that as ICT became more valued by principals and DET, changes initiated in the school centred around its increased value, such as new promotion positions within the school related to ICT, as noted earlier. Additionally, the students identified ICT as important knowledge, developed it mainly independently of the school, and brought it into their school learning. The changes the participants identified in the school hierarchy indicated that ICT knowledge was valued by DET, principals, students and teachers as characterising the profession of teachers. They interpreted that their traditional 'teacher' knowledge was not enough anymore and, given that society values ICT to the extent it does, the participants identified this as a valid argument. As Fran stated at each interview conducted as part of the *e.ffects* study and this study, 'Teachers can't keep not knowing about ICT.' Interestingly, the critical moments that manifested for the participants all centred around 'not enough knowledge'. For them it was a combination of identifying they didn't have enough ICT knowledge and being in a situation that restricted developing the knowledge of their students.

The changing state of their school hierarchy and their position within this was significant to the participants over the course of the study. Observations and interviews indicated that regaining and/or enhancing their position within this hierarchy was a significant aspect of the participants' experiences with ICT over the five years of the study (Lave, 1996). Beth's quote is representative of the ways they used knowledge of ICT to advance their status (Vygotsky, 1981). Midway in the study, Beth stated:

> Teachers need to take control of their own learning. … no one wants to look like a dummy. We don't want to look stupid in front of other teachers. (Beth, 2002, interview data)

Four of the five participants experienced ICT as contributing factor to the school hierarchy to be, in the end, an empowering element. As is discussed in more detail later in this chapter, this came from the compromise they made within the hierarchy, rather than from the structures of the hierarchy.

In addition to the syllabus and their status within the school hierarchy, non-school uses of ICT were also an aspect of their context important to the TICT mediated practice of the participants. Non-school uses of ICT are the various material and social structures and processes that have been developed for use of ICT across a broad range of social settings. These include the processes in place for communicating, conducting business transactions and consumer needs such as buying tickets online. Non-school uses of ICT, importantly, communicated to participants, society's reliance on and embracing of ICT as valuable knowledge. While they referred to this aspect of their context less often, and in less explicit ways than they did the syllabus and their status within the school hierarchy, the participants increasingly identified non-school uses of ICT as an important source of information (standards). They used uses of ICT outside school to identify limitations in their own ICT mediated practice and in the ICT knowledge of their students, and non-school uses of ICT became for some participants, vitally important resources to develop their practice.

During the study, participants brought non-school uses of ICT into their teaching as reference points to identify gaps and inconsistencies in their ICT mediated practice. As the following quotes indicate, they identified these in terms of access to ICT and in terms of the aim of school learning.

> I know it's important for children to learn how to use computers … I only have one working computer in my class and no internet access. (Beth, 2001, interview data)

> The Information Technology industry expects particular skills and understandings. The syllabus outcomes don't reflect what the IT industry wants, it's outdated. (Philip, 2005, interview data)

Non-school uses of ICT contributed to the ways the participants conceptualised valuable learning and teaching. While the syllabus remained central to their teaching, they identified non-school uses of ICT also as an important factor to consider in what they should teach and how they should teach it.

Non-school uses of ICT also became valued resources for participants, who used them to fill in the gaps they identified in their ICT mediated practice. Some participants drew students' use of ICT outside school, into school learning to facilitate this. This was not evident in their practices early in the study. Vanessa, Beth and Philip developed projects and homework which necessitated students using their home-based ICT to complete. Students experienced their teachers to be more open to ways that students presented their work, expecting and encouraging them to use a range of computer programs and expertise to research and present their work in ways appropriate to the content requirements of the task. Fran stated that her reliance on students' home computers was a compromise measure in the face of pressures on her to teach with ICT in a situation that she identified as having significant limitations. Her reliance on students' home computing, she explained, compensated for her minimal access to school computer labs, as well as her minimal ICT knowledge.

For Philip, students' uses of ICT outside schools became an essential aspect of the ways his practice developed over the study. A simple example of this was in the final year of the study. At this time, flashdrives were becoming more widely used for saving content. Philip increasingly found that students were carrying flashdrives with them from class to class, to save their work. There had been a long standing problem with students logging onto the school server from home, and students had drawn on the use of flashdrives as a way of solving their access problem to their school work. Philip built on his students' introduction of flashdrives into his teaching by including them as a necessary resource for his subject. He then developed his teaching in ways which allowed and expected students to continue class work at home. Philip explained, 'This impacted on my teaching by default'. The distinction he was making in this comment is that that he did not initiate the change; rather, he built on the students' initiative for change. What this example shows is that Philip was drawing on his students' knowledge to craft his practice mediated by ICT and his identity as a teacher (Wells, 2007). Building on students' flashdrive use was not a critical moment for Philip; however, this situation contributed to his critical moment.

Students completing syllabus work well before the end of term, for a number of terms, was however a critical moment for Philip. Interestingly, this is a counter narrative to Beth, Fran and Vanessa who as stated earlier, found there was an unreasonably large amount of syllabus content to cover with their students. A distinct difference with the syllabus Philip used, was that his centred on ICT content, not on disciplinary content. This critical moment was personally stressful for Philip, as he perceived he was not adequately preparing his students for a career in the IT industry. This contributed to organisational change in which Philip drew on a unique combination of resources to inform his teaching. This also contributed to pedagogical change, with the introduction of new content and teaching strategies into his teaching. An account of Philip's engagement with this critical moment follows.

Philip's critical moment: Students' finishing syllabus content before end of term

In the final stage of the study, Philip experienced his students to be getting through the syllabus content, often three-four weeks before the end of term. He attributed this to the students' rapidly increasing ICT skills. Philip had also moved to a new school in the final stage of the study, and described his new school as having an emphasis on students taking responsibility for their own learning. As the following quote implies he perceived this also contributed to students moving through syllabus content more quickly.

I have probably gone a little more quickly through some of the content (syllabus) than maybe I would have done in my previous school. … I don't know if this has to do with geographical difference or even the fact that we are moving on in time that students can pick up things quicker nowadays than they used to. (Philip, 2005, interview data).

Philip experienced students working through the syllabus quickly as hindering his priority, to prepare his students to work in the IT industry. He identified the syllabus as not keeping up to date with the changes he was observing in the IT industry, therefore disadvantaging his students' career prospects and compromising his teaching. Philip was of the opinion that the rapidly innovative state of ICT and the IT industry did not fit with the lengthy process of developing a syllabus. He experienced that by the time a new syllabus got into schools, it was out of date, or quickly became out of date. He described this as the limitations of paper-based syllabuses for computer studies subjects, in particular that the time usually attributed to developing a new syllabus, often between five and 10 years, is too slow in a field such as ICT, which is highly innovative. Philip understood his role as a computer studies teacher was to prepare his students to work in the IT industry. Increasingly over the course of the study he experienced this aspect of the syllabus as frustrating for both himself and his students. It inspired a lack of trust in the syllabus as a suitable guide for teaching computer-focused subjects. Philip experienced an ethic-moral conflict between what the syllabus stated students in this subject should learn, and what he considered they should learn (Wells, 2007; Green, 2009).

To address this critical moment Philip made organisational changes by drawing on a different range of resources than he previously did in his ICT mediated practice. Philip increasingly drew on the IT industry's uses of ICT to supplement the syllabus content he taught. He was observed to plan more of his teaching and assessment around industry websites and publications so as to make a meaningful link between industry knowledge and issues and student learning. This contributed to pedagogical changes in his ICT mediated practice.

By the final stage Philip had developed 'additional' teaching units for these units, which centred around his experiences with current IT industry practices. He stated that while his experiences were from an outsider's perspective he enthusiastically followed changes in the industry. Philip explained that these units supplemented the syllabus content. He explained that teaching the syllabus was his priority: however, as students now generally finished the syllabus content well ahead of the end of term, developing additional units of work was a way to keep school learning relevant for them.

In the final stage of the study, for the first time in his teaching career, Philip developed a unit of work which relied on one student's expertise. As the following quote indicates there were numerous learning and student motivational reasons Philip developed this unit of work.

> One of the boys, who the other students find a bit of a role model in that regard created a good animation and the other students responded to it. So seeing their response and seeing it is two weeks until the end of term and that we want to keep them doing something productive then we used that idea … In the graphics aspect of this unit his (the student's) understanding of the particular software that we are using was superior to the others insofar as he could finish early and had some time to work with the other applications and to his credit he did this rather than be distracted.
> (Philip, 2005, interview data)

Philip's was interested in keeping his students motivated and providing good role models for students. This student represented someone who had agency in their learning, was motivated and had expertise in a valued program. Philip explained this as a useful resource for his ICT mediated practice.

Philip's decision to draw on a student's expertise facilitated further organisational change for other teachers in his faculty.

> The other Year 10 teachers from the other two Year 10 classes were thinking about where to take the 'Flash' tutorials to. I mentioned to them that I had a student who created this animation and that it was probably a good direction to go in. You know it generated interest amongst the students, it also fulfilled the criteria we're working on, and so then we moved into that direction and they have been happy to follow. (Philip, 2005, interview data)

Interestingly, Philip reflected on his ICT mediated practice in previous years by explaining how he understood his knowledge of ICT to influence the changes he made in his ICT mediated practice. As the following quote indicates, when he had lacked ICT expertise and confidence in his ICT, he had made pedagogical changes in his ICT in ways that served to contain student learning.

When I changed to a computer teacher I would limit the knowledge or understanding allowed in the classroom to maintain control of the situation … I am now comfortable enough with my own knowledge not to be threatened by other students' knowledge—I can now build on their knowledge … I am now confident enough with ICT to start looking to the outside world of ICT and bring in this knowledge into the classroom … In a sense it's still threatening if I let it be, because there are some very, very capable confident computer users and technology users everywhere at that age. You know they are better than anyone … I suppose my identity as a teacher is not as the fountain of knowledge, so it's not based on that so I am not under threat … I don't see myself as the computer teacher I just see myself as you know someone trying to learn something the same as we all are, then the threat is not there. (Philip, 2005, interview data)

Participants also brought their own non-school uses of ICT into their ICT mediated practice. The ICT knowledge Beth developed over the course of the study contributed to her identifying a gap between the ICT skills she considered her students to need and the ICT skills acknowledged in the syllabi she worked with. To address this, Beth added content to her teaching based on her avid personal use of her home computer. She perceived that if the ICT skills she developed in her personal use were useful for her, then they would also be for other users of ICT, such as her students. She stated that it was her use of the site EBay that developed most of her skills, and which contributed to her confidence as a computer user. From her non-school experiences with ICT Beth was also learning about learning with ICT. In a final observation of Beth she explained during the lesson that the process she took her class through for learning how to insert an image into a Word document, was how she had learnt to do it herself, using her home computer. Beth stated in a later interview that her own learning with ICT was the basis of the majority of her ICT mediated practice.

In summary, the participants identified the syllabus, the school hierarchy and non-school uses of ICT as important to their ICT mediated practice. The information they drew from these contexts was associated with the roles and expectations of teachers and of what valuable teaching and learning is. Importantly, the two bodies of information they drew on, the teaching profession and non-school uses of ICT, were often used by participants as two opposing bodies of information. Over the course of this study, information about their teaching profession was prioritised by the participants to conceptualise what 'valuable' learning is and how this related to their ICT mediated practice. Over time, some participants identified limitations in sources drawn from the teaching profession, specifically the syllabus, and began to draw more on non-school uses of ICT to supplement the limitations they identified. They identified affordances in information drawn from non-school uses of ICT for their ICT mediated practice.

4.2.2 Key individual resources

As stated in Section 4.1, individual resources are psychologically-based, and in terms of this study, broadly centre on the participants' individual interpretations of core approaches to teaching and learning, as well as their individual ability to and motivation for developing themselves within their practice. Research Question 2 asks how teachers think about and understand their ICT mediated practice. The findings of this study indicate that these two broad individual factors were important to the different positions the participants demonstrated in their understanding of their practice, and the decisions they made regarding it. Identifying these individual factors as key resources, assists in clarifying the passions, goals and knowledge embedded in their ICT mediated practice (Connelly & Clandinin, 1999), and the individuality of this practice and the ways it changes.

As described in Chapter 3, core approaches to teaching are defined in this study as the ways that participants understand how students learn, and the types of teaching that support this. This includes the types of teaching strategies, classroom management strategies, relationships with students and classroom environment that they foster as teachers. Summaries of each participant's core approaches to teaching are included in Chapter 3. As indicated in the summaries, each participant's core approach to teaching was unique.

Two aspects of their core approaches were important to the participants' ICT mediated practice. These included the level of control they identified as important for classroom management in their ICT mediated practice. Also important to their core approach to teaching was the stage of life for which they were preparing their students. For example, were they preparing their students for the end of the year, secondary school or their working career? The participants' interpretations of these concepts influenced the information they drew on to develop their ICT mediated practice and the resources they used to gain this information. Additionally, their interpretations of these concepts were consistent over the course of the study. Consequently, they continued drawing on similar information as a resource over the course of the study, when engaging with changes in their context. This influenced the knowledge and actions they incorporated into their ICT mediated practice over time. This can explain why dramatic transformations were not observed in the TICT mediated practice of the participants. Rather, minor changes and evolving changes or refinements were observed in this practice.

Interestingly, ‘core approaches to teaching’ often refers to aspects of teaching such as teacher-student relationships, classroom environments, student motivation, classroom management, and teacher or student-centred practice (Killen, 2009; Whitton, Barker, Nosworthy, Sinclair, & Nanlohy, 2010). As stated in Chapter 2, the literature on teaching with ICT has particularly associated constructivist practices—for example, teacher-student collaboration and co-construction of knowledge—as core approaches to teaching with ICT (Hennesy, et al., 2007).

Numerous aspects of core approaches to teaching were referred to by the participants during the study: however, ‘future’ and ‘level of control’ were their dominant points of reference. ‘Control’ refers to the level of teacher direction and management of student learning that the participants identified as important to their ICT mediated practice. Observations and interviews indicated that participants had differing interpretations about the level of control needed in teaching. For example, observations of Philip demonstrated that he encouraged his students to decide what they needed to learn. His students did not have to take part in classroom discussion if they considered that they knew the content of the discussion. They had the opportunity of continuing their work instead. Conversely, Lisa considered that students could not learn properly without a teacher; that they needed explicit direction if they were to learn properly. Each participant expressed a different interpretation of level of control. This is of significance, as it contributes to understanding the teaching strategies that participants incorporated into their teaching, the relationships they developed with students and the type of classroom environment they would strive for in their classroom. In terms of understanding their experiences over time, this gives an indication of what guided their experiences.

It is unclear whether the participants’ interpretations of appropriate level of control were school-based or overall ideologies. However, some insight may be given by Philip, the only participant to change schools over the course of the study. Observations and interviews indicate that his school in the final stage of the study was much less demanding in terms of troublesome behaviour and the scaffolding needed to support students’ learning, than his previous school. Philip’s interpretation remained consistent over the course of the teaching in both schools.

It was also evident during the study that the participants were preparing their students for different stages of life. Observations and interviews indicated that each participant focused their teaching to prepare their students for a particular point in time. Lisa's perceptions of the local secondary school contributed to her preparing students for high school. She believed that in secondary school, they would not receive any help from teachers in learning to use ICT. Philip prepared his students to work in the IT industry. He perceived this subject as training for a future career. He explained anecdotally that, in discussion with his students, many confirmed they planned to work in the IT industry. Vanessa stated on many occasions she was 'Preparing her students for life'. She explained she therefore focused on collaboration and peer learning as the lifelong skills important for every stage of life.

Similarly, the participants' understanding of appropriate level of control and the stage of life they were preparing their students for, remained consistent throughout the study. For example, in 2001, Lisa stated 'Children need repetitious practice, just drill it and drill it'. Similarly in 2003, she argued, 'Teaching needs to be thoroughly planned for' (Lisa, 2003, interview data). Similarly in 2005, 'I can only teach well if I am in control of the learning environment. Each lesson begins and ends with a set routine to focus on practising and remembering' (Lisa, 2005, interview data). All participants' data indicated similar consistency in their interpretations of level of control. Similarly, they remained consistent in the stage of life they were preparing their students for.

Their consistency in their interpretations of appropriate level of control and the stage of life they were preparing their students for, influenced the resources and information the participants drew on in their ICT mediated practice during the five years of the study. For example, Lisa consistently taught ICT programs and content that she perceived to be relevant to learning at the local secondary school. Her intention was to help her students to be ready for this future. In the early stage of the study she was teaching her students how to use spreadsheets, because she thought this would be useful for students when they worked on projects in high schools. Similarly, in the final stage of the study she taught students how to use the program *Publisher* because they could use this to present their projects in high school. In line with her interpretations of control, each lesson was characterised by step by step, explicit instruction. Lisa explained that she had heard anecdotally that students from her school entering the local secondary school were perceived by staff at that school as having good ICT skills. She interpreted this as her success, and the value of her approach to teaching.

The participants' core approaches to teaching were sustained over the course of the study and were reflected in the changes that developed in their ICT mediated practice. The changes that developed in their practice can be described as refinements to their core approach to teaching. ICT mediated practice was used by the participants to add value to their practice. Dramatic transformations in TICT mediated practice were not evident in the data of any participant. This can be illustrated in the example of Vanessa. Vanessa had been a Stage 3 teacher for the five years of the study. All of the lessons observed of Vanessa were of her using ICT to teach her students about the theme 'Rainforests'. Coincidentally, this may be related to the observations of Vanessa having taken place at similar times of the year. Below I present some notes drawn from two classroom observations of Vanessa's teaching: one in the early stage of the study and the other in the final stage. Comparison of these two lessons highlights some of the ways that Vanessa's teaching changed in ways consistent with her core approach to teaching.

In 2001 field notes were taken during an observation of Vanessa's teaching. The lesson began with students working on a photocopy of a question sheet on which the teacher had handwritten10 questions about 'Rainforests'. Some questions included: What is a rainforest? Who and what lives in a rainforest? Why is deforestation happening now? The students' task was to work on researching and answering the questions over a series of lessons. Students also had the opportunity to negotiate with the teacher some other questions they would like to find out about.

There was a box of library books the teacher had collected at the front of the classroom. Students worked in pairs, to select from these books and research the questions.

Students who had finished answering their 10 questions were able to research 'Rainforests' further using the two classroom computers. One pair of students working on the computer used a CD ROM game about 'Rainforests'. The CD Rom has games, quizzes and information to read about rainforests. Students decide for themselves how they progress through the software. A second pair of students were using the internet to find out more about 'rainforests'. They used Google to identify useful sites and write notes about rainforests. Students did not have questions to drive their research, and wrote random notes about 'rainforests'. They were permitted 15 minutes to work on the computer, after which time other students then used the computer. The teacher worked with students using books for research. Students using computers were expected to work independently or to ask other students for help. Completed questions were handed to the teacher to mark.

In 2005 Vanessa was observed teaching a lesson with a similar focus to the one observed in 2001. The 2005 lesson was team-taught with another Stage 3 teacher. Students had each been given an integrated contract book. The theme of the book was 'Rainforests', and students worked on the integrated unit over a five to six week period. The book included a detailed range of tasks drawn from different aspects of the curriculum. The majority of tasks were ICT related and required students to choose an ICT program appropriate for researching and representing the answer. Questions included, 'Research an area of concern you have in relation to the rainforest and prepare an email to send to either a government agency or a logging company. In your email outline the facts you know about this problem, expressing your concern and suggesting action that could be taken' and, 'Design and make a rainforest diorama and then use the diorama to make a digital *Claymation* (animated film) to represent the deforestation of the rainforest. Students selected five of the tasks to work on over the term. Students chose to work individually, in pairs or in small groups, to complete the tasks. Each task had a criterion that guided the process of working through the task and with each other. Each task also included a self-assessment section for students to guide what was expected of the task and how well they achieved in it. Students could approach their teacher at her desk if they needed assistance.

Vanessa's core approach to teaching is evident in both these lessons. The lessons were guided by syllabus outcomes. The theme 'Rainforests' addresses syllabus outcomes for the subject Human Society and Its Environment (HSIE). Teaching centred around students working through a set of questions and activities to be addressed over a series of lessons. Students had opportunities to work with each other in both lessons. Also, both lessons did not include explicit instruction, explanations or support. The lesson atmosphere of both lessons was informal, and students asked for help when they needed it. Elements characteristic of Vanessa's core approach to teaching were demonstrated in all her lessons.

Comparison of these two lessons indicates some of the refinements Vanessa made around her ICT mediated practice in this curriculum focus. For example, change was evident in the types of questions asked of students to research and answer when using the computer. The questions about 'Rainforest' in the final stage required higher levels of analysis, synthesis and evaluation of ideas. In the early stage of the study they aimed to identify facts. In the lesson observed in 2005, Lisa's questions also aimed to stimulate creative and critical thinking and the bringing together of different ideas.

Additionally, change was evident in the ways students were able to use the computer to research those questions. There was increased freedom and more options, as well as the expectation that they would work independently and collaboratively with peers to research those questions in appropriate ways. Students could select the ICT program to use, or books or other resources that best supported their research. Rather than being allocated time on the computer when book research was finished, there was a flow of movement, initiated by individuals and groups of students, around the computers and books and other resources.

There was also change in the ways those answers could be represented using the computer. In the earlier lesson, students were expected to write the answers they had developed from their research into their workbook and submit the book to the teacher. In the 2005 lesson there were expectations of and support for, representing ideas in creative ways using a range of ICT programs and uses of those programs.

Additionally, there was change in the assessment procedures that Vanessa included in the lesson. There was a little evidence of assessment strategies used by teachers in their ICT mediated pratice during the study. In the final stage of the study some participants were beginning to think about assessment in a more considered way: its purpose, need and ways of undertaking it, and were just beginning to include this in their teaching. Vanessa however was the only participant in the study who purposefully developed assessment strategies for her class in her teaching mediated by ICT. Vanessa developed criteria for each task that required students to self-assess the standard of work achieved in their *Rainforests* theme book. The self-assessment was based on the *NSW Quality Teaching* criteria and took into consideration, assessing both the process of working and the product.

The differences between these lessons can be categorised as Vanessa using a wider range of ICT resources and incorporating more complex thinking on the part of the students. Still evident was the focus of the syllabus, focus on co-operative learning and developing students' ICT knowledge and skills. Throughout the study, Vanessa continually advocated the need for a balance of teaching and preparing students for life. These were skills she considered addressed this balance.

Associations can be made between the changes that developed in Vanessa's ICT mediated practice and her critical moment. Vanessa's critical moment, as explained earlier, centred on her new principal's vision for teaching with ICT. The new resources she brought into her practice by 2005 were those her principal had organised intensive teaching staff professional development around. For example, *Claymation* was one of those resources. Her teaching with another Stage 3 teaching was associated with the teaching teams her principal had initiated in the school. Also, as stated, Vanessa's principal had prioritised constructivist-style teaching in his vision for the teachers in his school. However, a change in her teaching that was reflective of her principal's vision, was not evident in Vanessa's teaching. This affirms that teachers take from their context what they identify as important to their own individual factors.

The change evident in other participants' ICT mediated practice can be described, like Vanessa's, as refinements to their core approach to teaching. Philip, Lisa and Beth all used ICT to add value to their practice. The consistency of their interpretations of control implies transformation in individual participants' ICT mediated practice would be unlikely. No participant made dramatic transformations. Additionally, the points raised earlier in this section regarding the school hierarchy, also suggest that for any change initiated by DET or the school executive to be successful, would necessitate acknowledging the differing interpretations held by participants about 'control' and the future they were preparing their students for.

An interesting and important finding associated with the participants' intrinsic factors was the connection between the participants' ICT knowledge and their valuing of ICT for learning. It was evident that the participants' increased ICT knowledge, that developed over time, contributed to a greater valuing of ICT, and vice versa. There was no evidence of it leading to a devaluing of the educational use of ICT.

Where this connection began was different for each participant. For some, such as Fran, it can be traced to their critical moment. Changes to Fran's English syllabus prompted her to consider ICT as an important aspect of school learning and for the first time during the period of study she took action to develop her ICT knowledge (see Fran's critical moment). For other participants, positive and new experiences in their personal life contributed to their valuing of the educational use of ICT (Grant & Knowles, 2000). For Vanessa, a significant event was taking her 17 year-old daughter to apply for a driver's learning permit. The point she made about this in an interview was that ICT was becoming part of every facet of our lives, that they were now even used to get a learning permit. This situation was a significant point of reflection for Vanessa on the value of ICT in society and what this meant for her role as teacher. It was not a critical moment for Vanessa, as it did not lead to her taking action to develop her knowledge; however, it contributed to her critical moment being a critical moment.

The participants' increased ICT knowledge of and valuing of ICT contributed to greater confidence in their ICT mediated practice. This facilitated their being more focused in what they wanted to achieve in their ICT mediated practice, and the resources they needed to support this. It is important to note that their focus remained consistent within their core approach to teaching; particularly, as stated, their understandings of control and the future. ICT was brought into given meaning, and reconstructed in terms of their core approaches to teaching (Ottensen, 2006a; Ruthven, 2008). Importantly, the participants perceived that ICT could support their interpretations; that the use of ICT in their teaching was not outside nor in opposition to their core approaches to teaching.

Identifying the ICT-related content they wanted to use in their teaching was evidence of increased confidence in their ICT mediated practice. For example, Beth's increased ICT knowledge contributed to her identifying inadequacies in the ways the syllabus included ICT as part of school learning. In the final stage of the study, she supplemented the syllabus content with her own content, which centred around teaching the students ICT skills.

Their greater confidence extended to the participants' increased discernment of the ICT resources they would use in their teaching. In the final stage of the study, Vanessa and Philip both made the decision not to use an ICT program that their school had newly purchased and which was related to their teaching. Philip perceived the classroom management program his school had purchased took responsibility for their own behaviour away from students, therefore not adding value to his teaching. Similarly, Vanessa decided not to continue trialling a new animation program the school had purchased, evaluating it to be cumbersome, slow to manipulate and adding little to the students' English learning, for which she had been using this program.

The participants' increased ICT confidence also positively influenced how they perceived their professional identity within the school hierarchy. In the final stage of the study, four of the five participants referred to feeling more confident in their ICT MP. Vanessa and Beth no longer considered themselves as lesser in status than other teachers in the school, but rather were empowered by their learning. Vanessa proudly announced in her final interview, 'We can teach well with ICT, because we have evolved.' (Vanessa, 2005, interview data).

Similarly, in a comparison of herself with other teachers in the school Beth expressed pride in herself as a teacher who uses ICT. In response to an interview question on whether she thinks teachers have changed in their teaching with the implementation of ICT in schools, she stated:

> I would say it's definitely fifty, fifty. There are a lot of teachers that have been around for a long time that are fighting it (teaching with ICT) all the way and are happy if someone else in the school will do it like the librarian, therefore they are learning the computer, so I just let them do it so therefore they are not changing their teaching very much. (Beth, 2005, interview data)

This quote illustrates that Beth identified herself as different from these teachers who had not changed their practice. She described herself as confident in her ICT mediated practice and an active and valuable participant in a school community that valued ICT in teaching and learning (Lave, 1996).

Beth's retrospective reflections on her data over the five years, represent the ways that confidence with ICT is associated with greater enthusiasm for using ICT in one's teaching.

> Oh definitely … I wasn't confident teaching computers therefore I avoided it and I suppose I wasn't confident enough to be prepared to sit down and say OK Joey, you know how to do this you teach the rest of the class, I will do that more now because of the fact that I do have some background knowledge that I can monitor what Joey is doing and I can follow it and then show people because I've got enough background … I don't have to pick up too much from what Joey is showing everybody. Whereas back then it would have been gobbledygook you know, for Joey to go through I would have been processing too much, and that is why I got the [home] computer because I'm a hands-on person, once I have done it it is more likely to sink in. … So yeah that is the only way really to become comfortable teaching it in the classroom … the two previous schools I was at, computers were taught in one-hour sessions in a computer lab by a computer teacher during RFF (structured relief from face to face time) so I didn't have to be there, so they were taught it and it had nothing to do with me … if I had put my hand up and said I want one [a computer] in my classroom I would probably have been given one … a school like this they were starting to turn around, to try to get computers in the rooms and their computer room [lab] and I sort of felt I need to know what is happening here, I can't go forward myself unless I get one and actually starting working on it. (Beth, 2005, interview data).

Philip and Vanessa related their increased confidence as the realisation that they did not need to know everything about ICT in order to teach with it. In the final stage of the study they were both of the opinion that ICT knowledge is boundless, and that no one can know everything about it. They both stated (in the final stage of the study) that they felt comfortable now with their level of ICT knowledge and that they knew enough to be able to teach confidently with it.

In the final stage of the study Philip and Vanessa did not demonstrate the conflicted professional identities that they did earlier in the study (Wells, 2007). Their interview and observation data indicated they were more secure with their ICT mediated practice. They reinstated their role of teacher as curriculum expert, not ICT expert. Reflecting on students often having more ICT knowledge than teachers, Philip explained: 'Teachers have to give up on being the fountain of knowledge'. He advocated that ICT knowledge 'travels like wildfire' (Philip, 2005, interview data), and that students can very easily teach each other and themselves new skills. Similarly, Vanessa expressed, 'Teachers can't be in competition with children' (Vanessa, 2005, interview data). She stated that teachers most importantly support student learning with their pedagogical expertise. This suggests a shifting in the ways they perceived their professional identity. For these participants there was a point where ICT expertise became the way they constructed the view of what a teacher should be. It suggests that over time they had a crisis of identity, which was alleviated by their developing ICT knowledge.

In the final stage, all participants considered ICT important for school learning. Reflecting this, they gave greater attention to their ICT mediated practice than they did in the early stage of the study. This influenced the time and effort they put into developing their practice. In her final interview Vanessa stated, 'We are using ICT more and more in everyday life … we need to ensure children use it.' (Vanessa, 2005, interview data). At this time, Vanessa also demonstrated high motivation to continue changing in her ICT mediated practice.

A second aspect of key individual resources important to the TICT mediated practice of the participants was their priorities and their ability to develop themselves within their practice: a resource that was unique for each participant. Difference was evident in the value individual teachers gave to that particular resources in terms of their ICT mediated practice. Difference was also evident in the level of initiative they demonstrated in taking up suitable resources to inform their ICT mediated practice. A comparison of Philip and Fran can be used to explain this difference.

Throughout the study, Philip explored and took up opportunities he perceived would be valuable for his professional identity within the school hierarchy and for his teaching practice. Previous to the study, he took up the opportunity from DET to retrain as a computer teacher because he stated he didn't want to be a 'dinosaur': that is, a teacher with no value. In 2004, he took up opportunities offered by his school to train in a Robotics course. He explained while he wasn't necessarily a Robotics enthusiast, the school identified they needed a leader in this area, so he took up this opportunity. In 2005 he also took up opportunities to learn from students and teach what they valued. He began building units of works around students' knowledge (see 'Philip's critical moment').

Conversely, Fran did not demonstrate the same ability or motivation for developing herself within her practice as Philip. In the early stage of the study, Fran was mentored by Barb, a staff member whose role it was to develop teaching with ICT in the school. Fran had been targeted by Barb as potentially benefiting from mentoring in this aspect of her teaching. Fran agreed to this, and took part in this mentoring relationship, which involved teaching together and planning together. Fran's participation in this mentoring relationship spanned approximately 6 months, at which time Barb left the school. During her time of being mentored Fran demonstrated some development in her knowledge of ICT and using it in her teaching. She also stated that she reluctantly agreed to Barb's invitation to teach a Design and Technology class for the following year. This is a school subject that requires substantial use of ICT and other technologies by teacher and students. Agreeing to teach this subject demonstrated some increase in her confidence in her ICT mediated practice. When Fran was contacted in 2005, and asked whether she would like to take part in this study she agreed, but stated 'I don't know much more about computers than last time I saw you' (Fran, 2005, interview data). She stated that she made decreasing use of ICT in her practice and, when spoken to in November, 2005 she stated she had only been in the computer lab twice that year.

The comparison of Philip and Fran indicates they had different abilities and motivations for developing themselves in their ICT mediated practice. Philip looked for and acted on changes in his context that he identified as holding value for his ICT mediated practice and also his place in the school hierarchy. This catalysed him to reflect on his place within his profession in terms of his practice. Throughout the study, Fran demonstrated she was committed to her work as an English teacher: however, she did not build on aspects of her context supporting her ICT mediated practice. A consistent theme in Fran's data was that she did not apply and build on that learning that took place in her mentoring relationships. The concept of Zone of Proximal Development (ZPD) (Vygotsky, 1978) can be used to give some insight into this. ZPD describes the distance between what a learner can achieve alone and what a learner can achieve with the assistance of a more advanced partner. It is possible that the teaching process did not match Fran's readiness to develop her ICT mediated practice or her learning style. Similarly, she may not have been ready to change her established conceptualisation of what a teacher is and shift her professional identity to that of a teacher who uses ICT (Renshaw, 1998).

Furthermore, there was a consistent theme in Fran's data, of avoiding ICT-related changes in her context so that she didn't have to deal with them. For example, she identified one class she taught as having exceptional ICT skills. Anecdotally she had heard of one student in that class breaking into school records online. Her account of this indicated that she perceived similar misbehaviour problems a possibility that she might have to deal with when using ICT with this class (Bruner, 1990). This was a confronting issue for Fran and she did not want to deal with it. She responded to this by not teaching with ICT with that class anymore. Similarly, so as not to deal with the manager of the computer labs, whom she found difficult to deal with, she did not use the computer labs anymore.

Fran also consistently stated the need to develop her ICT mediated practice, but did not demonstrate a commitment to this. Remarking on an Intel course she enrolled in which focused on teaching ICT skills, she stated:

> I didn't finish the *Intel* course because I had a family holiday booked … Yeah, I mean I am aware of like the importance of it but you know it was just paying lip service to it more than anything. (Fran, 2005, interview data)

Similarly, in 2003 Fran stated:

> Trying to do that (go to the computer lab) what's the point. You know its just as easy for me to say that kids, you know, do that, type that, that's your homework, than me being in the computer lab trying to monitor what they are doing, how they go about completing their work. (Fran, 2003, interview data)

Difference in the disposition between Fran and Philip may be accounted for in terms of their level of professional knowledge and how it supported them seeing and understanding aspects of their context that others with less developed professional knowledge did not (Kemmis, 2005; Kemmis, 2006; Schon, 1983). Philip was an IPT teacher throughout the study, and increasingly developed a very good understanding of ICT. Additionally, he was the only participant in the study who consistently drew on theory to explain his ICT mediated practice. He drew on theory about ICT and about teaching and learning to do this. As explained earlier, Philip also took up opportunities to build himself within his profession. None of this was evident in Fran's data. Philip and Fran demonstrated different levels of knowledge of ICT, educational theory, and school hierarchy. Consequently, this influenced their ability to develop and motivation to developing their ICT mediated practice. A deeper knowledge in each of these areas makes one more able to create possibilities for developing one's ICT mediated practice.

A central focus of this thesis is that the TICT mediated practices of the participants are situated. Fran identified aspects of her professional and personal context as hindering her ability to develop her ICT mediated practice. She described the interpersonal skills of Barb's replacement as 'Rude, obstructionist, unapproachable, difficult to talk to about any aspect of technology' (Fran, 2003, interview data). Fran explained this in terms of technical expertise she considered a teacher needed if they were to use the computer lab. She worried she would not have any support from the lab manager if she had any technical hitches while using them and the organistaional issues that would arise as a result. Additionally, she referred to her home computer situation as a hindrance. She explained:

> My (ICT skills) are sort of better but see I never use the computer at home, never, ever, I can't get on, the kids you know, and it's an Apple … so sort of … You know I mean we have got a new one here a flashy, but I haven't got a clue, what does this mean, you know my children go mum you go here you do this, so I find it very frustrating and I am actually thinking that I am going to go and enrol and do an *Apple* course. (Fran, 2005, interview data)

> Yeah, you know if you were just immersed in this all the time it just becomes, it would be really easy if you just did this all the time, if your whole work was just doing this stuff … but because I don't have to send emails very much you know I don't have a whole lot of stuff in there that I just never have to touch because I am a classroom teacher and I just get in. I am quite OK at the things that I have to do but I really do need to start expanding my repertoire. (Fran, 2005, interview data)

Fran's evaluations of her context and its influence on her ICT mediated practice suggest that at some point, she has made the decision that the reward (using ICT in her teaching) is not worth it. She explained on a number of occasions that she found dealing with the computer lab manager very difficult. The words she used to describe the computer lab manager were strong, emotive words that suggest that the cons of dealing with him, for her outweighed the pros. This perception may also have been exacerbated for Fran by her personal life. She was the only participant in the study who had younger children for whom she had to care. It was a bigger effort for her to change her practice because of the time and effort her home life required of her. Another consideration is that while Fran was the only participant to be mentored, that mentoring was not necessarily a situation which suited her learning style or her learning needs at the time. There may not have been a shared understanding between her and Barb that facilitated her internalising and building on what Barb was teaching her (Wertsch, 2000). Fran's response also suggests that different dispositions can better deal with the issues that arise regarding TICT mediated practice (Kemmis, 2005; Schon, 1983). For example, Fran perceived her home computer as a hindrance to her learning; however, other participants identified their home computer as vital to developing their ICT mediated practice.

A defining characteristic of individual factors was the influence of past experiences and learning. When referring to their core approaches to teaching, or their dispositions for developing themselves within their practice, the participants consistently drew on past experiences and learning to affirm their explanations. For example, Beth, Vanessa and Lisa were all aged in their early fifties, all primary school teachers, and all expressed similar deficit understandings of children so far as their being capable, independent learners is concerned (see Section 4.2.1). This understanding was commonly included in teacher education in the 1950s; reconceptualising movements of children as capable learners, is a more recent theoretical stance. This suggests that for these participants, their current teaching practice is comprised of and influenced by a layering of experiences and learning over many years. ICT is embedded into that layering. Their previous experiences in their teaching, related and unrelated to ICT, are therefore part of the resources they drew on to interpret changes in their context.

As this chapter has presented, there were key resources within their knowledge system that the participants used to inform their ICT mediated practice. These are summarised in the figure below. The key context resources featured in the upper section of the diagram include the syllabus, school hierarchy and non-school uses of ICT. The two lower circles in the diagram illustrate the key individual resources: understandings of how students learn, and motivation and ability for developing their ICT mediated practice. As the diagram also presents, and this chapter has explained, some of the participants' critical moments were associated with their status within the school hierarchy. Participants perceived school and/or DET to be directly putting pressure on them to change their ICT mediated practice. This related to their classroom teaching, as well as who they were expected to be as teachers. The pressure came from DET, their principal, other teachers and/or the students. As is also indicated in the diagram, and as has been explained in this chapter, some critical moments also related to the syllabus and were associated with the ways the syllabus addressed ICT. This stemmed from the participants' own increasing knowledge of and valuing of ICT, which contributed to their identifying gaps in the ways the syllabus understood the value of ICT in learning.

Other aspects of their context and individual factors, built up the importance of the critical moments for the participants. These stemmed from their context and Individual factors. The combination of these secondary influences was different for each participant. This foregrounds the particular importance of these aspects of their context for the participants, in terms of change in their ICT mediated practice. The participants' engagement with their critical moments has also been explained as initiating pedagogical and organisational change. Additionally the action, learning and change in practice stemming from a critical moment, contribute to the resources they are able to draw on in future engagements with their context. From this perspective, each engagement potentially contributes beyond the immediate issue or problem (Wells, 1999). This supports understanding how the participants' ICT mediated practice evolved over the course of the study.

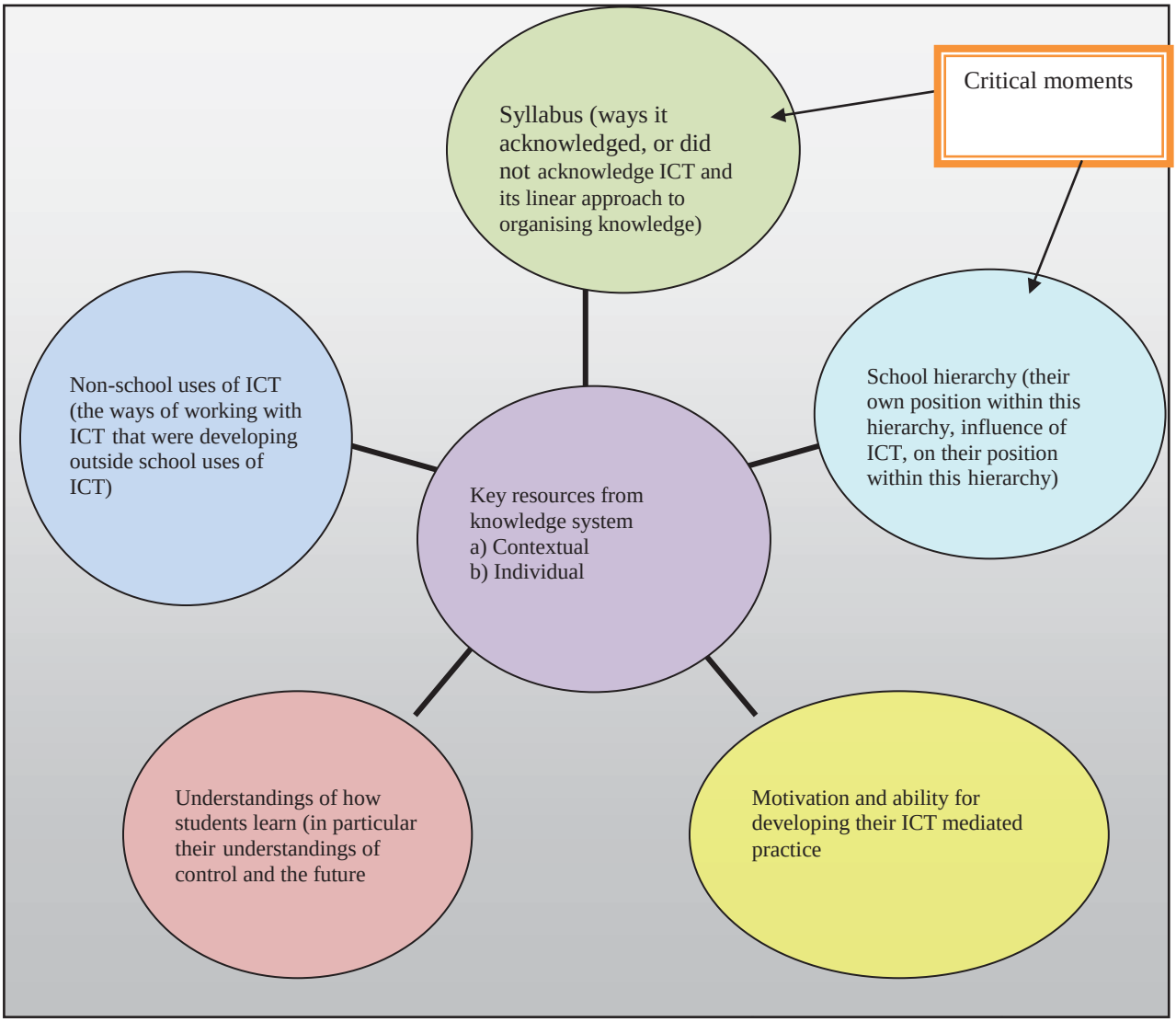

Figure 4.2. Framework of resources which participants used to engage with their context

Chapter 5: Contributions and Implications

In the morning they came up the ravine and took to the road again. He'd carved the boy a flute from a piece of roadside cane and he took it from his coat and gave it to him. The boy took it wordlessly. After a while, he fell back and after a while the man could hear him playing. A formless music for the age to come. (McCarthy, 2006, p.81)

This thesis examines the way that Teachers' Information and Communication Technology (TICT) mediated practice changes, and why. The above excerpt from *The Road* implies that the outcomes of an individual's creative expertise are useful and meaningful not only to themselves but to others as well. Similarly, this final chapter concludes this research by articulating the journey this research has taken, and its significance for future practice and research. In this chapter, the methodological and knowledge contributions of this study and their implications are presented. The implications of these contributions are presented in terms of relevant stakeholders: practitioners, school change managers, policy makers, students and researchers. Based on the findings of this study, this chapter also presents recommendations for professional learning for TICT mediated practices. The Rudd Federal Government's *Digital Education Revolution* is used as the vehicle for explaining the conceptualisation of professional learning that is recommended. This chapter concludes by presenting the contribution this study makes to the *e.ffects* study and implications for future research.

As has been documented in earlier chapters of this thesis, I embarked on this study with the aim of building on methodological and knowledge gaps identified in the research literature examining change in teachers' practices with ICT. Significant to these gaps were consistent claims presented in much of the research literature, that teachers have not changed their practices with ICT in the ways expected. Within this literature, the degree to which teachers adopt constructivist practices has been used as a measure of ICT adoption. While the research indicates that teachers have not (or have at best minimally) changed in terms of constructivist practices, there is minimal understanding of why they are not changing and of what other changes may have been occurring in their practices with ICT, that are outside that approach to teaching.

This gap in our knowledge of change in teachers' practices with ICT is a consequence of the methodologies that largely have been used in researching this practice. As stated in Chapter 2, a critical review of the literature on change in teachers' practices with ICT indicates that there has, in this body of literature, been constant use of large scale surveys and small cross-sectional studies. These methods have been used to examine change, and yet are only able to examine change from a single point in time, unlike longitudinal studies, which can track change over time. Reflective of the methods used, the large scale surveys and small cross-sectional studies undertaken have provided information on broad patterns of teachers' use of ICT and the ways that single variables such as access to ICT resources and teacher beliefs, influence teachers' practices with ICT and how they change. These methodologies however cannot be used to detail the complexity of the change process and why teachers use ICT in the ways they do.

In my review of the literature, I also identified that many studies examining change in teachers' practices with ICT often position ICT itself, rather than the user of ICT (the teacher), as the primary unit of analysis. Focusing on ICT has assisted understanding ICT resources and the possibilities for their use in schools. Using ICT as the focal point in research however, cannot provide complex detail about the user and how and why they use these resources in the ways they do.

The increasingly ubiquitous place of ICT in schools and the importance now placed on these resources for school learning, and in education as a whole, has contributed to the need for different types of information about what is largely available, about change and teachers' practices with ICT. Information on broad patterns of use of ICT and the ways that individual factors influence research, has been useful for understanding ICT as a new phenomenon in schools. ICT however, has been in schools for over 30 years now and during this time we have experienced an increasingly ubiquitous presence of and reliance on school education in ICT. Given this pattern it is likely that ICT will continue to increase in importance in teaching and learning. For example, teachers are now expected to use Web 2.0 technologies. Web 2.0 technologies facilitate sharing information, interactivity and user centred design. They can facilitate students' potential to create, share, collaborate and communicate ideas in their learning. It is likely that there will continue to be innovations that can offer valuable teaching and learning resources. For example, Web 3.0 technologies are on the horizon. Consequently, there is an urgent need to understand TICT mediated practice, which the mere overview of patterns that current research often provides, cannot sufficiently address. There is a need to shift the focus of research to one which provides a deeper understanding of teaching with ICT, what contributes to it and how this influences teaching and learning in schools and why. Shifting the research focus will facilitate guiding the future of this practice in ways which will meaningfully contribute to student learning.

As stated in earlier chapters, the premise of this study was to build on the existing research and provide different information in order to extend our understanding of change in TICT mediated practice. As has been documented throughout this thesis, this study was a qualitative longitudinal study that tracked the TICT mediated practices of five teachers over five years. This methodology was used to extend current knowledge of this practice by situating teachers' ICT mediated practice in the context in which it takes place. This method was used as a way of gaining evidence over time, of changes that developed in this practice, what influenced them, and how teachers understood the changes in their practice. An underlying aim of this study was to approach change in this practice from as a broad perspective as possible, and not to view it from a particular teaching approach, such as constructivist practices.

There are limitations in the new knowledge this study can provide. As has been documented in previous chapters this study focuses on the subjective narratives of five teachers and their TICT mediated practices. A common characteristic of the teachers was that they all worked in NSW government schools and that all the schools were located in the Sydney metropolitan area. Given this small sample and context it is not expected the findings from this study will be generalisable to the practices of all teachers (Bogden & Biklen, 2003; Flick, 2009). In order to address such limitations, a combination of qualitative data was used to develop the narratives of the teachers' ICT mediated practice. As ststed in Chapter 3, this included classroom observations and interviews with the teachers, as well as focus groups with students, interviews with school executive and key colleagues working with the teachers and document analsyis. This methodology supported developing rich, holistic descriptions of the complexity of their TICT mediated practice and meaningfully contributed to answering questions about how currently practicing teachers are making sense of their ICT experiences. This importantly will support more informed decision making in new policy development for meaningfully leading and managing future TICT mediated practice. This thesis will also be an empowering resource for teachers in that it will share the narratives of other teachers' ICT mediated practice which may contribute to reflection and affirmation of their own practices.

As stated in the previous chapters, the design of this study has been iterative, and the research questions have continued to be developed throughout the study in order to stay pertinent to the data and analysis. Three research questions were arrived at through the course of the study, and were used to present the Findings and Discussion in Chapter 4. The first research question focused on examining how the broad established contexts (social and material spaces and time in which participants situated their ICT mediated practice, as well as structures and conditions which characterised these spaces) contribute to TICT mediated practice. In particular, the first research question asks which aspects of this context support and which hinder TICT mediated practice, and why.

The second research question focused on examining the process of engagement with their context that teachers undertake as part of their TICT mediated practice. As explained in previous chapters, two sets of resources, individual factors and context, were identified as important to how the participants engaged with their context as part of their ICT mediated practice. This question focuses on examining the participants' process of engagement with their context as part of their TICT mediated practice in terms of these two sets of resources. The aim of this research question was to identify similarities and differences in their process of engagement and also how this process contributed to the participants' learning. The third research question built on Research Questions 1 and 2 by focusing on the relationship between changes in TICT mediated practice and changes in context. In particular it focused on examining which changes in their context were critical to changes in the participants' ICT mediated practice, and how they engaged with these critical moments. Also, given the symbiotic relationship between context and practice, this research question asked how changes in one participant's TICT mediated practice contributed to further or other changes in their context.

The methodology used to address the research questions has systematically worked through a process of data collection, coding, and the use of theory in analysis to produce findings that have importantly extended our understanding of change in teachers' ICT mediated practice. The model *Determining factors for change in TICT mediated practice* presented in Figure 4.1 in Chapter 4 encapsulates the findings of this study as: identifying the process of change in TICT mediated practice, which is influenced by two sets of resources: context and individual factors. Dominant contextual factors, such as the syllabus, teachers' own status in school the hierarchy and non-school uses of ICT, were identified as part of this study. Dominant individual factors identified in this study included teachers' core approaches to teaching and learning, which centred on how they understood students' learning as well as the participants' ability and motivation to develop themselves professionally in terms of their TICT mediated practice. In my analysis, these concepts stood out well above any other concept such as class, gender and inequality as important to the teachers' in this study and their changing ICT mediated practice. Given the complicated nature of context and individual factors, I made the decision to focus on an in-depth explanation of these. Less depth could have been achieved had I decided to focus on a greater number of elements.

The process of change represented in Figure 4.1 centred on a teacher identifying and interpreting a change in their context as a tension (some kind of professional identity dissonance), concluding that something is wrong and then working deliberately (or not) to resolve the dissonance. Resolution is achieved by rejecting, adjusting or reframing the teacher's knowledge system in regard to their understanding of teachers and students, and teaching and learning. The teachers' deliberations and actions, relevant to how to use ICT in their practice, drew on the dominant contextual and individual factors identified in this study. Those situations that resonated with their individual factors, instigated the participants to take action and make changes in their knowledge associated with their TICT mediated practice. This was represented over time as change in their TICT mediated practice.

This study supports the argument made by research in this field, and provides evidence that, TICT mediated practice is a much more complex practice than much of the current research presents (Selwyn, 2008; Underwood, 2004). A significant finding of this study is that teachers' TICT practices are changing. Also, that this practice and how it changes is complex, because of the significant influence that context and individual factors have on a teacher's professional identity in relation to this practice. A first contribution this study makes is in terms of the data itself, in relation to change in TICT mediated practice. The new information this study provides, importantly, expands on the three characteristics described in Chapter 2, that have often been used as reference points in the research literature for identifying change in this practice.

Integral to producing such findings was the methodology used in this study. Therefore, a second contribution this study makes is associated with new thinking and understandings of methodologies that can be used to examine change in TICT mediated practice. As stated in previous chapters, studies which focus on single points in time, single variables and pre-defined paths of change have often been used for researching change in teaching with ICT. As the title of this thesis indicates, this research was designed to detail change in TICT mediated practice as it happens and in context. The methodology used in this study successfully supported providing new information about this practice. The following sections elaborate on the two broad groups of contributions made by this study.

5.1 Methodological contributions

This study has shown that a qualitative longitudinal study using grounded theory methods, and which focuses on a small number of participants, provides information that extends current research about change in TICT mediated practice. Table 3.1, presented in Chapter 3, outlines the methodology used in this study in relation to the methodologies used by much of the research examining change in teachers' practices with ICT. As indicated in that table, it was the combination of methodological tools, rather than one particular strategy, that contributed to the findings produced.

5.1.1 Methodology integral to identifying complexity of change in TICT mediated practice

As indicated earlier, two sets of resources, context and individual factors, have been identified by this study as important to change in TICT mediated practice. Context was identified as important, due to its significance for the participants' 'critical moments'. As stated in Chapter 4, critical moments were a change in the participant's context which stimulated a process of reflection and change in the participant's TICT mediated practice. Context was important to the process of change. The change manifested in the participants' context, and also the participants, also drew on aspects of their context, such as the syllabus, to guide them in interpreting the critical moment in terms of their TICT mediated practice. Identifying how context influences TICT mediated practice sheds light on and assists in evaluating how the current context in which this practice is situated contributes to the change, or lack of change, that can potentially develop in this practice. For example, as the findings in this study indicated, a lack of change in the syllabus often hindered change from developing in the participants' ICT mediated practice. Identifying the importance of context for change is also important for the ways future contexts can be shaped to influence TICT mediated practice meaningfully in ways that support student learning. The importance of the syllabus and the participant's status in the school hierarchy, suggests that changes made in these two aspects of a teachers' context are likely to have an influence on their TICT mediated practice.

Individual factors were also identified as a key concept in terms of their contribution to critical moments. In addition to aspects of their contexts, the participants also interpreted the critical moments and what they meant in terms of their TICT mediated practice via individual factors and in particular, via the participants' understanding of how learning develops and also their motivation for developing themselves professionally. Identifying the significance of individual factors helps us to understand the individualised nature of TICT mediated practices and the changes that develop in it. This, importantly, clarifies the importance of a teacher's learning and experiences not associated with ICT, for this practice and how future professional learning can be used to support teachers in their TICT mediated practice.

The methodological approach used in this study was integral to identifying and detailing the significance of context and individual factors for change in TICT mediated practice. These two concepts helped to explain that change in TICT mediated practice is more complicated than simply a change in actions that a teacher performs in the classroom. This study showed that on the surface, it may appear that a teacher's TICT mediated practices are not changing; however, non-observable changes (which sustain and influence the observable changes) may be occurring. For example, of the five participants in the study, Fran, on the surface, looked like her ICT mediated practice had changed the least over the five years, compared to the other participants. As stated in Chapter 4, her ICT mediated practice demonstrated sporadic development. In the first year of the study she agreed to an offer to be mentored by a fellow staff member and appeared to be making a concerted effort to develop her TICT mediated practice while being mentored. After the first year of the study, the mentor left the school. The TICT mediated practice Fran demonstrated in the first year of the study, such as using ICT frequently in her teaching and incorporating various ICT applications in her teaching, was not observed again in her teaching over the course of the study. In fact, her TICT mediated practice seemed to regress and by the fifth year of the study Fran was making very minimal use of ICT in her teaching. Four years later, in the final weeks of the study, Fran began, for the first time, to take some initiative to change her TICT mediated practice. Change was associated with a critical moment.

If a cross-case analysis, or quantitative study had been undertaken of Fran in the first year of the study, it may have indicated she was changing her ICT mediated practices. She was using ICT more frequently in her teaching and, as stated in Chapter 2, frequent use of ICT has often been used as an indicator of changed practice. Mentoring may have been identified as a key variable that contributed to the change. If a cross-case analysis of Fran had been undertaken in the mid stage of the study, or in the final year of the study, it would likely have identified that she was not changing her ICT mediated practices. It may have been concluded that she had been mentored, yet still was not demonstrating changed practice, and therefore was resisting change.

The longitudinal, qualitative approach used in this study facilitated identifying whether Fran had changed in her ICT mediated practices, her path of change and why change did or did not occur in her practice. Fran's path of change can be described as sporadic, with only minimal changes observable in her practice. The qualitative data collected over numerous observations and interviews with Fran made it possible to identify that Fran's lack of observable change was contributed to by a discord between her individual factors and her context. Fran's motivation for developing herself professionally focused on developing her ability to teach English. This can be understood as one part of her individual factors, and this motivation influenced the way she engaged or did not engage with aspects of her context. For many years throughout the study Fran did not conceptualise ICT as part of the discipline of English. It was only when the English syllabus changed to include ICT that she started to make changes in her practice. As stated, the syllabus change was a critical moment for Fran. This was because her individual factors resonated with a change in her context.

The repeated contact with Fran and the collection of longitudinal qualitative data about her made it possible to identify many factors, (including her mentor, other teachers, students, lack of access to ICT resources, her family) that contributed to her ICT mediated practice. Importantly, tracking Fran's practice over time made it possible to compare her engagement with these factors and their influence on her practice. This made it possible to identify firstly that a change in the English syllabus change was a critical moment for her and secondly, why. As noted in Table 3.1, focusing only on a small number of participants made it possible to provide detail about what was important to Fran, what she was struggling with in terms of her context, why the mentoring she participated in did not have a lasting effect on her ICT mediated practice, why the syllabus change was a critical moment for her and also how it contributed to her ICT mediated practice.

The grounded theory strategies in this study made it possible to broaden how change in TICT mediated practice could be defined and what this change could look like. As stated in Chapter 2, constructivist practices have often been used to evaluate change in teachers' practices with ICT. The change evident in Fran's ICT mediated practices was not reflective of constructivist practices. The change that began to take place in her practice was associated with her own sense of competence as an English teacher. The methodology used in this study, importantly, facilitated providing evidence that teachers change in their ICT mediated practices in ways other than constructivist practices.

5.2 Knowledge contributions

This study makes an empirical and conceptual contribution to knowledge of change in TICT mediated practice. It provides evidence that professional identity is a central component of TICT mediated practice and also that change in TICT mediated practice often takes a long period of time before it is observed. The identification of these two elements importantly, facilitates the understanding that TICT mediated practice is more than actions a teacher performs and quickly improves. The following section presents in detail how this study shows that this practice is comprised of many aspects that centre on and are influenced by the teacher's professional identity. Additionally, the changed practice we can observe is contributed to by a substantial amount of change that is less observable. As will be discussed, these elements make a contribution to how we understand TICT mediated practice and what we knowledge about how it changes.

5.2.1 Centrality of professional identity

This study shows that professional identity is central to the change that develops in teachers' ICT mediated practice. Chapter 4 illustrated many critical moments in which the participants experienced an acute identity crisis, when old models of teaching were being challenged (McLure, 1998) due to ICT. These challenges centred on the ways non-school uses of ICT were realised, both consciously and unconsciously, in school teaching and learning. For example, in the early and mid stages of the study, students often had greater knowledge of ICT than teachers, which stemmed primarily from their out-of-school use of ICT. This caused an imbalance (and subsequent critical moment) in Beth's perception of her status within the school hierarchy. Beth had perceived the hierarchy of a school in relation to the varying levels of knowledge she attributed to each group. She stated that she considered students had less knowledge than teachers and therefore were at the lower end of this hierarchy.

Critical moments were changes in their context that the participants described as too important for them not to take action on. They were explained by the teachers as a challenge or imbalance in their professional identity (e.g., role, status, and sense of professionalism). As stated in Chapter 4, critical moments were identified in the analysis as different from other changes in their context, because they began a path of change initiated by the teacher. The path of change traced for each teacher from their critical moment, focused on their regaining this identity balance. Additionally, all participants spoke about the changes they initiated in their ICT mediated practice in terms of their professional identity. After time, their actions manifested as changed values and changed observable teaching practice. The participants' actions stemming from their critical moments allowed them to believe (consciously or unconsciously) that they were acting in a way befitting being a 'professional' and competent teacher at the time; either in terms of student learning needs or their own role in the practice. In light of this, professional identity surfaces as an important driver of and reason for change in TICT mediated practice.

Conceptualising professional identity as central to change in TICT mediated practice is important for shaping the contexts of TICT mediated practice in ways that support this practice and subsequently enhance student learning. Fullan (2008) proposes the need for deeper understanding of what motivates teachers and the need to tap into their self-motivation. This study shows (as explained in Chapter 4), a de-motivating element the participants experienced in their current context was policy and management literatures such as the syllabus and DET policies. They explained this literature as consistently constructing TICT mediated practice as a set of isolated teaching strategies (actions). The participants stated that such documents focused on teaching strategies alone. They described this in terms of isolating teaching practice from their knowledge, values, beliefs and experiences. Consequently, all participants experienced a diminishing sense of agency as professionals in their ICT mediated practice.

The participants' experiences with management literature in terms of their professional identity, had implications for the ways this literature, and other forms of professional development aimed at enhancing (changing) TICT mediated practice can be constructed and disseminated. The findings from this study support the view that professional development that centres on the aspects of their professional identity that are important to teachers' ICT mediated practice, will enhance this practice. It will stimulate for teachers, a deeper reflection on their practice, a reflexive search for knowledge and self-improvement in these areas. Drawing on the findings of this study, professional development which acknowledges the varying aspirations the teachers have for their role as teacher, and how ICT complements and fit in with that priority, would be a meaningful approach. Additionally, professional development that identifies the unique understanding each teacher has of the teaching and learning process, and using this as the basis for professional learning about TICT mediated practice, would also be a meaningful. Focuses such as these would support more focused and effective change than professional development that ignores the centrality of professional identity for change in this practice (Connelly & Clandinin, 1999), or that merely focuses on learning to use a new computer program, for example.

Identifying professional identity as integral to change, also has implications for future research. Designing methodologies that anticipate and examine change via professional identity would facilitate a more comprehensive understanding of change that takes place in TICT mediated practice.

5.2.2 Importance of individual and contextual resources

A second key contribution this study makes to knowledge is that the process of change in TICT mediated practice is contributed to by two sets of resources: contextual resources and individual resources. Research has acknowledged single variables that influence teachers' practices with ICT (Bauer & Kenton, 2005; Hennesy, et al., 2005; Hermans, et al., 2008). This study shows that the process of change is complex, because a teachers draws on an interrelated mesh of factors at the same time, to inform their practice. For example, in Chapter 4, in her decision not to use ICT in her teaching, Vanessa drew on many contextual and individual resources to make her decision. These included: professional knowledge, knowledge of DET, her experiences with policy initiation and her core approaches to teaching. Simultaneously, she discussed new policy with her principal, teaching peers and myself. At the same time, she interacted with other teachers, students, the school executive and teaching documents almost every day in intellectual, academic, political and creative ways and in multiple contexts such as staff meetings, teaching in the classroom, school executive meetings.

Identifying the many factors that the participants simultaneously considered in the decisions they made in their ICT mediated practice, has implications for the ways ICT is organised and managed in schools. It suggests that change that focuses primarily on one influencing factor, such as providing and manipulating ICT resources for teachers or students, is unlikely to result in immediate or significant change.

It was also evident that the participants mediated the contextual resources they drew on via their individual factors, such as their core approaches to teaching and their ability to develop and motivation for developing themselves professionally. It was evident in the study, that rigid, fully planned, top down change processes that do not value teachers' agency are open for interpretation by teachers as to how worthy they are for investment of their time and effort. One example of a rigid change process, given by Vanessa, included DET sending computers into schools and, in her explanation, expecting teachers simply to change their current teaching practices and start beginning to use them. She interpreted the decision to use ICT in her practice as being made for her by DET without consultation with her. As discussed in Chapter 4, of particular importance to the participants was how well policies resonated with their individual understanding of the future they were preparing students for. As indicated in Chapter 2, teachers are often perceived in research as ignoring or resisting change. This study shows that another way of understanding this is that the changes in their context, such as policy change, are perceived by teachers to be not congruent with their individual factors.

Also shown in this study is that change occurred to varying degrees in aspects of the individual factors of all participants. By the final stage of the study, all participants demonstrated increased ICT knowledge, and this contributed to a greater valuing of ICT. This influenced some changes in their core approaches to teaching. This has implications for facilitators of teacher professional learning. This study indicates that focusing on developing teachers' individual factors in ways that value TICT mediated practices would be a useful approach to professional learning. This would include developing dispositions, knowledge and beliefs in teachers which are conducive to valuing the educational use of ICT. This can include for example, using teaching strategies in teacher education programs that support positive experiences with ICT. Such experiences contribute to guiding the valuing of the educational use of ICT in the teaching and learning process.

Additionally, this study provides evidence of teachers using non-school uses of ICT in their practice. This brings a different perspective to the lament expressed in some research, of the disconnect between school learning with ICT and non-school uses of ICT (Facer, et al., 2003). Such studies indicate that the ways teachers use ICT are less engaging than the ways ICT is being used outside school by students and other users. Conversely, this study showed the importance of non-school uses of ICT on teachers' ICT mediated practice. As Chapter 4 has illustrated, the critical moments that many participants experienced were associated with non-school uses of ICT. This included for example, changes in the IT industry not being reflected in syllabus requirements for computer subjects for senior students. Also students' increased ICT expertise developed from home computer use which challenged a teacher's limited ICT expertise in class.

Furthermore, many teachers drew on non-school uses of ICT to inform the changes they made in their ICT mediated practice. Chapter 4 showed at least one instance where each participant perceived the resources their professional, school-based context offered did not resonate with what they identified as meaningful and useful to their ICT mediated practice. This was particularly evident for four of the five participants in the final year of the study. This may be because an examination of the teachers' context over the five years indicates that very little appeared to change in the syllabus that the teachers used during this time. As stated in Chapter 4, the syllabus was the central document that guided all the participants' teaching, and changes that related to ICT in the syllabus documents were minimal over the five years of this study.

Findings from this study, that describe the importance of non-school uses for TICT mediated practice, have implications for syllabus development. Firstly, in terms of the length of time syllabus documents are used in schools. As discussed in detail in Chapter 4, this study shows that ICT components of syllabi can quickly become outdated: therefore, methods are needed that contribute to keeping the syllabus content up to date. There are also implications for the ways ICT is included in the subject content of syllabus documents. In particular, how ICT is included in ways that meaningfully resonate with teachers' priorities and are consistent with their being considered a useful and up to date resource for teachers.

Additionally, the participants in this study were drawing on outside school-based documents and resources to develop their ICT mediated practice in ways they considered useful and valuable. In particular, they drew on websites that did not necessarily have an educational purpose, but which they adapted for classroom teaching. Additionally, they drew on programs that also did not necessarily have an educational focus, that were available commercially and were used in various sectors of society. This raises questions around the ways policymakers and managers of school change take the practices teachers have already developed for using ICT in their teaching, to develop policies and professional learning based on them (White, 2007). A policy developed in this way could also contribute to bridging breaks in communication, where management feels frustrated that teachers are not changing in the ways they expect them to change. Also, to teachers feeling they have little or no agency in their own ICT mediated practice. Drawing on teachers' practices could also enable clarity around what change is necessary and why (Singh & Han, 2005), for both teachers and leaders of change.

5.2.3 Long time frame needed for observable change

A third key contribution this study makes to knowledge is that a reasonably long time frame is needed to observe change in TICT mediated practices. Change in the participants' practice was not evident over the short term (the first eighteen months). This is in line with much of the research examining change over this period of time or less. Change however was evident in the TICT mediated practices of all the participants after five years. Following change in the participants' practice over the long term (five years) facilitated retrospectively identifying the genesis of the changes the teachers demonstrated in this practice. Chapter 4 presented critical moments the participants experienced as points of change. A close examination of the path leading up the critical moment permitted identifying some of the situations that led up to the critical moment being a critical moment. For example, Lisa's critical moment came about as a result of working with a new teacher, highly competent in ICT. In the four years leading up to that critical moment, factors mainly centring on Lisa's sense of belonging as a professional, contributed to the importance of this new classroom teacher for Lisa. These factors focused on what Lisa perceived to be the lack of ICT knowledge of other teachers, lack of guidance by her principal and DET, lack of syllabus for her role, physical isolation from staff by being in a computer lab, and highly demanding carer issues at home. It appeared that each of these issues contributed to a sense of isolation for Lisa. It seems obvious that a new staff member with high level ICT expertise, who bridges the gap between Lisa and the staff and also offers leadership and guidance professionally in terms of ICT, would be very important to Lisa.

In observing change over the long term, this study showed that change in the participants' ICT mediated practice occurred on two levels: a macro and a micro level of change. At a macro level the teachers' learning and change of TICT mediated practice was evident. For example, Beth had minimal computer skills early in the study and did not use it in her teaching early in the study. By the end of the study she frequently used ICT in her teaching and her ICT expertise comparatively was very advanced.

This visible chronological change was embedded in and contributed to by a series of micro events/situations/moments. These were not necessarily visible, nor a causal, chronological chain of events. For example, Chapter 4 illustrated the stop-start change process of Beth's ICT mediated practice. In the early stage of the study alone, she appeared to move forward in her ICT mediated practice, then stop, move back, plateau, then move forward again. This micro level was influenced by changes in her context and the key contextual and individual resources she drew on to interpret those continuous changes as described in the model in Chapter 5. From this micro perspective, the development of her ICT mediated practice was recursive and disordered rather than predictable and linear. This, in many ways, is a story that reflects many aspects of our lives. Teachers' interplay between many factors at the same time contributed to ICT mediated practice being disconnected. Also, the participants felt relatively unsupported by the school and the education system in their ICT mediated practice, and the disconnectedness was a reflection of that. Their change was in many ways gradual and unnoticed, not focused or quick. It depended on the teachers' level of knowledge and commitment. Only Philip demonstrated a deeper, theoretical understanding of teaching and learning and ICT. Reflecting this, his change was more consistent and focused than that of the other teachers. Management of school change that offers teachers support in the ways they want and need, would intersect this untraced approach to change, and therefore support a more effective change process.

5.3 Recommendations: Conceptualisation for future professional learning

This study shows the value and importance of taking a deeper view of change in TICT mediated practice if we want ICT to make a difference to student learning. This includes acknowledging change as developing on a micro and macro level and that it is influenced by two sets of resources (context and individual factors), Additionally, the importance of professional identity for this practice. Reflecting this, this study offers a conceptualisation for professional learning around ICT that focuses on enhancing the motivation and agency of teachers in their TICT mediated practice. This understadning both reflects and contributes to Fullan's (2008) proposal for the need of school leaders to tap into what motivates tecahers. It is envisaged that this conceptualisation of professional learning potentially will contribute to visions for schooling in the future, in particular by supporting TICT mediated practice in ways that support a culture of high quality, experimentation, diversity and innovation in teaching and learning (CERI, 2002). I will use the Australian Federal government's recent ICT initiative in schools, the *Digital Education Revolution,* to explain this conceptualisation. The *Digital Education Revolution* is one example of an initiative in which a substantial budget is given to resourcing schools with ICT. Such initiatives are continuously occurring at various levels of the school system: for example, at a school level, district level or an education system level.

The *Digital Education Revolution* initiative is the Australian government's response to capitalising on the benefits that ICT potentially holds for student learning. A major component of this initiative takes place over the next three to four years and involves the government spending $386 million (Australian dollars) on providing every Year 9 student and teacher in every Government secondary school in Australia with a laptop. This will occur each with each new cohort of Year 9 students for the next four years. Students in Year 9 are 14 or 15 years old and will own these laptops until they complete school in Year 12. The *Digital Education Revolution* project is in its early stages, with the first of the laptops being given to students in August 2009.

Australian State governments are contributing substantial budgets to supplement the resourcing of the laptops. For example, in Sydney (NSW), where this study took place, a further $25 million (Australian; just under $US 20 million) has been spent on software for these laptops. NSW state government press releases have described the resourcing of these laptops with software as the largest and most comprehensive roll-out of software in any education system worldwide. The NSW government's financing of the software is in addition to their four-year $693 million investment in providing connected classrooms, computer labs and technology to NSW schools and technical colleges.

This study indicates that a significant challenge of this *Digital Education Revolution* is that use of the laptops in ways that enhance students' current approaches and levels of learning is expected to happen quickly, in the three-four years that students own these laptops. For the current Year 9 students, this time has already started. As these laptops have been in schools only a short amount of time, a meaningful investigation of this progress cannot yet be ascertained. What this study has shown is that change in TICT mediated practice can be slow when support is absent or does not match the challenges ICT poses to teachers' professional identities.

An examination of the broad ranging issues that laptops in schools are posing for teachers is important. Thirty students attending their class expecting to use their laptop, is a very different and potentially unfamiliar scenario for many teachers, who previously, most likely, have only used a computer lab intermittently in their teaching. Additionally, while the government has resourced schools with laptops to extend student learning, they are simultaneously increasing pressure on teachers in terms of accountability: for example, through the publication of league tables in high profile newspapers such as the Sydney Morning Herald (Clennell & Patty, 2009) and on the *My School* website, a new iniative by the Rudd Federal government aimed at giving parents the opportunity to compare schools in terms of national standardised test results. ICT and new provisions for accountability are two changes in their context that place enormous pressure on teachers, yet there is little understanding of how and why teachers change practices. This study shows that undertaking an exploration of the challenges teachers are facing in terms of their professional identity and their teaching practices, would provide a useful and important basis for future professional development that would meaningfully support teachers.

Importantly, identifying the challenges that are facing teachers does not undermine their expertise nor put them in a position of feeling controlled. The lack of agency attributed to the participants in the management and organisation of change was something that the teachers in this study found difficult, and consequently felt unsupported and de-motivated by. Acknowledging and building on their challenges is an empowering strategy that includes teachers in the process of change. Drawing on the findings of this study, questions to explore should focus on: the students' level of expertise in using the laptops and what this means to the teachers, how the laptops fit in, or do not fit in, with what the teachers are aiming to achieve in student learning and in their role as teacher. Questions centring on the TICT mediated practices teachers are currently finding useful and how they would like to build on these, are also relevant.

For meaningful use of the laptops to occur in the short term, rather than the long term, there needs to be a congruence between what is important to teachers and the resources their school and professional environment provides. This study indicated that teachers did not consider their professional context to provide the resources they needed for change in their ICT mediated practice, and therefore they looked elsewhere. Teachers found non-school uses of ICT a valuable resource to inform their teaching. This is a good starting point for thinking about teaching documentation and professional development that schools, DET, the NSW Board of Studies and national bodies provide for teachers, and the ways they can be developed to address what teachers find useful.

Additionally, acknowledging and building on the diverse and relevant non-school uses of ICT has the advantage of developing ways of working that are important for the 21st century. This expertise have been identified as the ability to select, reorganise, combine or synthesise already existing facts, ideas, faculties and skills in original ways to serve new social, economic, and social purposes (McWilliam, 2008). Bringing formal school learning and informal learning that takes place out of school closer together, assists in working in these 21st century ways and will contribute to reforming schools in ways that meet the needs of contemporary society.

Additionally, drawing on the significant information that the methodology used in this study enabled, it is important to research and examine the progress of the laptops in schools initiative by focusing on the users (teachers and students), not the technology. This approach includes being open to examining changes that are developing on the macro and micro level and asking why they are occurring. Also, given the integral role that professional identity and individual factors play in changes that develop in TICT mediated practice, it is important these aspects are foregrounded in the identification and examination of the change that is occurring.

5.4 Implications for future research

As stated in earlier chapters, this study makes a contribution to the *e.ffects study*, which as explained in previous chapters is the larger study that this study was associated with. The published research from the *e.ffects* study, focused on school level factors that influenced practices with ICT in schools over three years (Hayes, 2003, 2006, 2007; Hayes, et al., 2005). This study adds to the *e.ffects* study by focusing on individual teachers' practices with ICT over an even longer period of five years.

Future research building on this study could explore in greater depth, the aspects of change in TICT mediated practice that this study identified and, in particular, examining further the critical moments that the participants engaged with as part of their TICT mediated practice. This could be facilitated by using different data analysis techniques, such as critical incidence analysis, to gain greater understanding of the critical moments of the participants in this study. Examining change in the TICT mediated practice of teachers outside this study, in relation to critical moments, would provide more data on the critical moments teachers engage with. Further understanding of critical moments could also be achieved by extending the longitudinal component of this study with the same participants, to provide evidence of the long term influence of, and the paths of change in, TICT mediated practices that followed them.

Future research building on this study could also focus on gaining a greater understanding of the two sets of resources the teachers drew on in their TICT mediated practice. An interesting aspect of the individual factors identified in this study (one set of resources), was the participants' varying conceptions of the 'future' they were preparing their students for (see Chapter 4). Further examination of how teachers understand the 'future' would contribute to conceptualisations of TICT mediated practice and how their understanding of the future is represented in this practice. Potentially, it would also add to our understanding of how varying understandings of the 'future' contribute to a teacher's overall pedagogy.

Similarly, the teachers' concept of 'control' also distinctly contributed to the decisions teachers made in their TICT mediated practice. Extending the longitudinal component of this study and/or exploring this concept in relation to other teacher participants would be useful. Such research would facilitate identifying whether control was associated with ICT being a new resource in schools, or whether it is a consistent association teachers make with TICT mediated practice

Additionally, two teachers participating in this study were teaching in the same school over the course of the study. Their principal had a creative vision for supporting TICT mediated practice in the school, and he implemented a number of initiatives during the study which each of the two participants responded to and engaged with in different ways. Future research would benefit from examining his leadership of TICT mediated practice in more detail, and the similarities and differences of the two teachers in their paths of change in relation to the principal's initiatives. Such a focus could also be extended to examining different leadership and management initiatives of principals and other significant staff in schools. The initiatives could be examined in relation to the process of change identified in this study, and the varying contributions those initiatives make to changes in the TICT mediated practice of teachers.

The novel 'The Road' focused on the journey of two individuals along a path in the hope of finding a peaceful and hopeful life. This thesis concludes with the same sentiment, that the findings of this study may meaningfully contribute to suppporting teaching and learning with ICT in schools in the future.

Appendices

Appendix 1: Sample of analysis related to collection of data

Matrix: Contexts								
Personal	Sub categories	Sub sub categories	Sub-sub-sub category	Vanessa	Lisa	Beth	Philip	Fran
Personal	Family	Commitments		2b Separated from husband A5.56 5b Lives with two grown up daughters A5.58 both daughters at uni A5.90a	2b Husband sick- she has had lots off time off work L3.01, L3.03a 3. husband sick 5a: husband just died	5b. Lives alone G5.58		5b Has children 5c Started Intel course then quit it when she went overseas with family
	Lifestyle	Home/location			5b Lives close to school	5b Lives in isolated country area G5.40b G5.42 G5.42b school is an	5a moved to new suburb (higher SES) so changed schools (higher SES) D3.57	

						alternate mailing address G5.40b		
	ICT resources	Access		Originally got home computers for daughters and needed to develop ICT skills for school A5.91a 2a Bought home computer A5.57, bought first home computer in later 1980s A5.64 2b Limited time available for use- I comp and two users A3.25	5c: Getting broadband at home L5.65	1. Bought a home computer (first one)- opportunity to schools ex-lease comps 5b Have upgraded home computer twice since 2001 G5.39 buys reconditioned computers G5.39 uses DET software to upgrade programmes for each new comp	5b Using computer more and more at home, but good to get away from screen at home- not a hobby D5.66 D5.67	2a Has a home comp- doesn't use it much C2.13 5c her children always using the computer- she doesn't get a chance to get on it C5c.12 new Apple computer at home- doesn't know how to use Apples C5c.13

				5a. Takes school laptop home for reporting and other personal uses eg banking A5.40 5b Have bought two laptops since 2002 one for each daughter A5.58, takes school laptop home during school holidays so has her own comp to work on and daughter has her own during this		G5.39 can't get Broadband in her area- has signed lots of petitions G5.41		

				time A4.13 A4.31, A5.57a, just bought digital camera to use with home computer A5.103				
		Learning to use ICT/support		1. Learnt how to email and developed a lot of ICT skills at home A5.91a 2b. Daughter teaches her what she needs to know A3.25 3. Learns the ICT skills she needs from		1. Colleague's son helped to set up new comp, friends use email a lot to communicate, peers provide ad hoc ICT support 2a Teaching peers give ad hoc ICT support 3. Teaching peers	5c Own skills much better- greater understanding of what is happening in the real world of computing- have a lot more outside knowledge. More confident	1. feels confident word processing C1.15 2a Can navigate way round the web C2.13 Skill level the same as six months ago C2.11, feels confident to say I can't fix this tech problem

				other teachers A4.16 daughter doing HSC uses home comp more now A3.27 time available for home comp use less this year A3.26 Does everything on comp at home eg banking A4.19 5a. Learns ICT skills from two of her teaching team- they have very good skills A5.34 A5.93		give ad hoc ICT support 5b Very comfortable using comps G5.25 Colleague's son provides tech assistance, updates comp for her- eg put last comp together for her G5.39	dealing with issues/discussing current happenings in computing D5.73	5a Fiona can fix only minor ICT tech glitches 5c her children ask her for help but she doesn't know how to help them C5c.13, not much demand for her to use computers C5c.14

Professio nal	Career Path			Came from small school A1.08 A5.64 School she was teaching at in early 90's got computers A5.64 1. Stage 3 teacher in this school since 1997 A5.101, Executive teacher (Assistant principal) 2a Stage 3 teacher, Assistant principal	1. computer teacher and maintenance eof comps L2.27 2b computer teacher 3 computer teacher 5a,b,c computer teacher	1. Year 4 teacher 2a Year 4 teacher 3. Year 4 teacher 5a Year 4 teacher 5b Spent first 16 years of teaching at a very small school with only three teachers G5.47 Led inservices on individual reading programs- focus was every child was their own group G5.47 Attended inservices on grouping chn	1. In 2000 finished participating in DET 2 yr retraining PD to become a computer teacher D2.01 D5.78, DET needed computer teachers for new syllabus D5.78, 2001 first year as ICT teacher 5b ISP teacher, D&T teacher D5.65	1. English teacher. Has agreed to take D&T class next year C1.13a 2a English Teacher, D&T teacher C2.65 3 Only teaching English no D&T C3.15

				2b Stage 3 teacher, Assistant principal 3 Stage 3 teacher, Assistant principal 5a. Stage 3 teacher, Assistant principal		G5.47b		
	School	Culture		2b Lots of interruptions to planned teaching A3.37 on the run all the time A3.38 3. Timetable		3. Stage team meetings hard to arrange because of timetable constraints 5b Principal very enthusiastic	5b Rooty Hill was a tough (and low SES) school- encourages collegiality, friendship and togetherness	3 No time for school staff development day next term- too busy C3.20 C3.20a

				continuously impacted on by other things A4.25 5b Principal very ICT focused, can't fully rely on anything happening in a day A5.77		about computers G5.53	amongst staff D5.61, mostly older and established staff in faculty at Castle Hill, he is new, young one D5.62 professionally run faculty, organised and focused D5.62,	
		Professional Colleagues	Collaboration	3. Works with other Yr 6 teacher to plan ICT integration A4.26 Other people available on staff to ask for help with	1. Collaboration on themes only- tries to get software that fits in with class themes L1.95 2a Classroom teachers know	5b School set-up Linda in library ICT teacher- teachers ask her for ideas and teachers approach her to teach different	2a Involved in school focus of putting reporting on comp- helping other faculties D5.60 lots of sharing ideas, resources within	1. working closely with head TAS teacher on using ICT (has previously worked as year advisors together- good

				ICT A4.16 3. Time given for teaching teams planning – focus on integrating ICT into planning stager (Sutherland 3.4) 5a. team teaches most of the time with neighbouring Stage 3 teacher A5.105 teaching teams are given one planning day each term 5b. Stage 3 team all very skilled	what she does in lab by seeing chn's work from lab L2.57 5a teachers never go near lab, they share themes or ask for help L5.39 5b David very demanding- expecting her to teach different things L5.4-9 L5.13, different relationship with David than others on staff L5.13, team teach with	things to students- ind Teachers decide how they will collaborate with her G5.31.	faculty D5.61 5a some of faculty involved in helping other faculties with IT and PD- he's not involved though D5.62, his faculty plan and collaborate continuously	working relationship C5c.02 2a Head TAS teacher approached Fiona to do some collaborative work when she saw Fiona in computer lab doing internet researching with class C2.08 lots of support- technical and teaching ideas- given to Fiona by Head TAS teacher C3.05,

				and sharing A5.58a, one teacher in team not very skilled in ICT A5.81a, 7 people in her teaching team A5.105	Graham L5.14			two people on English staff are good with computers- share teaching ideas C2.60 3. Head TAS teacher left school C3.04 New ICT technical maintenance person very difficult to work with C3.08 C3.09a 5a Little professional interaction with other faculties

			Teachers/ classes/ classrooms	1. Uses ideas from teachers at other schools A1.12 5a. Many teachers have bought home comps for their own PD A5.02	1. Limited ICT resources in classrooms L1.62 2aA lot of older comps in classrooms L2.80 Librarian uses ICT with students in library-very good 2b Ts ask her to do teach particular things in lab sometimes to address syllabus outcomes, doesn't know how classroom Ts using ICT, no	5b Many teachers in school using ICT a lot more in their teaching since Ross (principal) came to school G5.55	2b. Works in faculty with 2 fulltime men and 2 part-time women D5.56 5a Works in faculty with three other men D5.56, hasn't been into other teachers classrooms D5.57a. lots of informal sharing of ideas in faculty D5.60 D5.62 5c All faculty members started in different areas of teaching-	2a Teachers have limited time to be able to help you with computers C2.62 3 Many English teachers on staff don't feel comfortable about having English lessons in lab C3.02 Some of them have never done this before C3.03 5a Two teachers in English faculty very comp skilled 5b Not sure what

					scope and sequence in school for ICT, 7 new comps and printers for classrooms L3.05, some classes consistent internet problems L3.07 3. David very ICT skilled- starting new initiatives in school with ICT L4.27 5a. Classroom Ts use digital cameras now- not used much in		therefore have different slant on ICT D5.77	students do with ICT in other classes C5.04 Teachers too busy to ask them for help with ICT

					lab L5.56			
		School executive / decision-making		1. Principal shares her philosophy of student collaborative learning A1.10 Computer co-ordinator appointed- Linda 5a. Principal wants ICT integrated with the curriculum A5.74, as an AP Vicki has to follow up	2a Last principal trusted her with ICT in school, now acting principal 2b. With principal decides on ICT matters in school 5b David takes responsibility for school ICT decision making- Lesley his assistant L5.16 5c Principal leaves her role		2b Knows principal well D5.58 5a New principal- doesn't know very well D5.58	2a Head TAS teacher prime decision maker for ICT in school 3 Fiona not clear what new ICT person's role is C3.09 School exec working with issues associated with new ICT tech person C3.12a C3.13 new principal- laying low C3.22a 5c School has a

				Ross's vision with her own teaching team A5.99 5b Principal wants ICT integrated into the curriculum A5.74 principal has nagged her about taking on his vision for ICT and leading her team in this vision A5.99	for her to define L5.66			technology committee, school executive working very hard to get computer technician onside and making sure things are conducive to staff C5c.10
	School teaching and learning	ICT-focused curriculum		2a Focus on ICT integrated into planning stage, Library	2a She decides content to be taught in lab-minimal input	2a Library technology centre established,	2b ICT use linked to assessment/ reporting D2.29	2. Use of ICT not compulsory for English Stage 5 and 6

	focus			technology centre established 3 School focus aligning outcomes with the use of ICT	and organisation of lab learning, lack of ICT focused guidelines, over-use of generalisations for ICT in syllabuses, no set assessment for ICT in school. 5b hasn't looked at the syllabuses for a while L5.24	focus on ICT integrated into planning stage 3 School focus aligning outcomes with the use of ICT	D2.31 D2.12 School introducing an ICT generalist subject for all Year 11 students –ensuring all students have ICT skills for workforce D2.06 5a Information Processing and Technology syllabus D5.16, only very difficult subject texts available D5.57, lots of good resources available in	3. ICT part of new English syllabus 5. No record of what children have used ICT for in other classes C5.04a

							school, students go to Robo-Comp each year D5.35, heavy emphasis in syllabus on criteria based assessment D5.59 teaching must link to syllabus outcomes D5.60 5b Can be time for extension on syllabus outcomes- other ICT learning D5.64 New ISP course to implement D5.57	

							overuse of same assessment tasks year after year D5.63 5c Syllabuses not keeping up with students rapidly increasing skill level D5.72	
		Overall school focus		1. Principal to use ICT as the catalyst for developing more constructivist model of teaching and learning in the		1. Principal to use ICT as the catalyst for developing more constructivist model of teaching and learning in the school	1. heavy focus on step by step instruction across school D5.58- 60 2b. heavy focus on step by step instruction across school D5.58- 60 5a Focus on	

				school (Sutherland 3.2 1.2) 2a Establishment of school teaching teams across year levels weekly planning on consistency in planning, teaching and assessment, focus on working in stages to develop teaching for outcomes, focus		2a Establishment of school teaching teams across year levels- weekly planning on consistency in planning, teaching and assessment, focus on working in stages to develop teaching for outcomes, focus on 'core beliefs' regarding what teachers value in teaching and learning, time out of class	project learning across new school- increase responsibility of students D5.60, higher expectations for students to take responsibility for their learning at new school D5.58, expectation that chn know what to do D5.65, working towards HSC D5.04 5b At beginning of year each student is given	

				on ‘core beliefs’ regarding what teachers value in teaching and learning, time out of class given for teaching teams planning (Sutherland 3.3 2.2 2.3) focus on student-centred learning- chn know what comes they are working towards (Sutherland 2.5 2.6)		given for teaching teams planning (Sutherland 3.3)	their assessments and the weightings for each one for all subjects for the yr D5.36a	

				3. Aligning outcomes with the use of ICT 5a. School move to staging students 5b Focus on students cooperation and cooperative learning throughout school A5.68				
		KLA requirements		2b. Year 6 taking part in trial CSA A4.08 A4.07 3. Year 6 taking part in CSA-				1. English syllabus (Stage 5 & 6) requires a hand written piece of work for assessment-

				written and practical A4.07 5a. No CSA this year- lots of problems across the board administering the test A5.59b				works against computer use C2.56 2a There's too much syllabus requirements to fit in each term C2.63 3. Mandate of New Stage 4 English Syllabus which requires working with ICT- compulsory for Year 7 only C3.01 C3.21 5b English syllabus requirement for ICT broad and

								minimal C5.06, WP satisfies syllabus C5c.15 requirements C5.02 5c not much ICT use is required of her as a classroom teacher C5c.14
	ICT Resources	Access/ Provision		1. 3 classroom comps. 1 comp internet connected, older comp in class just used for games 2a School comp network upgraded	1. No internet, comp. lab for her sole use 2a. Better internet access L2.19 2b. Some classroom comps stolen, classrooms	1 In demountable classroom- shared 4 comps with class next door, 1 only efficient one, access to some software G1.03 G1.04, only one printer in central	1. all comp classes pre-booked into computer labs- no use/access to classrooms D5.66 2b computer labs throughout school,	1. Can book into school computer lab for lessons C1.8a 3 computer labs in school, no computers in English classrooms 2a School log-in

				(Sutherland 2.1) 2a 3 comps in classroom A2.26 Only one comp working A4.9 2b Library tech centre A3.30- not free for extra class use A3.35 only 1 comp working in classroom A3.10 A3.32 A3.30, Comp in year 6 available for use when classroom comp broken A3.30 uses comps in	having problems with access to internet connections, classroom comps inadequate- some new classroom comps 3. lots of old computers in school- getting rid of L4.31b, school intranet introduced L4.25a students can access school intranet files in both lab and classroom so can finish lab work in	office area G1.07, no access to common school files 2a In main school building- shares 4 comps with class next door G5.21b, library technology centre established (Sutherland 2.1), school comp network upgraded (Sutherland 2.1) 3. Shares 4	computers only in labs D2.46a, limited access for teachers and students D2.04 5a Adequate budget allocation for his subject D5.67, lots of good ICT programs/resources/internet available in school D5.68 D5.06 5b classroom management programs installed on comps D5.26,	system for students C2.09, computer lab is often free to book C2.25 3 New computer maintenance person doesn't give teachers working in computer labs any support- eg if comp not working C3.09a 5b Computers are all slow to log on to C5.45 inconsistency in computers- some computers slower

				library 2 or 3 times a term (A3..33) 3. Two roaming laptops available for use A4.9, only two working comp in classroom, weekly use of library tech centre by class A4.04 A4.30 A4.32 5a. Five comps in small withdrawal room off classroom, group of laptops	class L4.28 5a. Comp lab for her sole use	comps with class next door G5.21b, 1 comp in classroom, school establishes laptop pod, library tech centre available for booking G5.29 2004- in demountable- minimal ICT resources, library tech centre available for booking G5.29 5a Share 3 desktops with class next door	while could have access to classrooms emphasis on project work in school demands he uses computer lab 100% of time D5.67 D5.68	than others to process C5.53 C5.54 Comp labs need to be booked 2-3 weeks in advance C5.05, laptops available for English faculty for teacher borrowing, printing difficult in labs-only one per lab C5.01, wireless set up in school C5.92 Faculty has its own ICT peripherals C5.91, school

				that can be borrowed for class use A5.08 Data projector available for class borrowing 5b Not all class can use computers at once A5.76a, computers not always working A5.76a		G5.28 G5.08, 6 school laptops for stage 2 to borrow G5.15a, library tech centre available for booking class into G5.29 5b Shared comps with class next door- not as many as previous years G5.21a, 6 laptops for Stage 2 to borrow G5.15a, printer in class G5.26, library tech centre available for booking		computer labs often booked out C5.92 5c Computer labs freed up a bit, equipment works and is more reliable C5c.05

						G5.29, Mac computers throughout school G5.38		
		Maintenance		1. Consistent tech problems setting up comps and internet A1.04 2b External consultant fixing comps – delay in them being fixed A3.31 Tech support given by allocated person on staff	1. Problems with internet school wide L1.104 2a Part of role to attend to maintenance of comp L2.27 2b Hasn't kept up with repairs - husband sick , Principal helps with demanding tech aspects, minimal time	5b Classroom computers didn't work at all in Term 3 G5.18 Bronwyn attends to classroom glitches G5.19a G5.17		1. Head TAS teacher maintains all school computers 2a Head TAS teacher helps teachers during class if technical problem C2.45 computers/ internet not always working/not reliable

				but his time is limited A2.21 3. network repair outsourced, principal and comp coordinator tech support for school	allocated to tech aspect-does on weekends L3.04, not enough money for ICT technician L3.06, acting principals so does all tech aspect alone L4.29, L4.28a 3. school intranet facilitation added to her role L4.25a, sharing tech role with David now L4.27 L4.34a, found parent to help with tech aspect L4.29, L4.31a,			C2.52a 3. Head TAS teacher left- no one to attend to tech hitches during class time C3.07 C3.07a Printer has been left broken for long time C3.07a New ICT maintenance person- new rules C3.07a 5c Considerable upgrade of lots of ICT hardware C5c.06 Last yr lots of problems with hardware

					teachers ask for technical assistance L5.21			across school C5c.07
		Support in teaching with		2a whole staff PD on KidPix, iMovie, PowerPoint focus of PD was a team teaching model where teacher works with consultant Focus on exposing teachers and students to varied programs that can be used in classroom-bringing in	2a. current principal taught her a lot, not many ICT inservices for Ts now, Computer conference has good ideas but she thinks getting too expensive for school, 3. Learnt to use PowerPoint herself 5a Mentor L5.44 5b Taught herself-Knows	1, Completed TILT course in 1999, reports put on comp so teachers would use comp, school reports on comp-lots of problems writing reports on comps G1. 46 2a whole staff PD on KidPix, iMovie, PowerPoint focus of PD was a team teaching model where teacher	2b attended one ICT PD this year D2.10 5a Attended robotics and graphics PD took someone's role in school D5.63, builds on student's innovative, expert and motivating use of ICT program further teaching D5.62 D5.61 D5.63	1. Head TAS teacher tutoring and demonstrating ICT one-on-one with 2a No consistent training of staff's ICT skills C2.21 C2.22, Head TAS teacher wants teachers using computers and will do anything to help, very encouraging and supportive

				various experts, mentors coming into classrooms working with teachers on ICT A5.56a PD exposing teachers to different kinds of programs and different ways of using ICT A3.18 A3.27 A3.28 3. Whole school PD on Inspiration- external consultant 2 hr workshop, 3	how to use particular progs well- some easier to use than others L5.06	works with consultant, Focus on exposing teachers and students to varied programs that can be used in classroom- bringing in various experts 3. Whole school PD on Inspiration- external consultant 2 hr workshop, 3 pronged approach by principal: RFF time, after school	5B Choice of which textbook they will use to support ICT subjects D5.56 textbooks on ICT becoming more in depth D5.57, programs in use at school more supportive of student learning than programs used /available for use at previous school D5.58 D5.59 5c he is developing more skills in graphics	C5c.01 C2.46 one other staff member can help with tech hitches if Head TAS not around C2.46 3. School staff development day focusing on ICT use-optional to attend, complicated session C3.19 C3.20 no other support for teachers to use ICT in their teaching C3.32 5a available PD for ICT generally

				pronged approach by principal: RFF time, after school inservice, use of library as key motivator- principals' focus to build confidence among staff without a sense of inadequacy of things go wrong, A lot of PD in terms of change and incorporating ICT in your		inservice, use of library as key motivator- principals' focus to build confidence among staff without a sense of inadequacy of things go wrong 2004- chosen as part of small group for Melbourne PD session to well-reputed ICT school that runs its own courses G5.44 5b Linda in	and robotics because that's where the school needs the expertise D5.69	after school- impacts on Fiona's childcare arrangements, ad hoc PD with two skilled English teachers in English staffroom C5.95 5c A few people can be called on for ICT technical hitches C5.93 Two school appointed people to fix computers C5.94, English faculty have prepared lessons/units

				classroom and looking at teaching styles mentor working with stage teams on planning with ICTA5.56b 5a. External consultant focusing on *Claymation* and animation PD A5.26 5b Two of her teaching team are very good with computers and love it- help her A5.93, School reports		library ICT teacher- teachers ask her for ideas and teachers approach her to teach different things to students G5.31. Many teachers in school who are very computer literate to ask for help G5.54		ready for staff to use on intranet C5.96 Intel course on offer for teachers to this term and next term C5c.11

				on computer A5.93, money for PD comes from school budget not DET A5.107				
		School management/ support of student learning with		1. Library time focusing on ICT skills to be followed up in class- teacher present, 2a Library skills lessons- students taught PowerPoint by external consultant – group of experts		1. Library time focusing on ICT skills to be followed up in class- teacher present, Yr 4 able to use library once a week for comp use 2a 30min library lesson on comp skills weekly (the	5b installed NetOp to control all students screens- classroom management D5.26 5c cross marking to reduce plagiarism from internet D5.63, 5c cutting and pasting text a	1. Students learn how to use ICT programs in D&T (currently Power Point), students use ICT with just some subjects eg geography and not at all in others C1.11, 3. Some students stealing badges

				formed to teach other children - slideshows linked to class novel A2.1 A2.2 A2.36 A2.37 know more about Power Point than she does A2.37, students taught iMovie by external consultant A2.3 2b library comp skills lessons for students- KidPix, Inspiration and research skills		other half is library time) eg KidPix at the moment G2.15- teacher not present, students taught iMovie by external consultant 3 Students learning focused ICT skills during library ICT time eg Inspiration this term- linked to classroom Science unit G5.30 5b Central log-in for students	continuous problem D5.62 D5.64, 5C students learning ICT skills at a rapid rate, need to keep readjusting nature of the assignments D5.70, students achieving outcomes quicker and quicker- more need more extension learning D5.71	from front of comp- these classes banned from comp room by new ICT tech person C3.13 5a Yr 9 student stated he hardly used ICT for any KLAs except computer subjects C5.29a 5b Yr 12 very ICT skilled -open up multiple files and hide from teacher C5.09 one yr 12 student got into school's OASIS system

				linked to units of work A3.33, library skills lessons two or three times a term A3.34 3. Library comp skills lessons aimed at specialised skills that may be followed up in class, library skills lessons focusing on preparation for CSA- databases linked to HSIE Gov't unit A4.8 A4.7		G5.26, Library ICT skills lessons – this term researching on internet with targeted websites G5.20 G5.30		and falsified marks C5.10 5c Central log in for students C5.43a

				5a Homework doesn't require ICT use A5.24, students learnt to make a webpage in library comp skills lessons A5.10				
	Students	ICT skills		2a Slow typers when using WP A2.06 A2.28 2a Students ask friend for help with comp skills – gender issues makes this a problem (A2.18)	1. poor skills 3. older chn better ICT skills all round L4.32 5a. high home use, use at younger age, better ICT skills all round	1. Some chn use comp at home, only 4 chn don't have a comp at home 2a Some chn have more expertise than teacher 3 Children still	2b Using ICT well requires multifaceted knowledge D2.26 5a All students carry flash-drives with them. Students save class work to	1. thinks most chn have computers at home, some chn good with computers and help others C1.10 2a Students familiar with Word Processing

				3. Students learn ICT skills from each other A4.15 5a Some students don't have a home comp A5.25, students know more about ICT and the different ways it can be used than Vicki A5.31 A5.07a A5.11 Students share ICT skills with each other A5.35 Increasing number of		very much learning to use comp 5b These students generally don't use ICT much at home compared to last years class G5.22, some chn don't have a home comp G5.22 Some chn have more skills in some things than Bronwyn G5.52a	work on at home D5.64, students have problems logging into school intranet at home D5.64, students innovative and experienced users of ICT-influences class practice D5.61 D5.63a 5c expectation that students will use flash drives and finish their work at home D5.91 5c continuous	C2.6a, some students very good with using internet C2.15 some chn don't have a home computer C2.15, some chn haven't got a clue to using computers C2.49 3. Students skilled internet users C3.15, independent users of ICT C3.24 chn who don't have home ICT access are less skilled

				student ICT experts than in 2001 A5.70 5b Learning more ICT skills from peers A5.69 A5.98 greater access to ICT at home A5.70 more student ICT experts in the class now A5.70			use of ICT outside school- all students skills going through the roof D5.70 D5.79 Senior students teaching junior students what they are learning in class D5.70	C3.26 5b. Some students limited in WP skills- eg couldn't make a border C5.03 most Yr 9 students skills beyond Fiona's C5.05 Yr 9 students much more ICT skilled than Yr 7 students C5.07 other students help weaker ICT students C5.08
		Motivation/ Interests/		2a Students get frustrated when class computers	1. Enjoy using ICT at school	1. In class most chn choose to play a game on	1 think using comps in lesson is more exciting	2a different students have different

		attitudes		don't work (A2.9) 2b Students get frustrated when class computers don't work (A3.13) 5b Some children in the class spend substantial amounts of time on home computer A5.81		the comp- not many choose to use internet and not many chose a learning game G1.3 some chn do homework on computer at home G1.33 G1.34 G1.35, more and more using home comp for researching for homework/projects on comp, used home comps a lot for homework & research tasks	than trad lessons D1.09a 5a Use Mp3s and mobiles in social life continuously D5.71 D3. 02	preferences when using ICT C2.54, don't think comps are necessary for some subjects as you don't need to publish much in those subjects C2.90 5a Like using comps at school C5.04a 5c Computer labs air-conditioned- students love working in them C5c.08, students enjoy using computers at

						G5.23 5b Children mostly use comps at home to play games G5.52b		school- see it as a free period/fun C5c.09
	As learners	At school		2a Students work slow with and without ICT A2.15 Student lack ICT skills A2.33, lots of student absences some students like working with ICT others don't A2.17 3. Class works	2a Different learning dispositions, knows students very well- long history at school/as teacher 5b- good source of information L5.04		2b Some tough, difficult to control kids at school D5.57 5a students have different learning disposition, D5.66, many Asian students at school with limited English D5.69 D5.56 Students motivated by	2a Different learning needs/styles/ attitudes to learning and preferences eg some chn find using comp to edit really valuable, others prefer to edit on paper C2.30 C2.51 Classes often have

				well in groups A4.03 students have different learning styles/interest 5b This years Stage 3 cooperate very well A5.68			success of good marks D5.58 expect criteria based assessment D5.59 students at this school pick ICT things up quicker and get through more content D5.57b D5.57c	similiar needs/ interest C2.30 Some very poor readers in Year 10 C2.53 5c Like working with PowerPoint C5c.03
Broader societal	ICT resources	Continual new innovations			5a. Changing state of programs being used heavily in business/society L5.47	5a Using e-bay continual change of program/requirements G5.41 e-bay use linked to banking ICT resources G5.41	5c. ICT has changed a lot in last five years, eg with thumb drives D5.91 Technical advances such as increasing speed of processes	

							allows you to work using different/ multiple programs with students that you couldn't use before- closer to industry type of work D5.74 D5.75	
		Commercial/ online resources available for use		5a. Purchasing of current affairs website for class use A5.83		3. Good educational websites difficult to locate	1 Focused ICT chat rooms for students to use D1.09b	2a Websites relevant to school curriculum C2.38 layout of screen text assists poor readers C2.53
		Expectations for				5b computers are very important in	5c There are changed	2a Different literacy methods

		use				our society G5.52	expectations of what you do with computers now (by students school, society) D5. 79 D5.80 D5.81, students should be producers, not just consumers D5.83	accepted/expected , use of i not I C2.58
	Other Stakeholders	DET/BOS		1. DET providing ICT resources by no support for setting up and maintaining resources A1.4 2a External TA available for		5b DET providing more and more ICT resources G5.57		3 Require teachers to use ICT in their teaching C3.21a

				school to use (Sutherland 2.2) 5a introduction of quality teaching framework A5.72, DET not supporting hardware maintenance, numerous policies for using ICT implementing by DET- but not evaluated, quality teaching focus- student self-assessment, open ended				

				teaching, no DEP ICT PD A5.03, has done a lot of PD on Quality Teaching A5. 27, no extra time given by DET for integrating ICT, quality teaching influenced how she developed task books (A5.28) 5b Lack of support from DET for ICT in schools A5.59a, implement and				

				promote many new initiatives into schools over the years A5.67, school practice evaluated in terms of quality teaching A5.103a				
		Educational interest groups		3. Went on ICT PD and someone said don't get too obsessed with ICT its just another tool A5.78		3. Ed magazines a good source of ICT teaching ideas		
		Business		5b Need in society to use			2a Demands ICT skills of workers,	

				ICT eg- to go for a drivers licence A5.80			demands good oral communication skills from workers D2.06 Demands particular skills of IT workers D2.30	
		High school			1. little ICT support for students in high school 5a Higher expectations for students skill level L5.49			
		OH&S				5b Organisation/ location of computers in a		

						classroom affected by OH&S requirements G5.57a		
		Media		5b Newspaper article on the huge hours teachers put into their teaching A5.62 A5.63				
		Knowledge		5b Too much information now to retain it all A5.80a				
ICT Resources	Technical	* Distinct characteristics of		5b Have a life expectancy of only a few years A5.57	1.a computer works/is organised in a particular way 2. comps break		1. Use of ICT is highly individualised 5b Doesn't require linear	2a Computers are a complex piece of technology, many skills needed to use a

					down-particularly when chn high/silly 5a. technology advancing very quickly L5.49 5c Some programs great to work with L5.70		usage, enormous amount of info, own sort of literacy required D5.64	computer effectively C2.49
		Content		5b IT comes down to a few programs that are used constantly with ICT A5.70		5b Internet available for information researching G5.52	5a. Distinct design features needed for ICT-based information D5.07 Distinct ways of working with information with ICT D5.16a D5.07 D5.09 D5.11	1 ICT requires focus on presentation and design of content C1.9a 2a Content on computer professional-always edited and designed C2.23 design of

							5b Content generally designed in a meaningful way D5.65 5C ICT content is equally presentation, user-friendliness and content D5.81 D5.82	text on web is good for poor readers C2.53 3. New literacy practices/text types with ICT C3.27a New literacy practices can be in conflict with traditional literacy practices C3.27b
		Programmes				5b Many ways/steps to go through to produce the same end product G5.33	5b offer a lot more learning than syllabus requires of them-lots of potential for extension D5.57d 5c ICT now	2a Software use is not straightforward-need to get familiar with each program's C2.18, C2.47 5a Some

							offers students a much richer multimedia experience rather than just text D5.80	software is accessible and easy to use, eg PowerPoint C5c.04 C5c.03 other programs problematic to use C5c.07
	Social/ethical				5a Some unsuitable content on internet L5.37-8		2b. ICT part of life D2.23 5a. Many social and ethical aspects to understanding how and why ICT is used D5.16 D5.29. legal implications for incorrect use of ICT content, ICT can encourage particular social behaviours D5.16b D5.03a	3. Child protection issues with chat rooms C3.27

Appendix 2: Sample of analysis related to data set

Table 3: Contexts are an important tool for mediation. Teachers' ICT practices are mediated by drawing on a range of contextual factors	Socio-cultural theory Practice theory	Practice is purposive not random. Not necessarily planned but our intentions are part of this purposiveness (Green, 2008). Mediation is an interpretation and negotiation of what a context means for their practice. It provides a basis for making sense- making decision about teaching. It is part of tool use (Wells, 2001; Ruthglen, 2008). Mediation is developing explicit understanding. Knowledge is constructed from mediation (Vygotsky, 1978; Wells 1995). Adding something new to the context (a new tool) opens the opportunity to think and act differently (affordances)(Vygotsky..)	Mediation often occurs in the context of a significant problem (Wells 1995) Person acting-with-mediational-means could be person, person-acting with another person, person-acting-with-ICT, or person-acting-with-particular knowledge (Sutherland, et, al 2004) The physical tool (computer) can be seen as an instrument of	What problems/opportunities opened up for teachers in their practices mediated by ICT? In what ways was this important to them, purposive? What aspects of their context did they mediate? Which dimensions of their practice did this relate mediation relate to? How do the issues/opportunities ICT open up relate to the established meanings in which teaching practices mediated by ICT are situated? What learning was evident from the teachers' mediations? In what ways did it scaffold their development in their practices mediated by ICT? How did the purpose of their mediation for their practices mediated by ICT change over time? Technology (Internet) can force educators to think about pedagogical issues (See Peruskis & Mishra, 2004)

			labour, a thing that is interposed between a person and the object of their labour which serves as a ‘conductor’ of their activity (Verenikina & Gould, 1998) Although objects can expend our possibilities to manipulate and transform different objects, they also have limiting effect in that the object can only be manipulated within the limitation of that tool (Verenikina & Gould, 1998)	

			When ICTs are integrated into the school curriculum they become tools that mediate teaching and learning activities to develop higher order thinking skills (Lim & Hang, 2003)	

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